

6. STEM BORERS OF GRAMINEOUS CROPS IN SOUTHEAST ASIA

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Major Stem Borers Attacking Gramineous Crops in Southeast Asia

More than a dozen species of stem borers are known as injurious pests of cereals and sugarcane in Southeast Asia.

Names of major stem borers are given below in Table 1, and their host plants and distribution are shown in Table 2.

Table 1. The list of major stem borers of gramineous crops in Southeast Asia.

Species	Scientific names formerly used	Common name
<i>Chilo suppressalis</i> (Walker)	<i>Chilo simplex</i> (Butler) <i>Chilo oryzae</i> (Fletcher)	rice stem borer striped stalk borer
<i>Chilo tumidicostalis</i> (Hampson)	<i>Argyria tumidicostalis</i> Hampson	stem borer (India)
<i>Chilo partellus</i> (Swinhoe)	<i>Chilo simplex</i> (Butler) <i>Chilo zonellus</i> Swinhoe <i>Argyria lutulentalis</i> Tams	stem borer (India) maize borer (India)
<i>Chilo auricilius</i> Dudgeon	<i>Chilo auricilia</i> Dudgeon <i>Diatraea auricilia</i> (Dudgeon) <i>Chilotraea auricilia</i> (Dudgeon)	stem borer stalk borer (India)
<i>Chilo polychrysus</i> Meyrick	<i>Diatraea polychrysa</i> Meyrick <i>Proceras polychrysa</i> (Meyrick) <i>Diatraea auricilia</i> (Dudgeon) <i>Chilotraea polychrysa</i> (Dudgeon)	paddy borer paddy stem borer
<i>Chilo infuscatellus</i> Snellen	<i>Argyria sticticraspis</i> Hampson <i>Argyria coniorta</i> Hampson <i>Chilotraea infuscatella</i> (Snellen) <i>Diatraea shariinensis</i> (Eguchi)	early shoot borer (India) shoot borer (India) yellow top borer (Java)
<i>Chilo sacchariphagus</i> <i>sacchariphagus</i> (Bojer)	<i>Proceras sacchariphagus</i> Bojer <i>Diatraea striatalis</i> Snellen <i>Diatraea venosata</i> (Walker) <i>Diatraea mauriciella</i> (Walker) <i>Proceras venosatus</i> (Bojer)	striped stalk borer (Java) spotted borer (Mauritius)
<i>Chilo sacchariphagus</i> <i>stramineellus</i> (Caradja)	<i>Argyria stramineela</i> Caradja <i>Diatraea venosata</i> (Walker) <i>Proceras venosatus</i> (Walker)	
<i>Chilo sacchariphagus</i> <i>indicus</i> (Kapur)	<i>Diatraea venosata</i> (Walker) <i>Proceras indicus</i> Kapur	internodal borer internod borer paddy stem borer
<i>Acigona steniellus</i> (Hampson)	<i>Chilo trypetes</i> Bisset <i>Bissetia steniellus</i> (Hampson)	
<i>Tryporyza incertulas</i> (Walker)	<i>Schoenobius incertellus</i> (Walker) <i>Schoenobius bipunctifer</i> (Walker)	yellow stem borer paddy stem borer rice stem borer
<i>Tryporyza innotata</i> (Walker)	<i>Schoenobius sericea</i> (Snellen) <i>Schoenobius monostigma</i> Zeller	white rice borer

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Species	Scientific names formerly used	Common name
<i>Tryporyza nivella</i> (Fabricius)	<i>Scirpophaga auriflua</i> Zeller <i>Scirpophaga rhodoproctalis</i> (Hampson) <i>Scirpophaga xanthogastrella</i> (Walker)	top borer
<i>Tryporyza nivella intacta</i> Snellen <i>Ostrinia furnacalis</i> (Guenée)	<i>Scirpophaga intacta</i> Snellen <i>Pyrausta nubilalis</i> Hubner <i>Pyrausta salentialis</i> (Snellen) <i>Pyrausta damoalis</i> (Walker) <i>Micractis nubilalis</i> (Hübner) (in part)	white top borer corn borer
<i>Sesamia inferens</i> (Walker)		pink borer

Table 2. Host plants and distribution of major stem borers.

Species	Host plant				Distribution										Others		
	rice	sugarcane	maize	wheat	CHINA	JAPAN	FORMOSA	PHILIPPINES	INDONESIA	MALAYSIA	VIETNAM	THAILAND	BURMA	PAKISTAN	INDIA	CEYLON	
<i>Chilo suppressalis</i>	*				*	*	*	*	*	*	*	*	*	*	*	Ussuri, Korea, Hawaii, Spain	
<i>Chilo tumidicostalis</i>		*														*	Nepal
<i>Chilo partellus</i>	*	*	*	*												*	Africa, Afganistan, Comores
<i>Chilo auricilius</i>	*	*	*	*			*	*	*		*	*		*	*	*	Nepal, Sikkim, Buthan, Sangir, Molucca
<i>Chilo polychrysus</i>	*	*			*		*	*	*	*		*		*			(Assam)
<i>Chilo infuscatellus</i>	*	*	*				*	*	*			*		*	*		Central Asia, Afganistan, Timor, Vulcan
<i>Chilo sacchariphagus</i>		*					*	*	*								Mauritius, Reunion, Madagascar
<i>C. s. indicus</i>	*	*														*	
<i>C. s. stramineellus</i>	*		*				*	*	*								
<i>Acigona steniellus</i>	*								*								
<i>Tryporyza incertulas</i>	*						*	*	*	*		*	*	*	*		
<i>Tryporyza innotata</i>	*								*	*							N. Australia
<i>Tryporyza nivella</i>	*																New Zealand, Africa
<i>T. n. intacta</i>	*		*							*			*		*		
<i>Ostrinia furnacalis</i>		*	*	*			*	*	*	*		*		*	*		Manchuria, USSR, Korea, Australia, Micronesia, Solomon, Sikkim, New Guinea
<i>Sesamia inferens</i>	*	*	*	*	*		*	*	*	*	*	*	*	*	*		Korea

Recently, genera *Chilotraea* Kapur, 1950 and *Proceras* Bojar, 1856 were recognized as synonyms of genus *Chilo* Zincken, 1817 by Bleszynski. *Bissetia steniellus* Hampson, 1899 is also transferred under genus *Acigona* Hübner, 1825 in his series of taxonomic study on Crambinae.

The corn borer widely cited as *Pyrausta salentifulis*, *Ostrinia damoalis* and *Micractis*

nubilalis in both temperate and tropic Asia, was determined to be changed to *Ostrinia furnacalis* Guenée by Mutuura and Munroe (1970).

Characteristics in the Identification of Major Stem Borers

Adult

Most of the species of stem borers are belonging to Family Pyralidae and Noctuidae. Following diagnostic characters have been prepared for convenience of the entomologists serving in agriculture to recognize easily above mentioned thirteen species.

1. Hind wing with vein 8 shortly fused with vein 7, less than a third way out on cell.....Noctuidae.....(*Sesamia inferens*)
- Hind wing with veins 8 and 7 very closely approximate, or more often fuse, beyond end of cell.....Pyralidae 2
2. Hind wing with pecten of hairs on lower margin of cell; proboscis present; fore wing with vein 7; maxillary palpus triangularly scaled.....Crambinae (*Chilo suppressalis*, *C. tumidicostalis*, *C. partellus*, *C. auricilius*, *C. polychrysus*, *C. infuscatus*, *C. sacchariphagus*, *Acigona steniellus*)
- Hind wing without pecten of hairs on lower margin 3
3. Proboscis reduced.....Schoenobiinae (*Tryporyza nivella*, *T. innotata*, *T. incertulas*)
- Proboscis present; fore wing with veins 7 and 10 from cell; fore wing with no raised tufts of scales in cell.....Pyraustinae (*Ostrinia furnacalis*)

Key for the separation of the three species belonging to Schoenobiinae is given below:

1. Fore wing both male and female shiny white; anal tufts of female orange yellow *Tryporyza nivella*
- Fore wing both male and female not shiny white.
2. Fore wing of male dull ochreous white, suffused with ochreous brown; fore wing of female dull white or ochreous white; both male and female without black spot or fuscous streak.....*Tryporyza innotata*
- Fore wing male ochreous brown, with a oblique fuscous streak extending inward from apex to near inner margin; fore wing of female orange yellow; both male and female with black spot at lower angle of cell *Tryporyza incertulas*

Following tabular key showed the differences of the eight species belonging to Crambinae (Figs. 1-7)

	Ocellus	Face	Vein 11 in fore wing	Major characters of male genitalia
<i>C. suppressalis</i>	well developed	strongly producing forward with a distinct corneous point and ventral ridge	free	arms of juxta swollen near apices; costa of valva without median projection; aedeagus with ventral arm (Fig. 2)
<i>C. tumidicostalis</i>	well developed	moderately produced forward with a corneous point, without ventral ridge	free	arms of juxta slender with a pair of sharp conical teeth; costa of valva without median projection; aedeagus with ventral arm

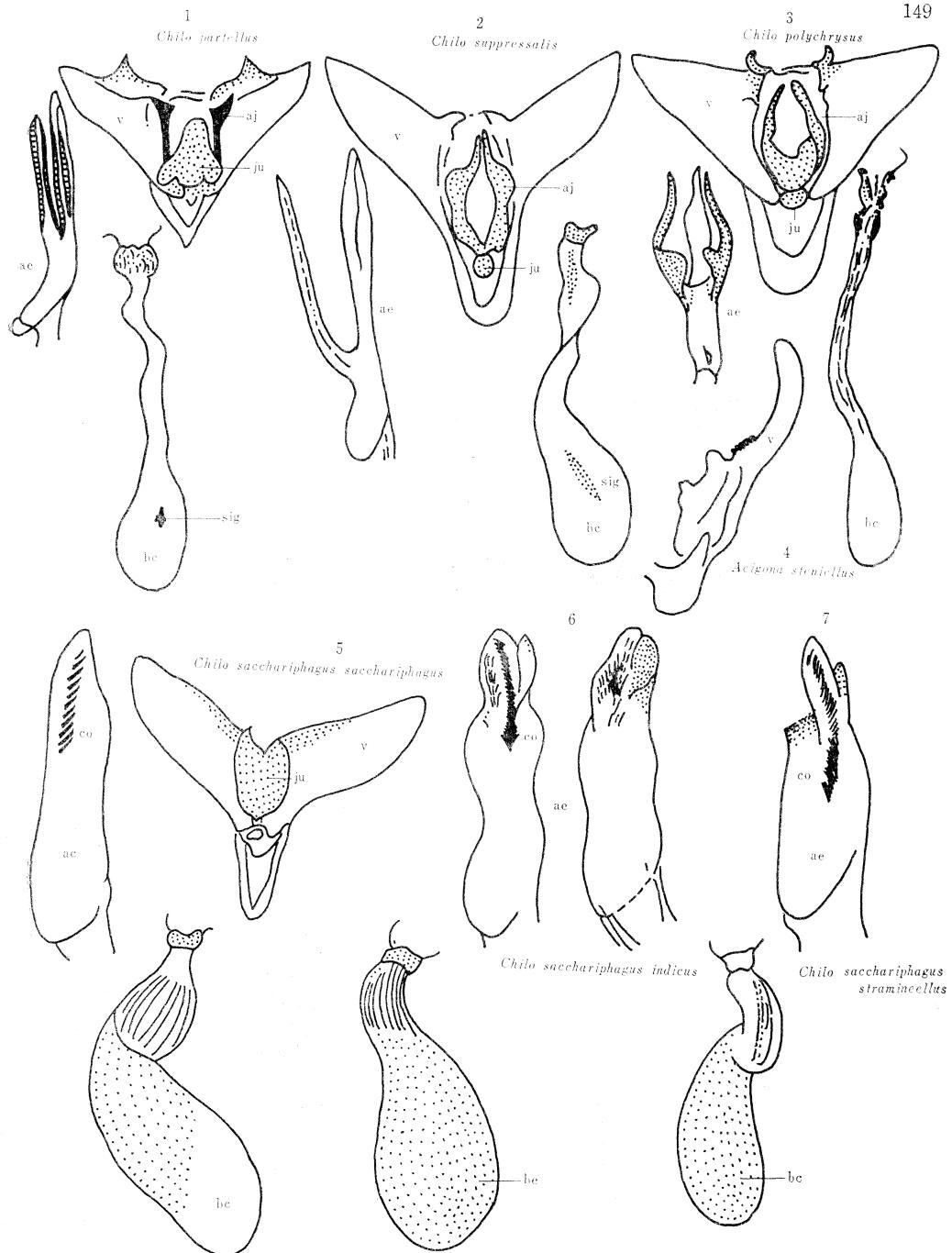
<i>C. partellus</i>	well developed	distinctly conical, with a corneous point, ventral ridge slight	free	arms of juxta stout, short and with subapical projection; costa of valva with a blunt median projection; aedeagus with ventral arm and basal bulbous projection (Fig. 1)
<i>C. auricilius</i>	small	produced forward, smooth or with small point, without ventral ridge	confluent with 12	arms of juxta slender and short; costa of valva without projection; aedeagus with distinct subapical projection and ventral arm
<i>C. polychrysus</i>	small	produced forward, smooth or with small point, without ventral ridge	confluent with 12	arms of juxta short and tapering with distinct notched; with pars basalis; aedeagus with bifurcated ventral arms and small cornuti (Fig. 3)
<i>C. infuscatellus</i>	well developed	rounded, slightly protruding forward beyond eye, without corneous point and ventral ridge	confluent with 12	arms of juxta slender with tooth; pars basalis slight; aedeagus with swelling ventrally, with a cornuti
<i>C. sacchariphagus</i>	absent	rounded, not protruding forward beyond eye, without corneous point and ventral ridge	confluent with 12	variable between subspecies; arms of juxta tapering without tooth; aedeagus with row of strong tapering cornuti (Figs. 5-7)
<i>A. steniellus</i>	absent	distinctly conical produced forward with a corneous point and distinct ventral ridge	free	valva with bilobed basalmostal projection, costal arm serrated near projection; aedeagus slightly bent, without cornuti (Fig. 4)

Larva (Figs. 8-9)

Though thirteen species are included in present key, selected characters of *Tryporyza innotata* are cited from Rothschild (1967) due to lacking of larval specimen. According to him larva of *T. innotata* strikingly resembles to *T. incertulas* and some differences of specific characters between them are inconspicuous. Therefore, only one of the distinct characters of mature larva is cited in the following key.

Key to the species for larva.

1. Crochets arranging in a circle; setae L₁ and L₂ on abdominal segments closed 2
- Crochets arranging in a mesoseries, uniordinal; setae L₁ and L₂ on abdominal segments separated *Sesamia inferens*
2. SV group of prothorax bisetose, of meso- and metathorax unisetose (Fig. 8) 3
- SV group of pro-, meso- and metathorax bisetose (Fig. 9) 7
3. Body with four longitudinal stripes (Fig. 8).....*Acigona steniellus*
- Body without longitudinal stripe 4
4. Crochets arranging in a semicircular, opened outer side, triordinal: adfrontal area nearly extending to vertical triangle; each seta of body with well developed tubercle (Fig. 8).....*Ostrinia furnacalis*



Figs. 1~7. Parts of genitalia.

1. *Chilo partellus*, both sexes; 2. *Chilo suppressalis*, both sexes; 3. *Chilo polychrysus*, both sexes; 4. *Acigona steniellus*, male; 5. *Chilo sacchariphagus sacchariphagus*, both sexes; 6. *Chilo sacchariphagus indicus*, both sexes; 7. *Chilo sacchariphagus stramineellus*, both sexes.

ae: aedeagus; aj: arm of juxtaplate; bc: bursa copulatrix;
co: cornuti; ju: juxtaplate; sig: signum

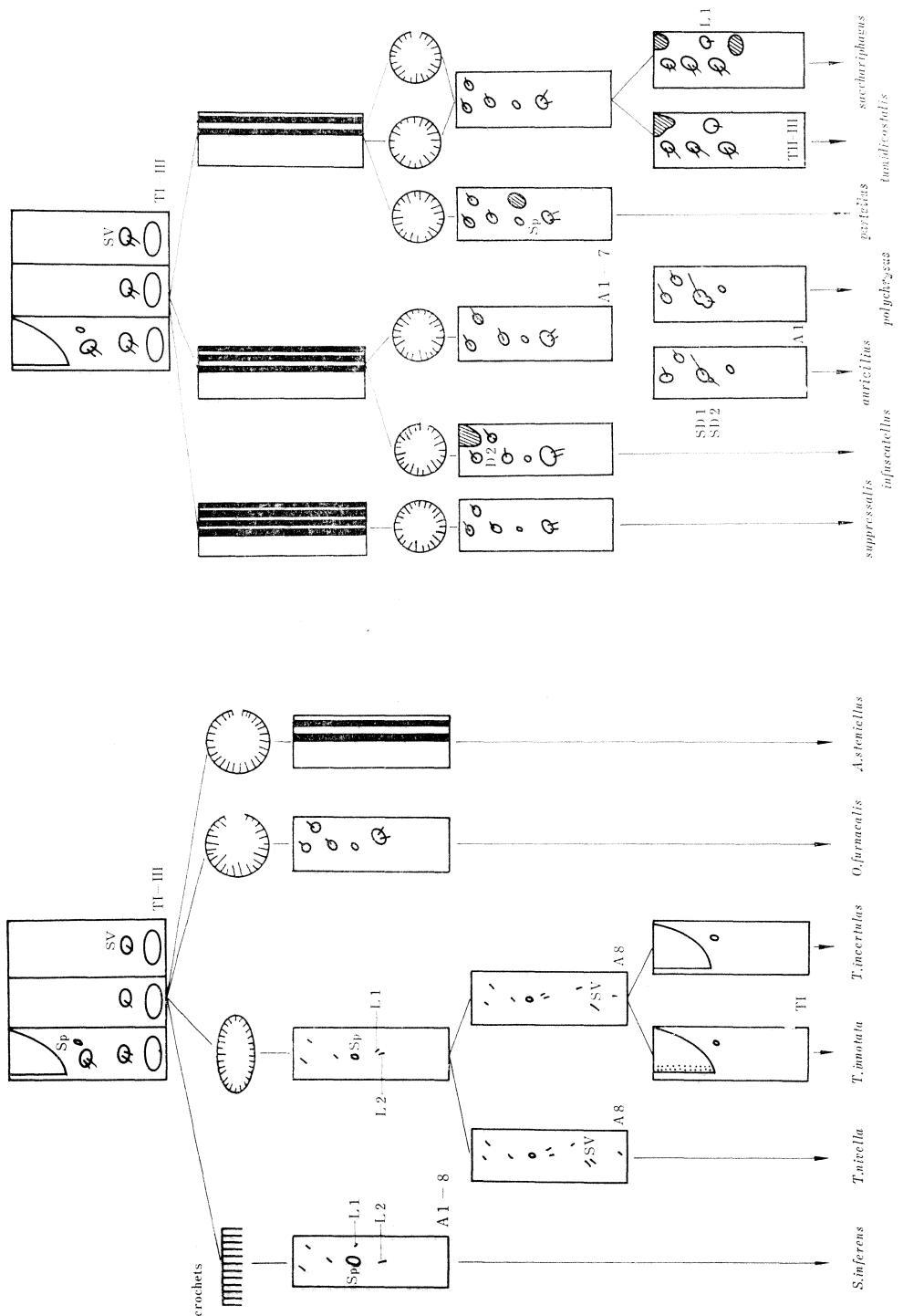


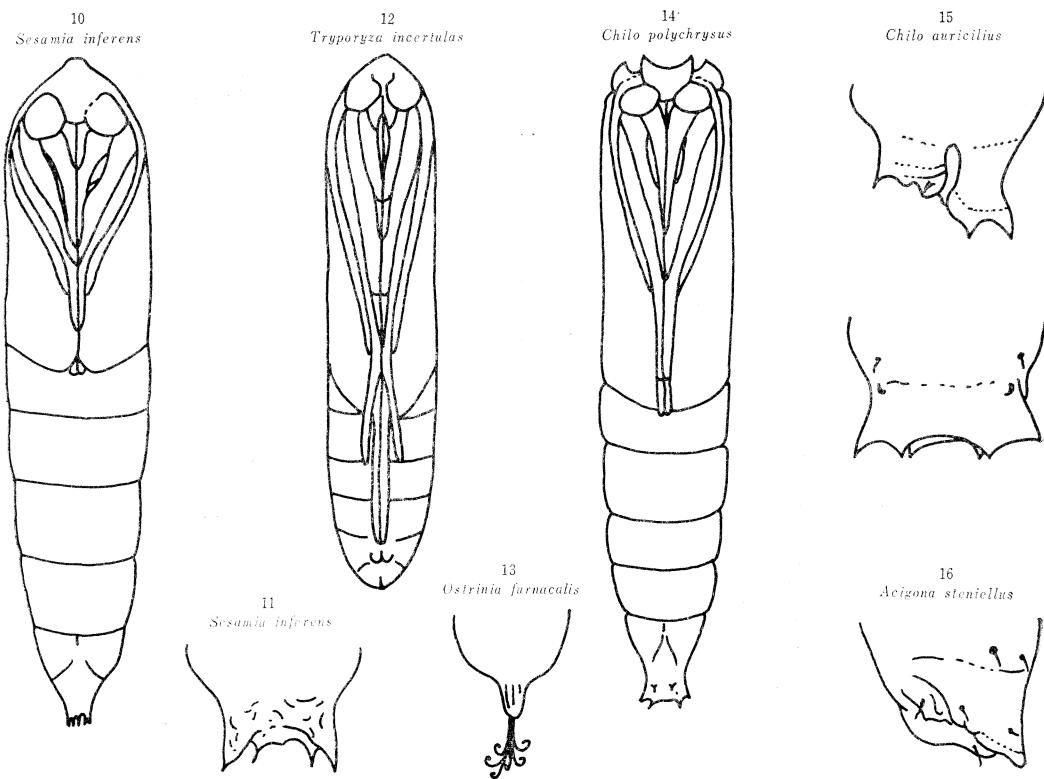
Fig. 8. Schematic key to the species in larvae.

Fig. 9. Schematic key to the species in larvae.

- Crochets arranging in a ellipse, sometimes lacked outer side, biordinal sometimes almost uniordinal; adfrontal area not reaching to vertical triangle; each seta of body without pinaculum 5
- 5. SV group of 8th abdominal segment bisetose (Fig. 8); attacking sugar-cane *Tryporyza nivella*
- SV group of 8th abdominal segment unisetose; attacking rice 6
- 6. Anterior margin of prothoracic shield with numerous minute black spots (only in mature larva) (Fig. 8) *Tryporyza innotata*
- Anterior margin of prothoracic shield without numerous minute black spots *Tryporyza incertulas*
- 7. Body with seven longitudinal stripes including dorsal line (Fig. 9) *Chilo suppressalis*
- Body with five longitudinal stripes including dorsal line 8
- Body with four longitudinal stripes, without dorsal line 10
- 8. 1st to 7th abdominal segments with a dorsal tubercle dorsad to seta D2; crochets opening outer side (Fig. 9) *Chilo infuscatellus*
- First seven abdominal segments without dorsal tubercle; crochets arranging in a complete circle 9
- 9. Major axis of spiracle of 8th abdominal segment is twice as long as of 1st abdominal segment; SD2 on 1st abdominal segment completely associated with tubercle SD1 (Fig. 9); attacking rice *Chilo polychrysus*
- Major axis of spiracle of 8th abdominal segment is more than twice as long as of 1st abdominal segment; SD2 on 1st abdominal segment partly associated with tubercle SD1 (Fig. 9); usually not attacking rice *Chilo auricilius*
- 10. 1st to 7th abdominal segments with a tubercle caudad to spiracle (Fig. 9); ventral longitudinal stripe running mesad to spiracle *Chilo partellus*
- 1st to 7th abdominal segments without tubercle caudad to spiracle 11
- 11. Meso- and metathorax with a tubercle ventrad to tubercle L3 (Fig. 9) *Chilo sacchariphagus*
- Meso- and metathorax without tubercle ventrad to tubercle L3 (Fig. 9) *Chilo tumidicostlis*

Pupa (Figs. 10-16)

- 1. Fore wing in contact with for short distance each other at caudal tip of mid leg (Fig. 10) *Sesamia inferens*
- Fore wing not in contact with each other, separated by legs (Figs. 12, 14) 2
- 2. Without cremaster; hind leg extremely extending beyond caudal end of fore wing (Fig. 12) 3
- With well developed cremaster 5
- 3. Mid leg adjacent each other on the meson for the caudal one third of its length *Tryporyza nivella*
- Mid leg adjacent each other on the meson nearly caudal one third, but extreme tips separated 4
- 4. Distal margin of labrum more or less indented *Tryporyza incertulas*
- Distal margin of labrum straight or slightly convex *Tryporyza innotata**
- 5. Cremaster with several curled hooks (Fig. 13) *Ostrinia furnacalis*
- Cremaster without such curled hooks 6

Fig. 10. Ventral view, *Sesamia inferens*.Fig. 11. Cremaster, ventral view, *Sesamia inferens*.Fig. 12. Ventral view, *Tryporyza incertulas*.Fig. 13. Cremaster, ventral view, *Ostrinia furnacalis*.Fig. 14. Ventral view, *Chilo polychrysus*.Fig. 15. Terminal segments, side view and dorsal view, *Chilo auricilius*.Fig. 16. Terminal segments, side view, *Acigona steniellus*.

- 6. 10th abdominal segment with lateral longitudinal furrow (Fig. 15) 7
- 10th abdominal segment without lateral longitudinal furrow (Fig. 16); frons produced conical.....*Acigona steniellus*
- 7. Frons with projection (Fig. 14) 8
- Frons rounded, without any projection.....*Chilo sacchariphagus*
- 8. 5th to 7th abdominal segments with a row of ridge or spines 9
- 5th to 7th abdominal segments without such ridge or spines*Chilo suppressalis*
- 9. 7th abdominal segment with a row of strong spines around segment.....*Chilo tumidicostalis**
- 7th abdominal segment with a ridge around segment.....*Chilo infuscatellus*
- 10. Thorax with spiracle somewhat protruding; numerous minute dorsal spines on 5th to 7th abdominal segments forming arranged in a transverse band*Chilo partellus*
- Thorax with spiracle protruding out distinctly 11

11. Antenna extremely extending beyond caudal end of proleg.....
 Chilo auricilius
 – Antenna extending over a little beyond caudal end of proleg (Fig. 14)
 Chilo polychrysus
 * The pupal specimens of *T. innotata* and *C. tumidicostalis* have not been available.
 The characteristics used in the key are cited from Rothschild (1967) and Gupta (1960).

Discussion

S. Areekul, Thailand: Why don't you put *Chilo* to *Chilotrea*?

Answer: *Chilotrea* is a synonym of *Chilo*.

K. Yano, Japan: Is the larval material of *Tryporyza innotata* in your key based on the Malaysian material?

Answer: I do not have the specimens of *Tryporyza innotata*. Therefore, in the key of this paper, characteristics of *T. innotata* are cited from Rothschild (1967).

M. B. Kalode, India: During your last visit you collected some specimens of *Chilo* larvae from C.R.R.I. Cuttack (India). Would you kindly let me know what those species are?

Answer: I collected three species of the rice stemborers during my stay in C.R.R.I. The most abundant species was *Tryporyza incertulas*. I collected only a few specimens of *Chilo suppressalis* and one larva of *Chilo polychrysus*.

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