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Rice Stem Borers in the Philippines

Technical Advisers: **Santiago R. Obien**
Leocadio S. Sebastian

Subject Matter Specialists: **Herminia R. Rapusas**
Amelita T. Angeles
Genaro S. Rillon
Gilely C. Santiago
Emmanuel R. Tiongco
Alejandra B. Estoy
Ravindra C. Joshi
Gertrudo S. Arida

Managing Editor: **Olive Rose O. Matchoc**

Photographers: **Arleen Robert E. Baclit**
Nestor M. Aldemita

Layout Artists: **Carlo G. Dacumos**
Dennis Glenn Flores

Illustrator: **Carlito N. Bibal**

For further information, contact:
Crop Protection Division
Philippine Rice Research Institute
Maligaya, Muñoz, Nueva Ecija 3119

Foreword

Rice stem borers are distributed worldwide and are particularly destructive in Southeast Asia. There are six stem borer species in Asia: yellow stem borer *Scirpophaga incertulas* (Walker), white stem borer *Scirpophaga innotata* (Walker), striped stem borer *Chilo suppressalis* (Walker), dark-headed stem borer *Chilo polychrysus* (Meyrick), gold-fringed stem borer *Chilo auricilius* (Dudgeon), and pink stem borer *Sesamia inferens* (Walker).

When stem borers infest the rice plants during the vegetative stage, the youngest shoot dies. The damaged shoots are called *deadhearts*. However, when the plants are infested with stem borers during the reproductive stage, affected plants produce panicles with empty grains. The damaged panicles are called *whiteheads*.

Current commercial rice varieties planted by rice growers in the Philippines exhibit low to moderate resistance to rice stem borers. Owing to the lack of resistant varieties, farmers use insecticides to control the pests. However, the stem borers feed inside the stem where chemicals cannot easily penetrate hence, chemical control method is often not effective when applied at this time.

This bulletin presents practical, environment-friendly, and tested ways to manage the stem borers at different growth stages of the rice crop. It also provides information on how to identify the different species common in the Philippines, as well as their habitat, host range, distribution, and nature of damage.

The information contained in this bulletin were drawn from experiences of the authors and results of studies conducted at PhilRice and IRRI. I am confident that this will be a useful reference to researchers, extension workers, and farmers in effectively managing the rice stem borers.

SANTIAGO R. OBIEN
Executive Director

Importance of Rice Stem Borers as Pest

Rice stem borers occur in all rice ecosystems. In Asia, yield losses due to the two most important species, the yellow and striped stem borers, range from 1 to 20%. However, during outbreak conditions, yield losses may range from 30 to 100%.

Except for the yellow stem borer, which is monophagous to rice, the other species also feed on corn, sorghum, sugarcane, wild rices, and other species of grasses.

- They are present in both diapausing (in other crops between rice) and nondiapausing (continuously on rice) populations.
- The larva feed inside the rice stem. Thus, they are less exposed to beneficial organisms and insecticides.

Local Names

White stem borer [*Scirpophaga innotata* (Walker)]

Tagalog: aksip na puti, puting bagombong

Ilocano: simut-simut, puraw nga rusot, kulibang-bang (adult), puraw nga bokbok

Bikol: puti na pasok, puting parabansok sa lawas, barat

Hiligaynon: puti nga tamasok

Waray: busag nga ulod, ulod ha solian busag, busag nga paraluho dagami

Yellow stem borer [*Scirpophaga incertulas* (Walker)]

Tagalog: aksip na dilaw, dilaw na bagombong

Ilocano: amarillo nga rusot, duyaw nga bokbok

Bikol: dilaw nga parabansok sa lawas, barat

Hiligaynon: kanaryo nga tamasok, dulaw nga tamasok

Waray: dulao nga ulod, ulod ha solian dulaw, dulaw nga paraluho dagami

Striped stem borer [*Chilo suppressalis* (Walker)]/Dark-headed stem borer [*Chilo polychrysus* (Meyrick)]/ Gold-fringed stem borer [*Chilo auricilius* (Dudgeon)]

Tagalog: aksip na guhitan, guhitang bagombong

Ilocano: rusot, guritan nga bokbok

Bikol: kurisan na pasok, barat

Hiligaynon: guray-guray nga tamasok

Waray: sinamay nga ulod, ulod ha solian bagis-bagis, badis nga paraluho dagami

Pink stem borer [*Sesamia inferens* (Walker)]

Tagalog: aksip na mala-rosas, rosas na bagombong

Ilocano: rusot, derosas nga bokbok

Bikol: rosa na pasok, rosang parabansok sa lawas

Hiligaynon: rosa nga tamasok

Waray: rosa nga ulod, ulod ha solian pula

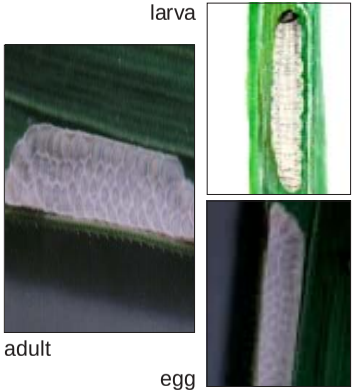
Habitat, host range, and distribution

Stem borer	Habitat	Host Range	Distribution
Yellow	Flood-prone and multiple rice crop areas.	Rice and related wild rices	Luzon, Visayas, Mindanao
White	Abundant in areas with distinct wet and dry seasons.	Rice, wild rice, sugarcane grasses	Visayas, Mindanao
Striped	Areas that are flooded.	Rice, corn, grasses	Luzon, Visayas, Mindanao
Pink	Abundant in upland rice.	Rice, wild rice, corn, sugarcane, grasses	Luzon, Visayas, Mindanao
Dark-headed and Gold-fringed	Abundant in lowland and upland rice fields.	Rice, corn, sugarcane, grasses	Luzon, Visayas, Mindanao

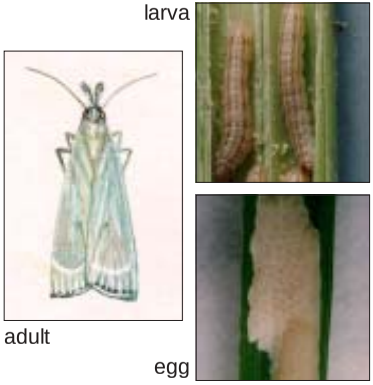
Common stem borers in the Philippines

Yellow stem borer *Scirpophaga incertulas* (Walker)

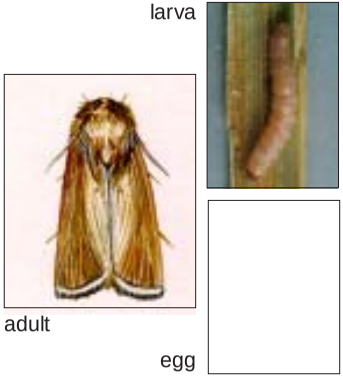
White stem borer *Scirpophaga innotata* (Walker)



Dark-headed stem borer *Chilo polychrysus* (Meyrick)



Striped stem borer *Chilo suppressalis* (Walker)



Pink stem borer *Sesamia inferens* (Walker)

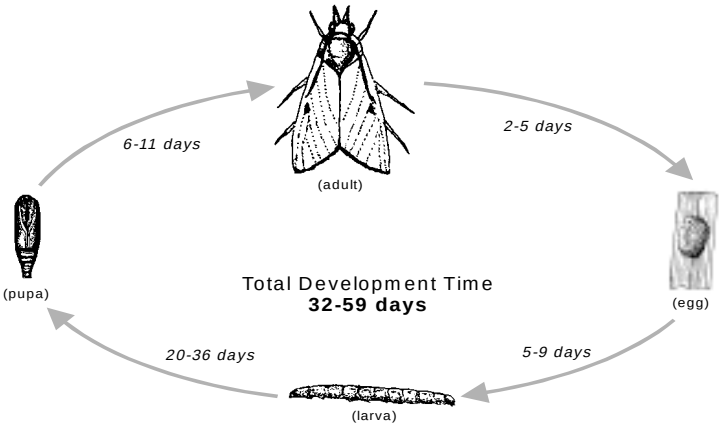
Larva and egg mass are similar with striped and dark-headed stem borers.

Gold-fringed stem borer *Chilo auricilius* (Dudgeon)

Table 1. Description of common stem borers in the Philippines.

Stage	Yellow Stem Borer (YSB)	White Stem Borer (WSB)	Striped Stem Borer (SSB)	Pink Stem Borer (PSB)	Dark-headed/Gold-fringed Stem Borer
Egg	Disc-like; laid in oval batches; and covered with mat of anal hairs of the female moth.	Identical to the YSB.	Scale-like; deposited near the base of the leaves or leaf sheaths; pale yellow, not covered with hairs; overlap in the egg mass.	Bead-like; laid in rows between the leaf sheath; and not covered with hairs.	Similar to SBB.
Larva	Small orange head with pale, hairless, yellowish body; only one larva per stem; and larva seals the entrance hole with silk to make stem watertight.	Similar to the YSB except that it is white; may remain dormant at the base of the plant during the dry season.	Yellowish brown head with five longitudinal purplish brown stripes; many larvae may be found in one rice stem; aggregates in 3-16 inside the leaf sheath of the flag leaf and feeds on the panicles.	Purple-pink on top and white below, with an orange-red head; may pupate between the leaf sheath and the stem instead of inside the stem.	Black head; three dorsal and two lateral brown distinct stripes on the abdomen.
Pupa	Elongated and yellowish white with green tinge and turns dark brown just before emergence; found at the extreme base of the plant often below the soil.	Similar to the YSB.	Dark brown.	Dark brown, robust, and with purple tinge on the head region.	Yellow-brown with two distinct bumps at the front of the head.
Adult	Female moth is straw colored, generally bigger than the male and has a very distinct black spot in the center of the forewing. Male moth is light brown and has numerous small brownish dots–five along the subterminal area and eight or nine near the tip of the forewing	Similar to YSB except that the female does not have the black dots on the forewings; have longer hairs on the prothorax.	Straw color to light brown with a number of silvery scales, and a row of black dots at the tip of the forewing.	Fawn colored with brown streaks on forewings; white hindwings; and with cluster of hairs on neck.	Straw to light brown with silver scale at the center of the forewings, and several black dots at the tip of the forewings.

Life cycle of the stem borers



Nature of Damage

Young stem borer larvae feed on young leaves then penetrate and feed on the leaf sheath and the inner tissues. Later, they bore into the stem and feed inside it. Successful entry to the plant exhibits the following damage manifestations.

1. Deadheart

- Occurs during the vegetative stage.
- The central leaf whorl does not unfold, turns brownish, dries off, and dies.
- Damaged shoots can be easily pulled out by hand.
- Lower leaves remain green and healthy.
- Yield may not be affected even if 30% of the tillers show deadheart. Plants compensate for deadheart damage by producing more tillers.

2. Whitehead

- Occurs after panicle initiation.
- Affected tillers produce straight panicles that are whitish and with empty grains.
- Dried panicles can be easily pulled out by hand. If not, the damage might be caused by rice black bug, leaf sheath or neck blast diseases, rats, or other organisms.
- Yields may be reduced if more than 18% of the panicles exhibit whiteheads.
- In case of late infestation, some grains are filled.

3. Other signs

- Presence of frass (excreta) at the feeding sites, at the larval entry, and at exit holes near the base of the plant.

Management Options

The following activities can be done to manage stem borers at the different stages of the rice crop. However, it is recommended that the management strategies be implemented in a community-wide scale for more effective results.

1. Before sowing:

- Select varieties with known level of resistance to stem borers. Varieties with moderate resistance to stemborers are the following:

IR36	IR74	PSB Rc14	PSB Rc50	PSB Rc74
IR42	PSB Rc1	PSB Rc20	PSB Rc54	C22
IR60	PSB Rc4	PSB Rc26H	PSB Rc56	BPI Ri10
IR62	PSB Rc6	PSB Rc28	PSB Rc60	BPI Ri12
IR64	PSB Rc8	PSB Rc30	PSB Rc62	UPL Ri1
IR65	PSB Rc10	PSB Rc34	PSB Rc68	

- Plow and flood the field to kill larvae and pupae in the stubbles.
- Know the peak of stem borer populations in your locality and schedule transplanting to avoid it.

  For example, light trap catches of yellow stem borer adults at PhilRice Maligaya from 1996 to 1998 showed two population peaks during the year — from last week of March to 3rd week of May, and from September to October (Fig. 1).

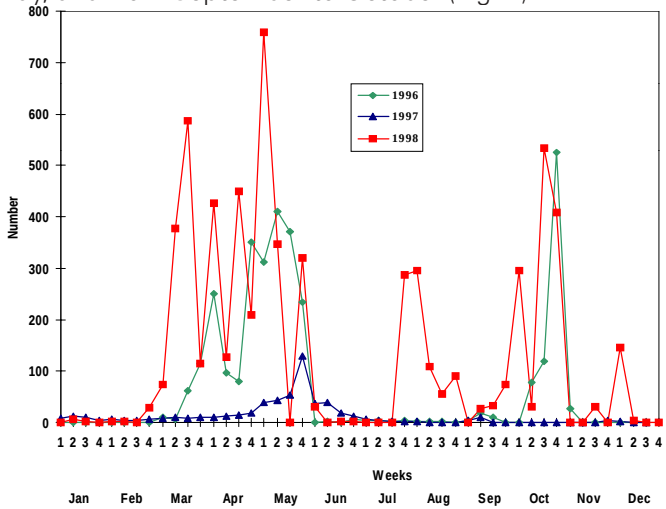


Fig. 1. Population trend of yellow stem borer adults collected from light trap. PhilRice Maligaya. 1996-1998.

Based on this information, transplanting should be done in January and June so that the crop will be harvested before the peaks of adult population.

- Practice synchronous planting. Plan planting date with farmers of neighboring fields. Planting a large contiguous area within 15 days allows fewer stem borer generations within the cropping season thus, reducing damage. This is true for most insects and diseases.

2. At seedbed and transplanting:

- Hand-pick and destroy egg masses. Also, keep some egg masses in a small jar/bottle to determine hatching and to time the insecticide application, when needed.
- Raise the level of irrigation water periodically to submerge the eggs deposited on the lower parts of the plant.
- Before transplanting, cut leaf-top to reduce carry-over of eggs from the seedbed to the field.
- Split application of nitrogen (N) fertilizer following recommended rate and time of application. High N rate increases crop duration and susceptibility to stem borers.

3. After transplanting:

- Know the signs and symptoms of stem borer infestation for better management options.

  Deadhearts. Search for deadhearts during the vegetative stage. The damaged shoot can be easily pulled out by hand. If not, it might be caused by rice black bug or other organisms.

  Severe damage by stem borers at early stage of the crop may look like *kresek* at far distance. *Kresek* is caused by a bacteria and it is characterized by rapid yellowing and death of seedlings.

  Whiteheads. Look for whiteheads during the panicle stage. They can be easily pulled out by hand. If not, it might be caused by rice black bug, leaf sheath, or neck blast diseases.

- Maximize the use of biological control agents in the field. Biological control agents are grouped into parasitoids, predators, and microbial agents.

Parasitoids. Egg parasitization is usually very high and widespread. Among the most important stemborer egg parasitoids are the wasps - *Telenomus*, *Tetrastichus,* and *Trichogramma* species. Several species of hymenopterous parasitoids (wasps) also attack the larvae and pupae.

Predators. Long-horned grasshopper and crickets prey on stemborer eggs. Carabid ground beetles prey on larvae while spiders and dragonflies prey on moths.

Microbial Agents. Stem borer larvae get infected with some species of bacteria, fungi, viruses, and nematodes.

Several natural enemies attack stem borers at different stages as shown in Figure 2.

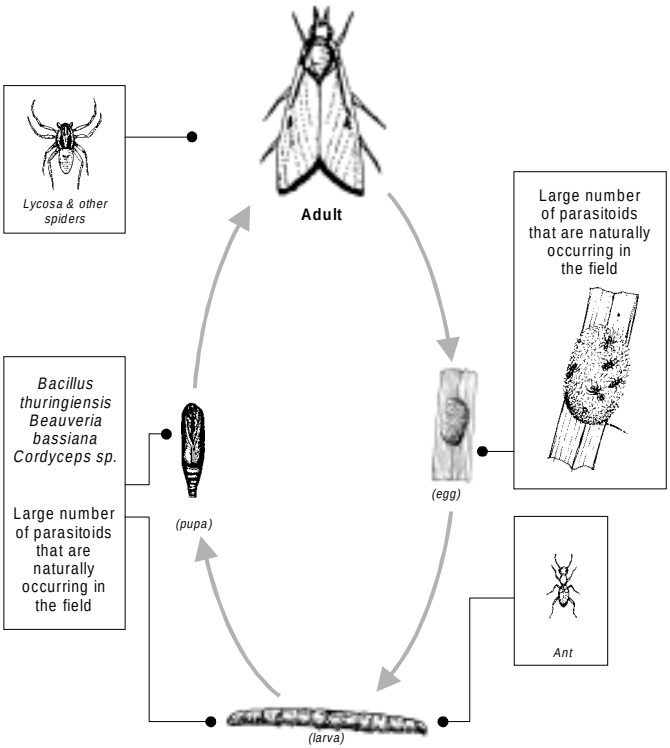


Fig. 2. Natural enemies that attack stemborers.

- The use of naturally occurring biological control agents is the cheapest management option for stem borers. Hence, the conservation and enhancement of these agents is highly recommended. This could be attained through reduced or judicious use of pesticides.
- Use insecticides only when needed. Stemborers are difficult to control with insecticides because the larvae and pupae are concealed inside the stem. The eggs are also minimally killed.
- To determine when insecticide is needed, observe the abundance of adults attracted to light before and after transplanting. This will indicate the population of adults and egg masses in the field.
- Earlier studies revealed that yields were not significantly reduced even when the deadheart incidence was up to 31%. It is possibly due to the ability of the plants to compensate for damage at the vegetative stage. Hence, insecticide application may not be necessary at this level of damage.

Yield reduction due to whiteheads becomes significant only when incidence is more than 18% (Fig. 3). This level of damage however seldom occurs in the field. To avoid such damage, schedule transplanting so that the crop will be harvested before the peak of adult stem borer population.

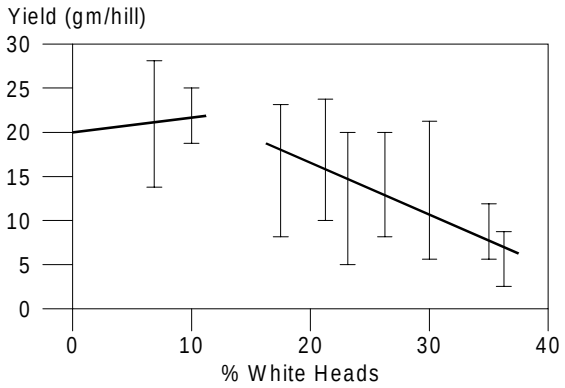
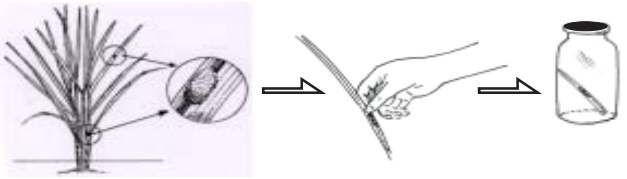


Fig 3. Yield of IR42 at different levels of whitehead incidence.



- Another way to determine when insecticide application is needed is to collect egg masses in the field. Place them in a covered jar or bottle. Observe the parasitoids that emerge from the eggs. If more than 3 out of 10 egg masses are parasitized, the parasitoids could control the pests. No significant damage is expected, and therefore, insecticides should not be used.

  If larvae emerge from more than seven of the 10 egg masses observed, insecticide application may be necessary. If so, apply insecticide before the larvae enter the stem (1-2 days after the collected eggs hatch).

At harvest/After harvest:

- Harvest plants at ground level to remove stem borer habitat.
- Plow and flood the field immediately after harvest to kill larvae and pupae inside the stubbles.

NOTE:

With the implementation of the recommended management practices mentioned in this bulletin, farmers can prevent the estimated yield loss of 20% or approximately 0.8 - 1 ton based on an average yield of 5 tons per hectare.

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DA-PhilRice

The Philippine Rice Research Institute (PhilRice), an attached agency of the Department of Agriculture (DA), was created through Executive Order No. 1061 on November 5, 1985 to develop and implement a national rice research and development program; to sustain the gains made in rice production; and to solve location-specific problems of the whole rice industry.

On November 7, 1986, PhilRice's mandate was further strengthened by EO No. 60, empowering it to direct and coordinate rice R&D activities of all agencies working on rice. PhilRice's ultimate objective is to improve the economic condition of the small farmers.

PhilRice implements the following programs: (1) direct-seeded irrigated lowland rice; (2) transplanted irrigated lowland rice; (3) hybrid rice; (4) rice for adverse environments; (5) rice-based farming systems; (6) rice and rice-based products; (7) technology promotion and development; and (8) policy research and advocacy. With these programs, PhilRice aims to solve specific problems in different locations and hopes to sustain the gains it has attained in the past years.

for more information, write, visit or call:

DA-PhilRice *Maligaya*
Muñoz, 3119 Nueva Ecija
Hotlines: 63 (044) 456-0112, -0354; (02) 843-5122
Trunklines: 63 (044) 456-0113, -0258, -0277, -0285
Trunklines/Fax: 63 (044) 456-0649, -0651 to 53
e-mail: philrice@mozcom.com
URL: http://www.philrice.net

DA-PhilRice *Los Baños*
UPLB Campus, College, 4031 Laguna
Tel.: 63 (049) 536-3631 to 33, -3635
Telefax: 63 (049) 536-3515
e-mail: philrice@laguna.net

DA-PhilRice *San Mateo*
Malasin, San Mateo, 3318 Isabela
Tel.: 63 (078) 664-2280, -2954
Telefax: 63 (078) 664-2953
e-mail: philrice-cves@digitel.com

DA-PhilRice *Midsayap*
Bual Norte, Midsayap, 9410 North Cotabato
Telefax: 63 (06422) 98178

DA-PhilRice *Agusan*
Basilisa, RTRomualdez, 8611 Agusan del Norte
Tel.: 63 (085) 818-2277, -3377
(0918) 406-1145
Telefax: 63 (085) 818-4477
e-mail: cvces001@philcom.com.ph

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Department of Agriculture
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