Destructive insects of China

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AT

CORNELL UNIVERSITY

DESTRUCTIVE INSECTS OF CHINA

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Chapter XXI
Order Lepidoptera

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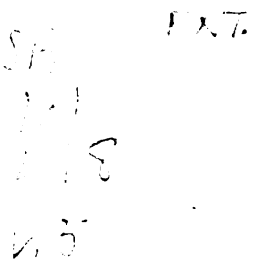
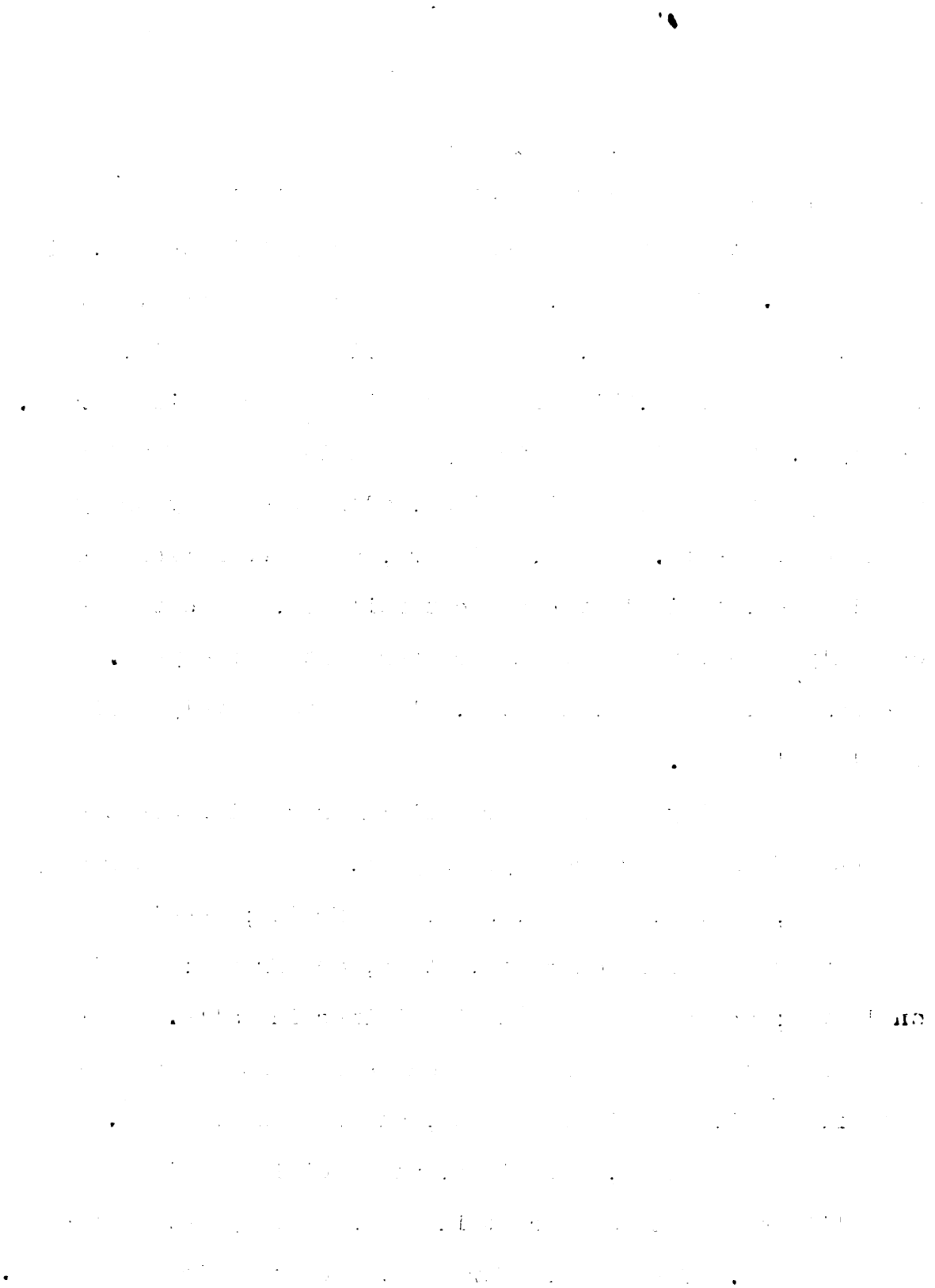


CHAPTER XXI

ORDER LEPIDOPTERA

The Lepidoptera, one of the best known orders of insects, interest man for their economic significance as well as for the attractiveness of their brilliant and varied coloration. Of some 100,000 species occuring all over the world, no less than 10,000 are found in Eastern Asia, including numerous, hitherto undescribed microlepidopterans. Nearly 8,000 species are already known in China of which about 650 are reputedly injurious, among them many truly destructive pests. Moths, skippers, and butterflies are the imagoes, their larvae are caterpillars, and both are commonly seen throughout the greater part of the year. The damage is created, however, almost exclusively during the larval stage.

The majority of the terrestrial forms which are the nucleus of the order are phytophagous, attacking externally the stems, leaves, flowers, buds, and fruits; feeding internally as borers on roots, stems, and fruits; as miners on leaves; as gall makers and inquilines in galls. Some that are saprophagous are found on dead plant and animal matter, fungi, clothing, carpets, and woolen products. Others are predators, parasites, and social parasites, which have little importance except inasmuch as they devour the lac cultures. The aquatic forms have no economic importance.



Most of the members are provided with four, well-developed, scaly, membraneous wings; but occasionally the wings of the females are vestigial. Mouthparts are built for sucking, forming a long proboscis; and metamorphosis is complete.

FAMILY HEPIALIDAE

It is a widely distributed family consisting of approximately 200 species best represented in Australia and South America. During the larval stage, it feeds either externally or internally on the roots, stems, trunks, and twigs of woody and herbaceous plants.

Occasional Pests

Name	Distribution	Affected
1. Palpifer sexnotatus Moore	1	Colocasia antiquorum, peach, tung tree
2. Phassus excrescens Butler	3	Peach, pear, walnut, grape, loquat, cherry, elm, willow, oak.
3. Phassus formosanus Shiraki	1	Mallotus japonicus
4. Phassus signifer Walker	1,2,3	Peach, grape, persimmon, tung tree, Tectona grandis, Paulowinia tomentosa, Bischofia javanica, Melia azedarach, willow.

FAMILY COSSIDAE

This family is similar to Hepialidae biologically in being borers, some of which render considerable damage to fruit and forest trees. Of a small number of species known to the world, seven have been reported injurious to China.

5. Leopard moth, Zeuzera pyrina Linne, has a wing spread of 4.5 to 6.5 centimeters. The foundation of body and wings is white, patterned with both isolated and fused black spots. Each of the abdominal segments has a broad blackish band. The larva is pinkish-white covered with many dark brown tubercles, has a large dorsal plate on the first segment, and when full grown attains a length of 2.5 to 3.7 centimeters.

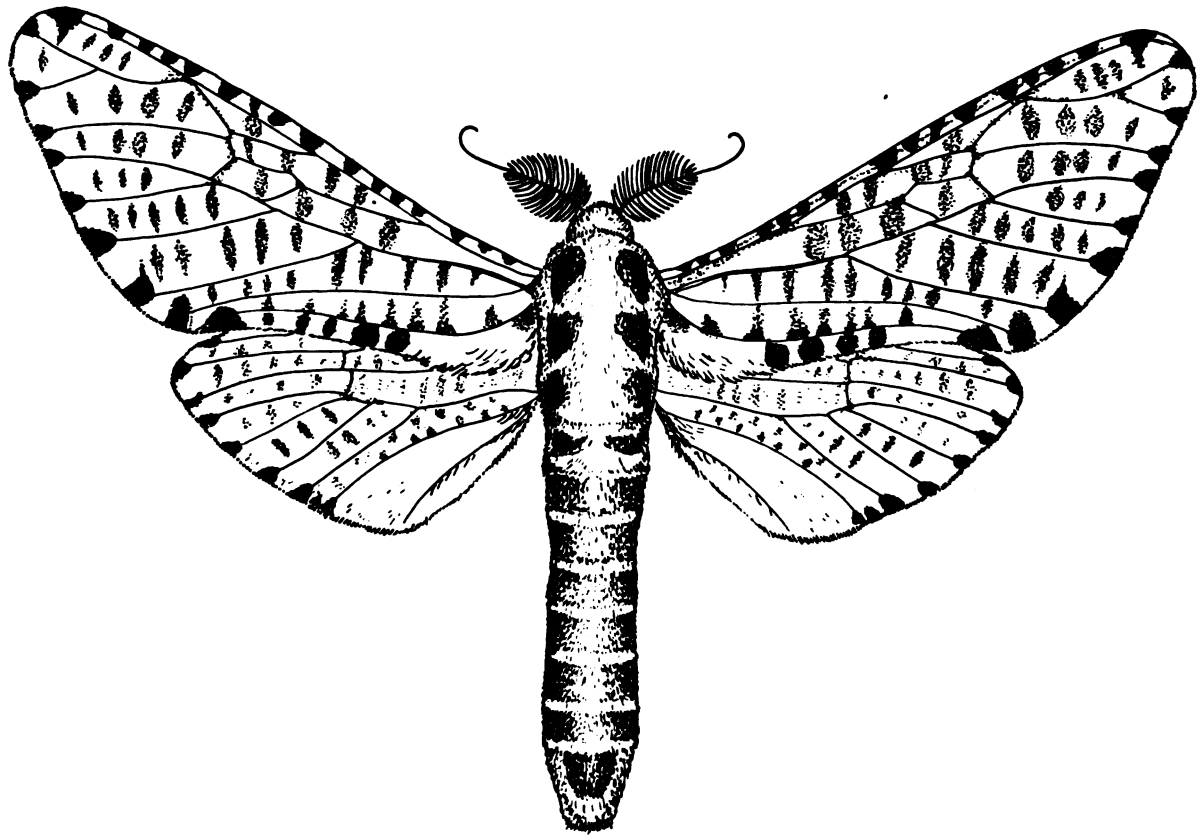
Distribution: It is widely distributed, being known in north China; it occurs also in Korea, Japan, Europe, and N. America.

Affected: Apple, pear, cherry, persimmon, pomegranate, poplar, willow, oak, maple, Ficus religiosa, and many others.

Nature of Losses: This borer attacks a vast variety of fruit and shade trees of all ages. It first girdles the branches, then gradually migrates down to large branches and trunk in later stage. Injured twigs and branches either suddenly or gradually die back. A warning can be detected by close examination since many larvae may appear on a small area.

Life History: A generation may be completed in every two or three years, hibernating in the larval stage. A female can lay as many as 800 eggs in 1 to 3 batches. Upon hatching, which requires about 10 days, the larva bores into the wood, and pupates in the old tunnel.

Control Measures: Since no better method has been found, pruning will be useful in the early stage of infestation. Wiring or injecting carbon disulphide warrants a trial for



Zeuzera pyrina Linne

valuable trees. During the growing season, wilting branches should be removed as soon as they are detected.

References

Biology & Control:

Britton & Cromie 1911

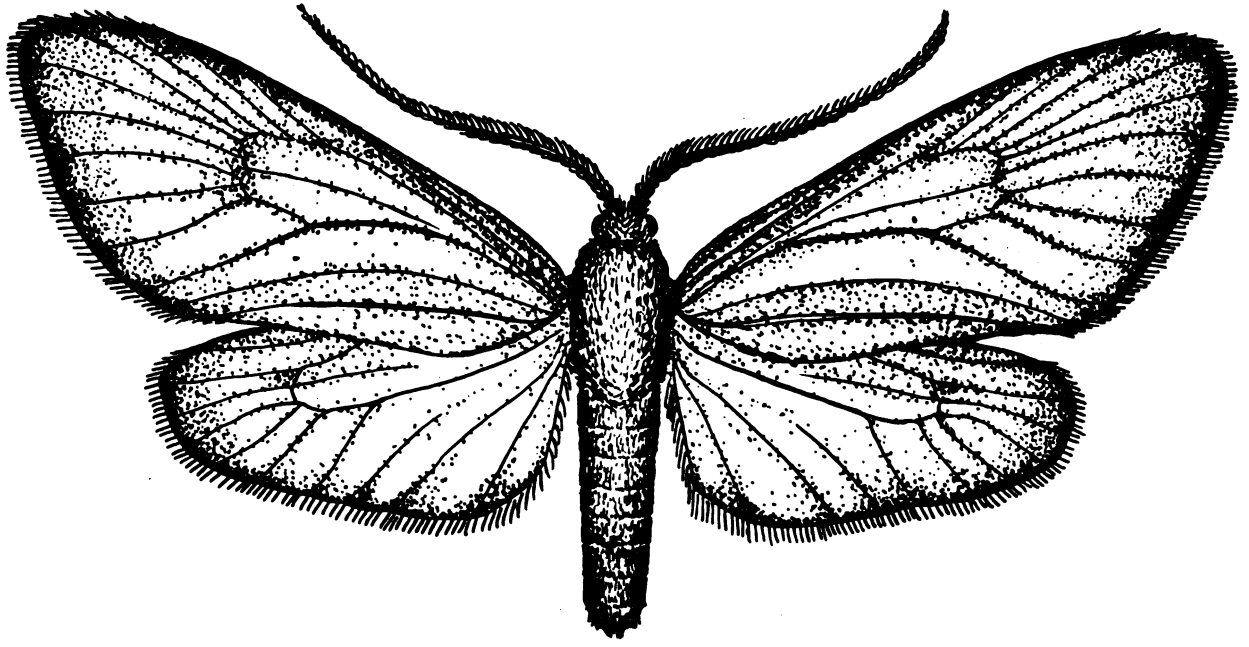
Kotinsky 1921

Control:

Flet 1933

Occasional Pests

	Name	Distribution	Affected
6.	Cossus Linnaeus	1,3	Timber
7.	Hoplococcerus vicarius Walker	2,3	Pear, cherry, chestnut, walnut, apple
8.	Hypopta sibirica Alpheraky	3	Asparagus
9.	Phragmataecia castanae Hübner	1	Phragmites communis
10.	Xyleutes strix Cramer	1	Timber
11.	Zeuzera coffeae Nietner	1	Coffee, tea, cocoa, cinchona, pear, indigo, kapok, cotton, teak, mahogany, rose



Illiberis pruni Dyar
(Original)

12. Pear leaf roller, Illiberis pruni Dyar,[1] is bluish-black, with wings more or less transparent, dusty, and when spread measure from 1.8 to 2.2 centimeters. The larva is hairy, whitish in the first instar, grayish in the second, and yellowish-white from third to sixth. Beginning with the second instar, the head capsule turns brown and there are a pair of black spots and a black transverse bar on each of the body segments. A full-grown caterpillar measures about 0.75 to 1.25 centimeters.

Distribution: The known geographical range of this insect in China includes Szechwan, Chekiang, Kiangsu, Hopeh, Shantung, and Manchuria; it also occurs in Korea and Japan.

Affected: Pear, apple, cherry, flowering cherry, plum peach, loquat.

Nature of Losses: It is primarily a pest of pear orchards in Chekiang, Shantung, and Hopeh, the damage being greatest in Shantung, where losses in some years may reach as high as 50 or 60 per cent, the month of May being the most serious time of year. It is essentially a leaf feeder, although sometimes it attacks leaf, flower, buds, and, in the absence of foliage, even attacks young fruits. Leaves are rolled together to form a protective shelter, and feeding occurs therein. Until maturity, the insect constructs new shelters as the old cases become skeletonized. As many as eight to thirteen leaves are destroyed by a single larva.

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1. Possibly additional species.

Life History: One generation is propagated annually, wintering as a second instar larva under the bark. In February, feeding is resumed on leaf and flower buds, but by April, the insect becomes exclusively a leaf roller. Pupation takes place in May within the roll and the adult appears about seven to sixteen days later. Oviposition may begin as soon as two days after the emergence of the adults. During June or July a female lays from 75 to 450 eggs in masses or in rows on leaves; these hatch in approximately ten days. The life of the male moth is seven days, and of the female, 10 days.

Control Measures: Wintering larvae can be destroyed by preparing straw bundles around the trunk of the tree before hibernation, then collecting and burning, or scraping the larvae off the bark where they remain dormant. Three coverages of lead arsenate spray applied at intervals of two weeks, beginning about the blossom time, will probably be sufficient to protect the buds and young leaves from injury.

Natural Enemies:

Larval stage:

Sarcophagids (Dip., Sarcophagidae)

Chalcids (Hym., Chalcicidae)

References

Biology:

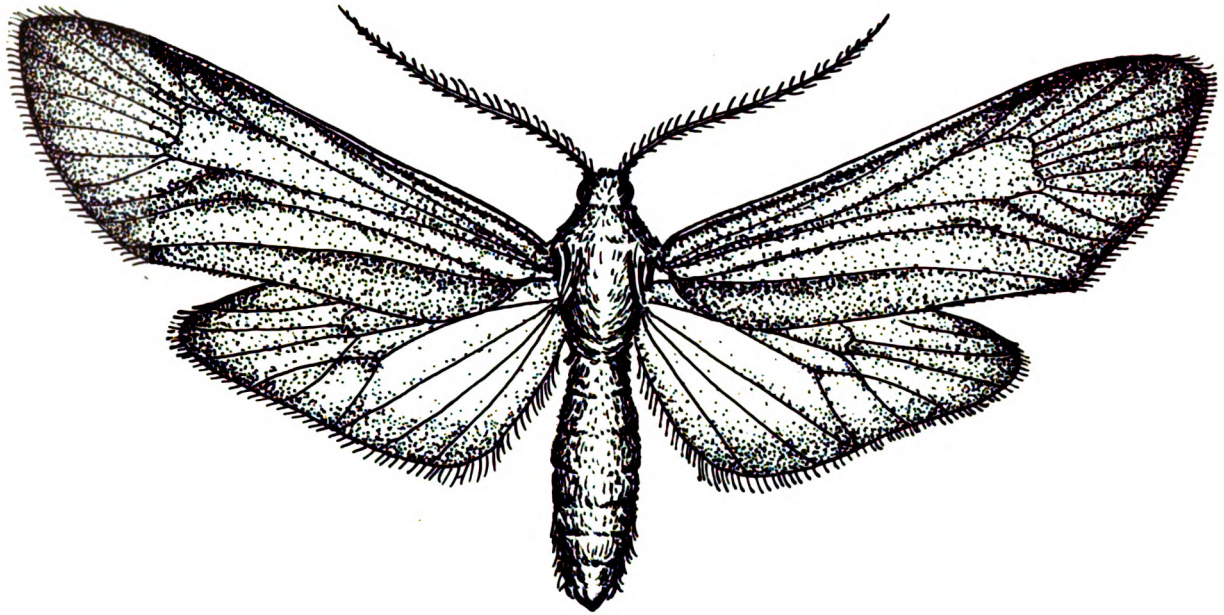
Arakawa & Akiyama 1933

Biology & Control:

Anonymous 1935

Matsumura 1932

Chang & Lin 1939



Artona funeralis Butler
(Original)

13. Bamboo Zygaenid, Artona funeralis Butler, brownish-black, antenna and body slightly metallic, wing expanse of approximately 2.0 centimeters, is a moth superficially resembling the pear leaf roller, but differing in having its forewing opaque and the median vein of the hind wing far apart from the cubitus; whereas these two features in the pear leaf roller converge at the base. A matured larva is yellowish-green, hairy, with a reddish-brown head, and measures about 1.0 to 1.5 centimeters.

Distribution: It is known in China in Kwangtung, Formosa, Chekiang, and Hupeh, and is also represented in the fauna of Korea and Japan.

Affected: Bamboo.

Nature of Losses: Particularly in Chekiang, it attacks plants of the genera Bambusa and Phyllostachys, preferring the former. The larva feeds superficially on the under surface of the leaves, but consumes entire leaves later, thus defoliating the plant. Production of shoots is thereby reduced and occasionally the plants are entirely wilted.

Life History: Three generations are recorded annually in Chekiang where it winters as a matured larva in the cocoon. Beginning in April it transforms into a pupa; the adult of the first brood appearing in May, the second in July, and the third in September. The egg-laying capacity of the female varies from 114 to 188, and these eggs are deposited in batches on the underside of the leaves and on the sheathing part of some

leaf bases. The newly hatched larva is gregarious, congregating on the back of the leaves. Pupation takes place in brush piles, under bark and stones, within leaf sheaths, or in other protected places. The egg, larval, and pupal stages of the first generation conclude in 11 to 16, 25 to 32, and 11 to 18 days respectively. The entire life cycle may be completed within fifty-one to seventy-four days, and the life span of an adult covers four to eight days.

Control Measures: Successful destruction of the over-wintering larvae can be achieved by cleaning up; but such a measure must be taken before they leave hibernation. Effective sprays are made with arsenicals, rotenone, and especially pyrethrum. For small scale control, hand picking during the larval stage is recommended. A large number of natural enemies are found on the larval and pupal stages and since parasitism sometimes reaches 40 per cent, all possible aid should be given to the propagation of these beneficial creatures.

Natural Enemies:

Larval and pupal stage:

Many species of parasitis dipterous and hymenopterous flies.

References

General note:

Ng 1936

Biology and Control:

Matsumura 1932

Chin 1937

Occasional Pests

	Name	Distribution	Affected
14.	Elcysma westwoodi Snellen	3	Plum, peach, apple, flowering cherry
15.	Eterusia aedea Linne	1,2,3	Tea
16.	Eterusia formosibia Strand	1	Tea
17.	Illiberis tenuis Butler	3	Grape, Euonymus japonica
18.	Phauda flammans Walker	1	Ficus wightiana, Crotolaria retusa
19.	Pidorus glaucopis Drury	1,2,3	Eurya japonica
20.	Pryeria sinica Moore	3	Euonymus japonica
21.	Zygaena niphona Butler	3	Alfalfa

FAMILY EUCLEIDAE[1]

This is a small family containing some 800 known species highly developed in the tropics and subtropical regions. About 100 species have been recorded in China, of which about 30 are injurious to leaves of fruits and shade trees, but are seldom so abundant as to cause formidable damage. Because many larvae of these insects have poisonous spines which produce painful irritation on human skin, growers are warned to take precautions for protection.

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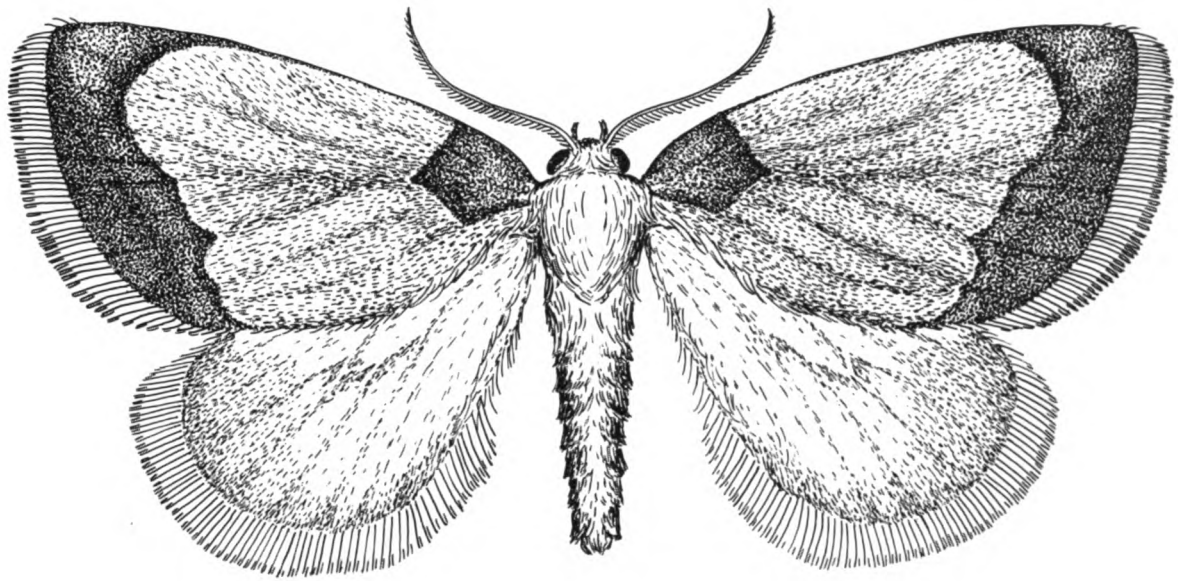
1. Names used by others are: Cochlidiidae, Limacodidae, Heterogeneidae.



Parasa sinica Moore
(Original)

22. Chinese Parasa, Parasa sinica Moore, has a wing spread of 2.3 to 2.8 centimeters. Both body and forewing are green, but the hind wing is brownish and the basal spot and the outer border are dark brown. The caterpillar is a footless, light green slug with black stripes and many yellow, transparent granules upon which poison spines are located. When full grown, it measures about 2.0 centimeters.

Distribution: This is a widely distributed species, being known in China in Formosa, North China, and Manchuria; the same is found in Korea and Japan.

Affected: Apple, pear, tea.

Nature of Losses: This pest attacks foliage exclusively and although not prolific, appears commonly, causing some injury to plants.

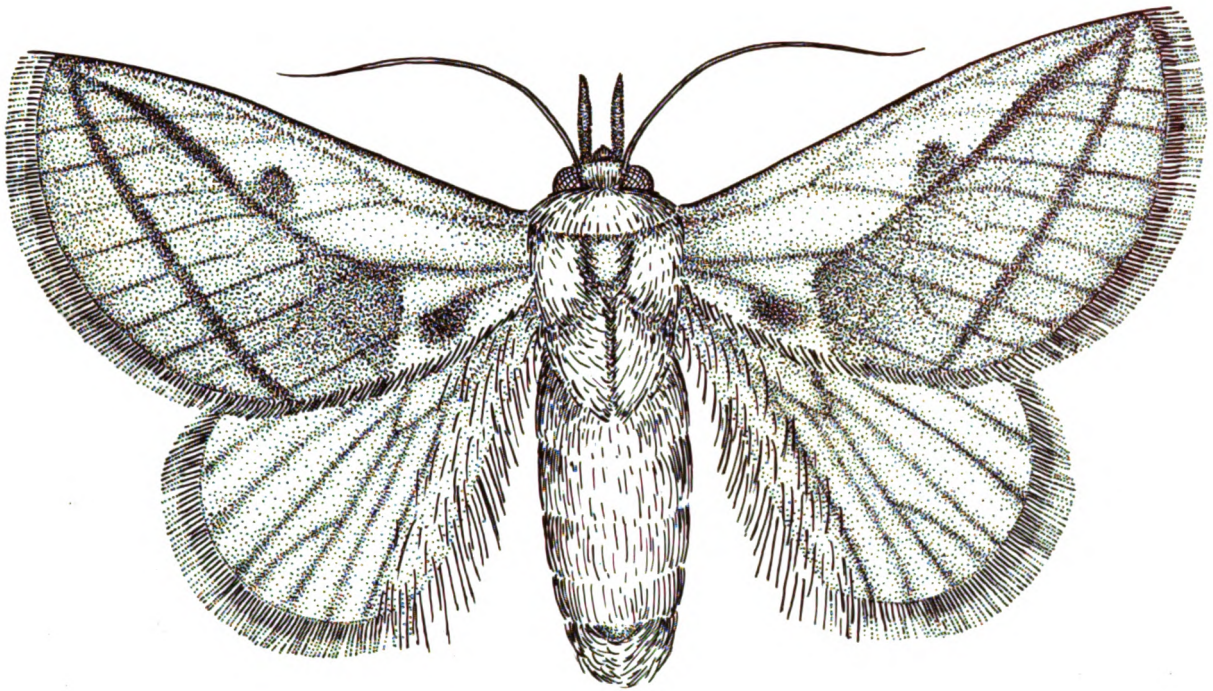
Life History: No study has been made on this insect in China. It probably has two broods in the area north of the Yangtze Kiang, and south of that, possibly three. The winter is passed in the egg-like cocoon; and in spring the overwintering larva transforms to the pupa from which the adult moth emerges.

Control Measures: In winter, cocoons may be collected and destroyed since they are easy to detect. During the growing season, arsenical sprays or pyrethrum preparations may be employed, for hand picking offers inadequate protection. Light traps at the time of emergence are reasonably effective.

References

Biology and Control:

Matsumura 1932



Monema flavenscens Walker
(original)

23. Yellowish-brown Monema, Monema flavescens Walker, having a wing expanse of approximately 3.0 centimeters. The body and wings are orange-yellow. The forewing has a brown spot near the base of the anal area; the outer border is largely brown upon which lie two dark slanting bands, the inner one of which disappears at its half-way point, whereas the other one runs across the entire wing. The larva is yellowish-green, spiny, with a large, obvious, greenish-blue patch placed dorsally on each of the 2nd to 4th, 8th, and 9th segments. When full-grown, it attains a length of 2.5 centimeters.

Distribution: In China, it has been recorded in Kwangtung, Formosa, Hupeh, Chekiang, Kiangsu, North China, and Manchuria. It also occurs in Japan and North America.

Affected: Pear, apple, cherry, flowering cherry, pomegranate, loquat, Citrus, persimmon, and numerous other plants.

Nature of Losses: This insect attacks only the foliage of the plants; the newly hatched larva feeding superficially on the lower side of the leaves, later gnawing the entire leaf beginning at its tip. When in great numbers, it causes considerable damage.

Life History: This insect apparently has two generations yearly in the vicinity of Shanghai, Kiangsu, where it winters as a matured larva in the cocoon formed during the autumn, not pupating until the following spring. The adult appears in May

and oviposits soon after emergence. Upon hatching, the larva assumes full growth in a month, and enters pupation in July. The adult of the second brood comes out in August and lays eggs which give rise to the overwintering larvae. A female lays about 200 eggs which are deposited singly on the underside of the leaves, usually one per leaf. The incubation period lasts approximately ten days and to attain maturity, the larva goes through four instars which requires about thirty days. The duration of the adult life is only some seven days.

Control Measures: In addition to the general recommendations for the Chinese Parasa, attention should be given to the utilization of natural parasites. In some instances, parasitism is said to be as high as 50 per cent, so all parasitized cocoons should be treated carefully in an effort to encourage the natural opponents. These parasites are, Chrysis shanghaiensis, Eurytoma monemae, and Cryptus sp., the first two being most numerous. The first is a cuckoo-wasp, bright green with metallic tints and partly colored with dark blue, which lays eggs on the larva of the pest after chewing through the cocoon, then refills the hole after oviposition. Upon hatching, this parasitic larva preys on the host until full-grown; then pupates, emerging as an adult. The second is a Chalcidid fly which has three generations a year. This fly seems dependent on the first one to pierce the cocoon so it may lay eggs; thus both of these parasites may occur on the same slug.

Natural Enemies:

Larval stage:

Chrysis shanghaiensis Sm. (Hym. Chrysidiidae)

Eurytoma monemae Ruschka (Hym. Chalcididae)

Cryptus sp. (Hym. Ichneumonidae)

References

Biology:

Okajima & Takeda 1932

Biology and Control:

Matsumura 1932

Piel & Covillard 1933

Control:

Nawa 1938

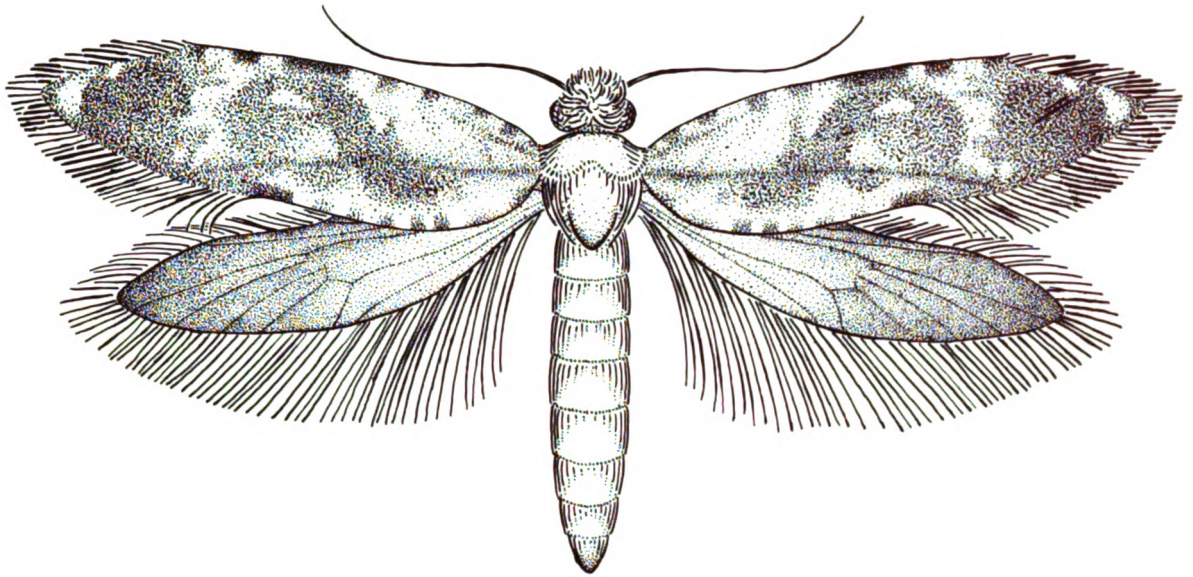
Occasional Pests

	Name	Distribution	Affected
24.	Cania bilinea Walker	1,3	Citrus, tea
25.	Cania sinensis Tams	1	Citrus
26.	Contheyla taihokuensis Shiraki	1	Citrus
27.	Heterogenea dentatus Oberthur	1,3	Chestnut, cherry, flowering cherry, pear
28.	Mahasena oolona Sonan	1	Tea
29.	Microleon longipalpis Butler	1	Pomegranate, persimmon, pear, flowering cherry, tea
30.	Miresa inornata Walker	1,3	Persimmon, pear, maple
31.	Nagodopsis shirakiana Matsumura	1	Citrus
32.	Narosa conspersa Walker	1,3	Walnut, maple, Prunus spectabilis, Rosa chinensis
33.	Narosa edoensis Kawada	(--)	Cherry, plum
34.	Narosanitobei Shiraki	1	Citrus, tea, Abrus precutorius

	Name	Distribution	Affected
35.	Orthocraspeda trima Moore	1	Orange, mulberry, tea
36.	Oxplax ochracea Moore	1	Citrus
37.	Parasa consocia Walker	1,2,3	Apple, pear, persimmon, cherry, mulberry, willow, poplar, alder, Debregeasia edulis
38.	Parasa hilarata Staudinger	1,3	Pear
39.	Parasa humeralis Walker	3	Walnut, jujube
40.	Scopelodes venosa Walker	1	Persimmon, jujube
41.	Setora nitens Walker	1	Tea
42.	Thoscoides fasciatus Shiraki	1	Citrus
43.	Thosea bicolor Shiraki	1	Citrus
44.	Thosea castanea Wileman	1	Tea
45.	Thosea postornata Hampson	1,2,3	Citrus, pear, peach, persimmon, chestnut, mulberry, jujube
46.	Thosea sinensis Walker	1,2	Citrus, tea, bean, mulberry

FAMILY TINEIDAE

This microlepidopterous family consists of some 2,400 species hitherto known, of which possibly 200 may be represented in Eastern Asia. They are largely saprophagous, scavengers of dried vegetables or dead animal matter and fungi, but also figure as household pests of stored grains and cereal products. A few destructive species commonly called clothes moths concentrate on clothing, rugs, and woolen articles. Other members are phytophagous. Of these a few are borers of fruit and wood, or are gall makers, some attacking lower plants and even devouring other insects; whereas some are social parasites.



Tinea granella Linne
(Original)

47. European grain moth, Tinea granella Linne, creamy-white, mottled with brown, having a wing expansion of 0.9 to 1.4 centimeters. The larva is yellowish-white with a pale brownish head and a brown thoracic plate.

Distribution: This cosmopolitan species has been reported in China in Kwangtung, Formosa, Liukiu, Szechwan, Hunan, Kiangsu, and Tibet.

Affected: Stored grains, flour, seeds.

Nature of Losses: This moth infests all kinds of grains and similar products in the field, and especially in storage, where it destroys and webs the grain together in lumps or clusters.

Life History: No information is available concerning the life history of the current species in China.

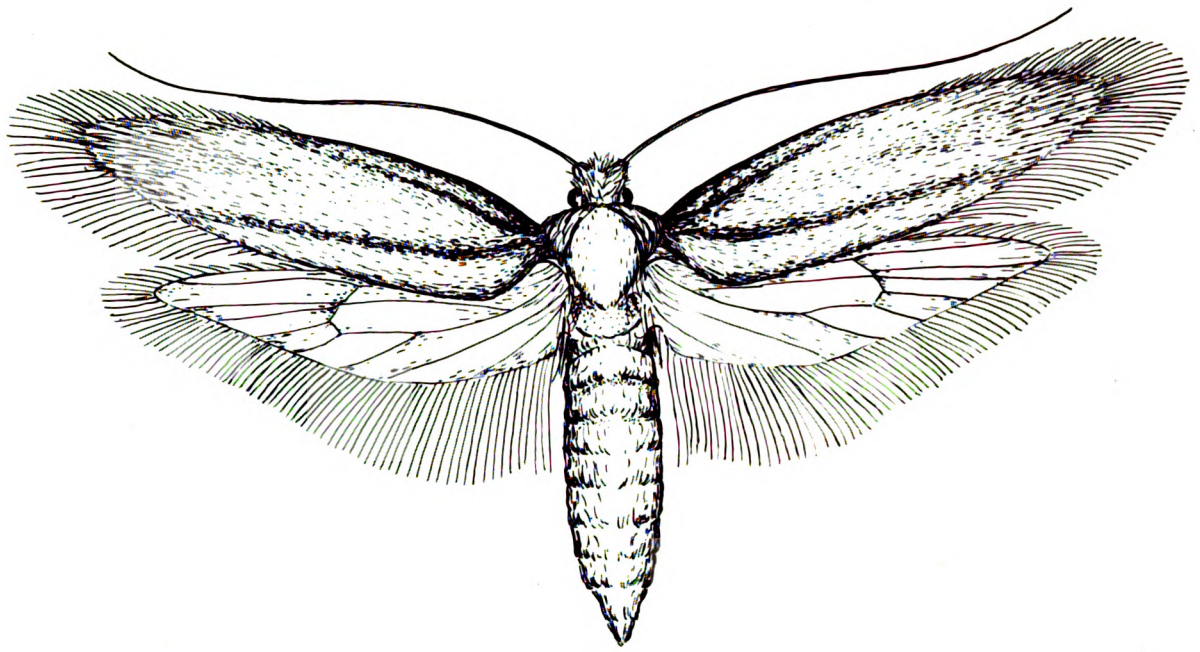
Control Measures: This pest is controlled mainly by fumigation which is discussed in detail in the section on the rice weevil and cadelle.

References

General notes:

Woo & Hsu 1935

Back & Cotton 1938



Tineola bisselliella Hummel
(Original)

48. Webbing clothes moth, Tineola biselliella Hummei, uniformly yellowish or light brown, having a wing expansion of 1.3 centimeters. The larva is creamy-white, and at maturity reaches a length of approximately 1.2 centimeters.

Distribution: It is widely distributed in many parts of the world; so far it has been recorded in China only in Kwangtung province, but is expected to have a wider range.

Affected: Clothes, rugs, fur, and woolen products.

Nature of Losses: The larvae of this pest attack only animal products, such as fur, rugs, and clothing, eating holes wherever it happens to be, and thriving particularly in heated houses.

Life History: It probably has several generations annually and under heated house conditions, will continue to multiply throughout the year, though it is most abundant in spring and early summer. In an unheated house, it probably winters in the larval stage, resumes feeding in the spring, and then transforms into pupa and adult. The egg-laying capacity of a female is about 150 or more. Eggs are deposited among the threads of the cloth and hatch about a week later under normal conditions. However, in the presence of adverse factors, this stage may last five or six weeks. The larva undergoes 5 to 12 instars, usually 5 to 7, depending on temperature and food supplies. This phase is concluded in about a month, often longer, and is followed by pupation in the cocoon, lasting approximately two weeks. The life cycle from egg to adult may be completed in

three of four months, though under exceptionally favorable conditions it may finish within two months. Moths survive from 10 to 60 days under laboratory observation.

Control Measures: Control measures consist mainly of prevention and destruction. To prevent infestation, one must first be sure that the stored items are free of clothes moths. Secondly, chests, trunks, or other containers should be tight. Stored items should be kept in cold storage if possible, for experiments have demonstrated that the larvae of the clothes moth are inactive at a temperature of 4.4° C. (40° F.). Destruction of the insects can be accomplished by exposing stored articles to direct sunlight for one or two days, or subjecting them to a dry heat of 49° to 54° C. (120° to 128° F.) for about ten minutes, or fumigating with material such as paradichlorobenzene used at a rate of eight to twelve ounces per trunk, napthalene at the rate of a half pound per trunk, or hydrocyanic gas. The last material has been discussed under the rice weevil, but such a fumigant is suitable only for control on a large scale and not for home use, because of its poisonous properties.

References

Biology:

Titschack 1925, 1926

Hase 1933

Mellanby 1934

Duspiva & Linderstom - Lang 1935, 1936

Yamada 1938

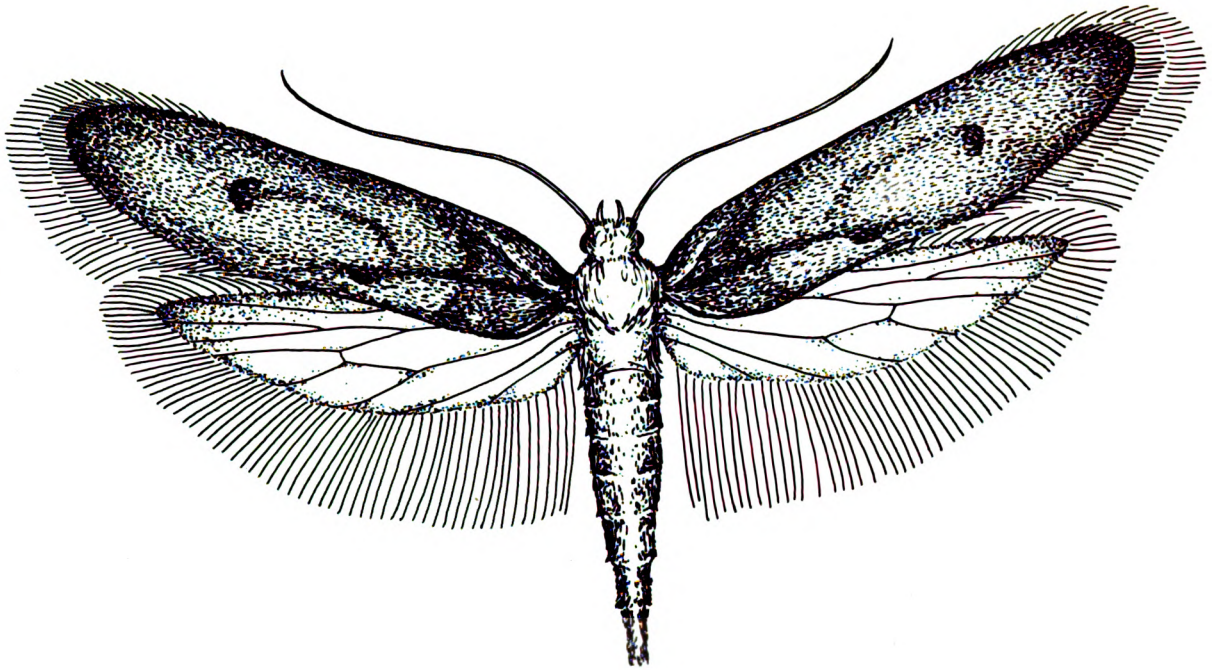
Griswold 1944

Biology and Control:

Austin & McKenny Hughes 1932

Back 1935

Herrick & Griswold 1941



Tinea pellionella Linne
(Original)

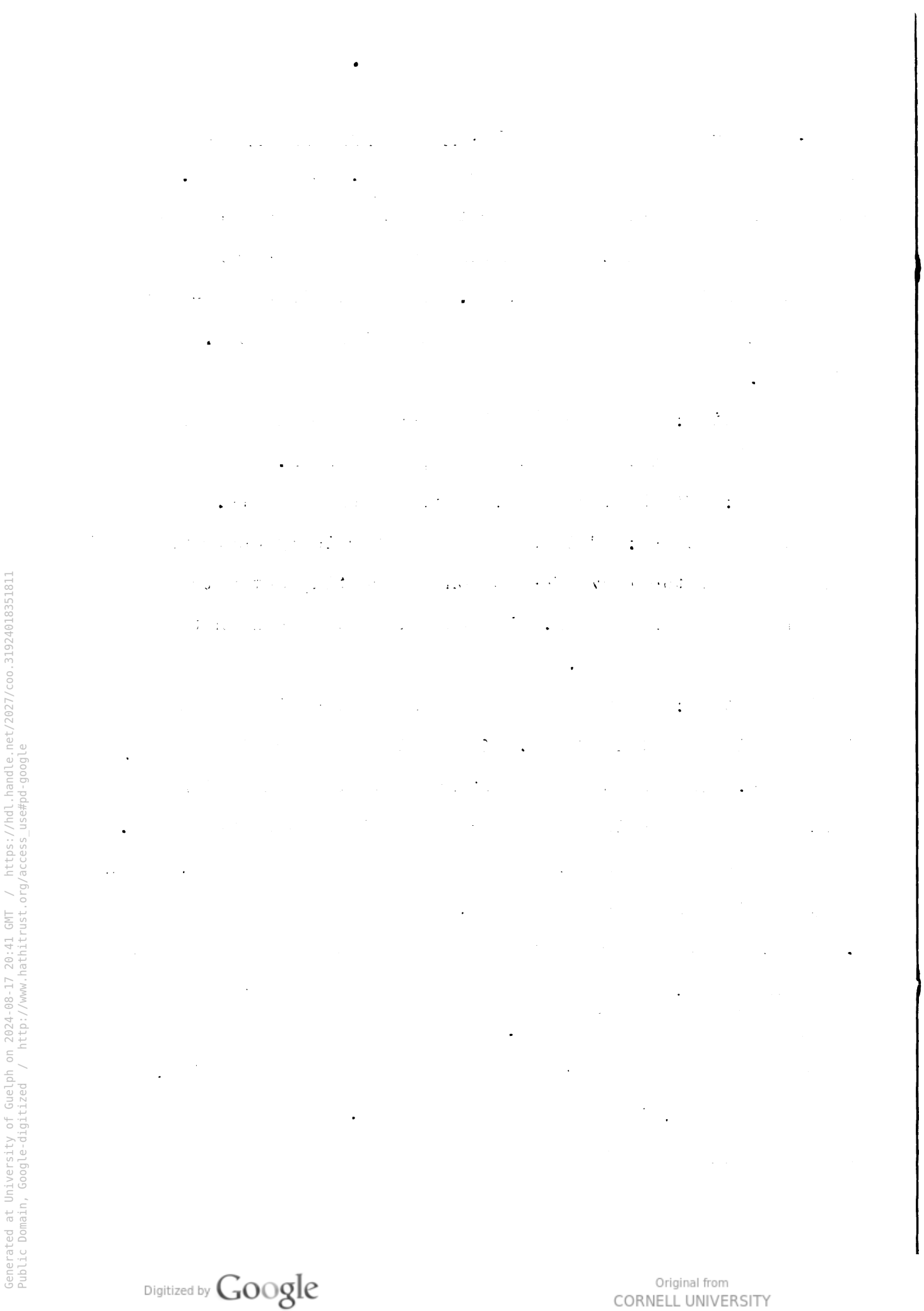
49. Case-making clothes moth, Tinea pellionella Linne, light brown, having a wing spread of about 1.2 centimeters. The hind wing is pale, but the front one has three dense spots along the center portion and sometimes a darker line running through the anal area from the base. The larva is creamy-white with a brownish head and at full growth measures about 1.2 centimeters.

Distribution: This cosmopolitan pest has been recorded in China in Kwangtung, Formosa, Liukiu, and Yunnan.

Affected: Clothes, carpets, furs, woolen products.

Nature of Losses: This household pest chiefly destroys woolen material, the larva feeding on and cutting out material to make its case for shelter. The extent of damage is not known in China at present.

Life History: No work has been done on the biology and habits of this insect in China. It possibly winters in the larval stage. In a heated house it may have two generations a year, whereas there is probably only one in an unheated house. Eggs are placed among the threads of fabrics by the female, which can lay a total of 225 eggs or more, some seventy eggs in one day. The incubation period of these eggs lasts about ten days, and upon hatching, the larva immediately builds a case which it drags along wherever it goes. The larva usually undergoes five or six instars to reach full growth and its entire life, including pupation, is spent inside the case. A life cycle may be completed in about six months or sometimes is prolonged to a year or more.



Control Measures: Same as webbing clothes moth.

References

Biology and Control:

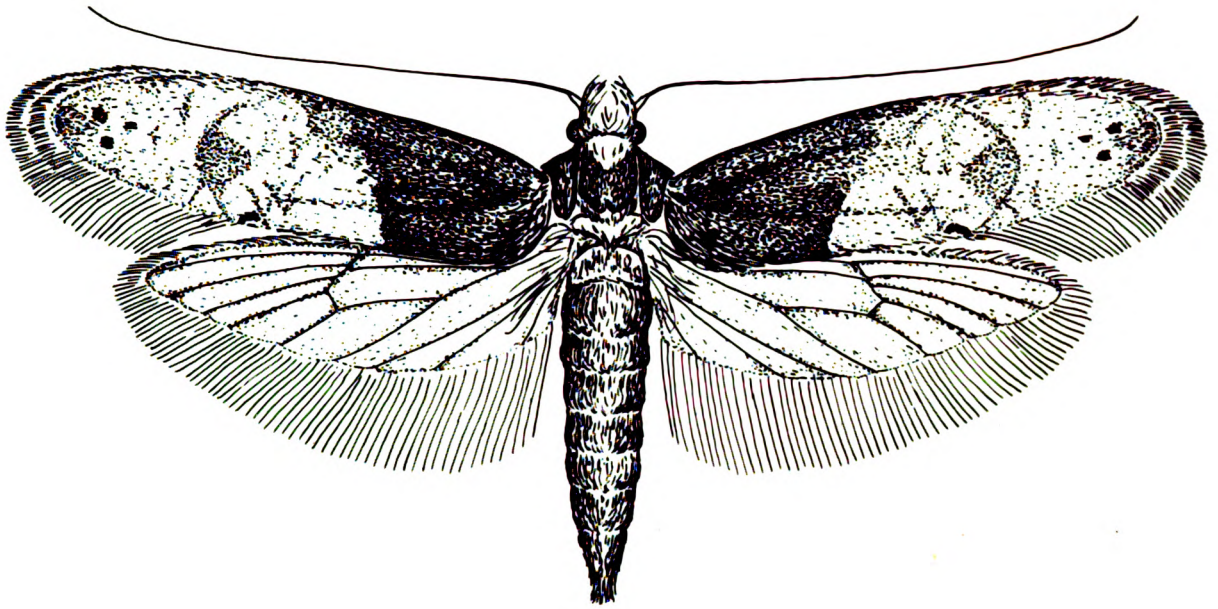
Austin & McKenny Hughes 1932

Back 1935

Yamada 1940

Herrick & Griswold 1941

Doner & Thomssen 1943



Trichophaga tapetizella Linne
(Original)

50. Gallery-making clothes moth, Trichophaga tapetzella Linne, has a wing expansion of 1.8 centimeters, and differs from the last two moths by being considerably larger with the basal portion of the forewing blackish, while the other portion is white, and the hind wing is uniformly grayish-white and somewhat transparent. The larva is whitish and when full-grown measures about 1.4 centimeters. This species constructs no case, but wherever it feeds, makes a silky gallery which it later converts into a cocoon prior to pupation.

Distribution: This cosmopolitan species is found in China in Kwangtung.

Affected: Fur, skin, carpet, and other woolen substances.

Nature of Losses: Damage occasioned by the current species is similar to that of other clothes moths, though this moth is said to prefer heavier fabrics than are preferred by the other two, and is more likely to be found in unheated houses and barns. In China it is the commonest species of all clothes moths.

Life history: No information is available concerning the biology and habits of this pest, but it is supposed to be fairly common in Europe, especially in the British Isles.

Control measures: Same as the previous one.

References

Biology and Control:

Austin & McKenny Hughes 1932

Back 1935

Herrick & Griswold 1941

Doner & Thomssen 1943

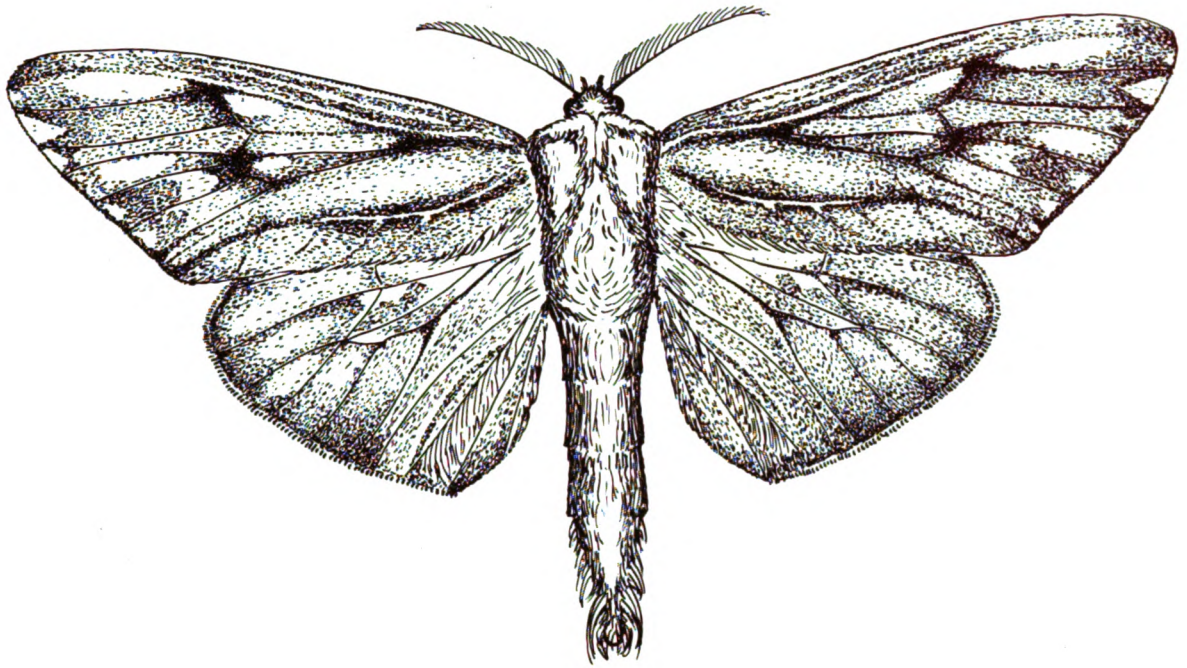
Occasional Pests

	Name	Distribution	Affected
51.	Monopis monachella Herbst	1	Woolen products, skins
52.	Morophaga barbata Christoph	1,3	Citrus
53.	Tinea colonella Erschoff	2	Stored rice, wheat flour
54.	Tinea nigrofasiata Shiraki	1	Woolen products
55.	Tinea parasitella Herbst	1	Cauliflower

FAMILY PSYCHIDAE

Bagworm is the common name applied to the larval form of this family because of the formation of the case in which the female passes its entire life. Nearly 900 species are described in the world's fauna, and the family is highly developed in the temperate zone of the old world. During the adult stage, only the males are provided with wings, whereas the wings of the females are much degenerated, and in extreme forms there is a total absence of antennae, legs, and even mouthparts.

Biologically, they may be separated into three groups: first, phytophagous feeders, including those which feed on woody and herbaceous plants and other lower types; second, the saprophagous feeders, including mainly those which feed on bracket fungi; and lastly, carnivorous insects that attack other insects. Economically, only the higher Psychids are of interest, for they are found generally on the vascular plants, especially woody vegetation; whereas the others feed chiefly on lower plants, such as lichens and moss. This family has not been well-studied in China, for so far only twenty species have been recorded, including ten injurious to fruits and ornamental trees, two of which may sometimes cause considerable damage.



Cryptothelia variegata Snellen
(Original)

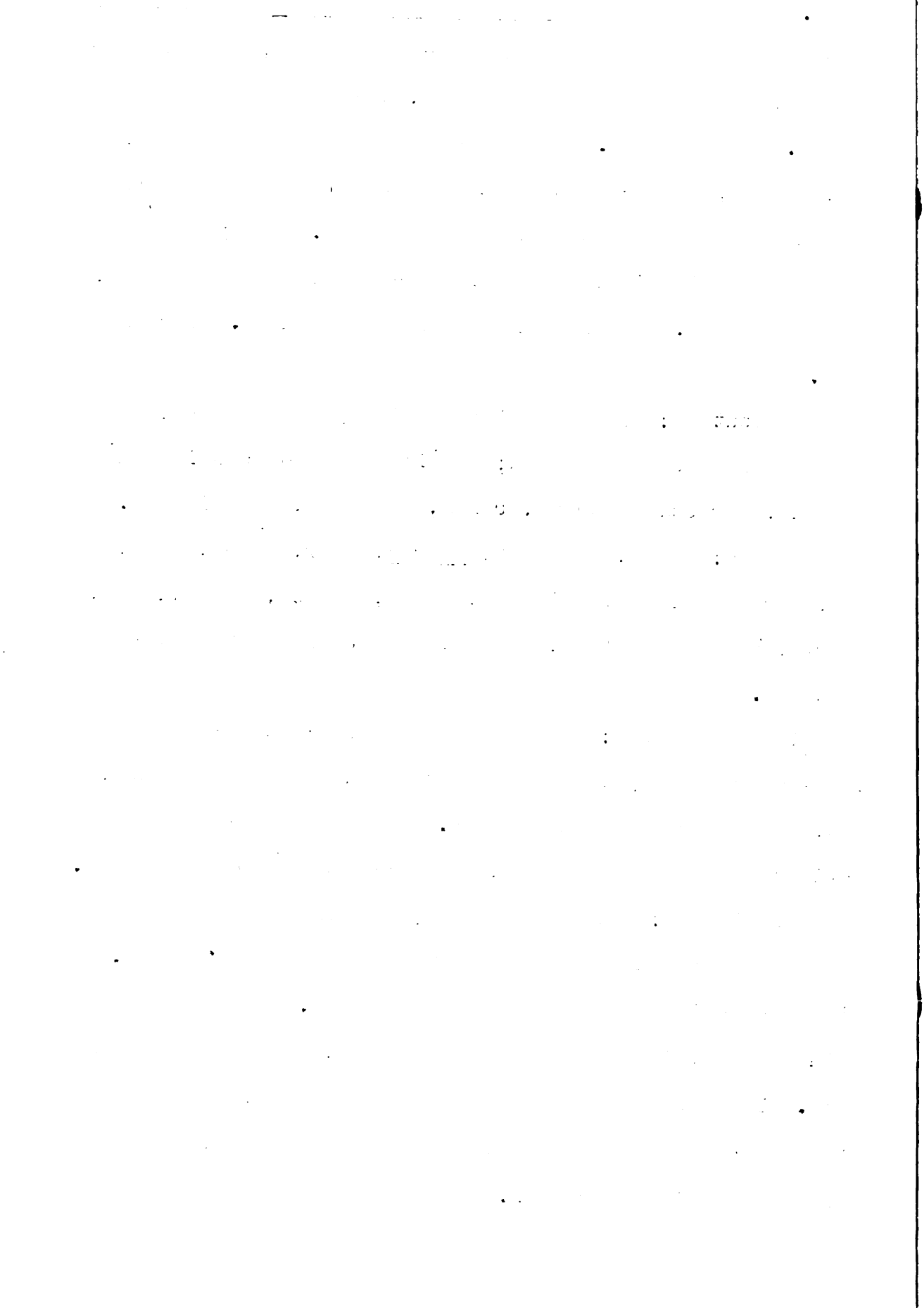
56. Large bagworm, Cryptothelea variegata Snellen, the female of which is a wingless, worm-like insect, and the male of which is provided with four wings, having a wing spread of 4.0 to 4.5 centimeters. The male is a generally brownish, hairy, active, swift-flying moth with several irregular lighter spots on the distal portion of the forewing. The young larva is generally yellowish, and when full-grown, blackish-brown, measuring from 2.5 centimeters for the male and 4.0 for the female.

Distribution: This species is widely distributed, extending from India to Japan; and is recorded in China in Kwangtung, Formosa, Szechwan, Yunnan, Chekiang, and Kiangsu.

Affected: Bean, eggplant, Citrus, pear, grape, plum, peach, persimmon, guava, lungan, lemon, banana, loquat, tea, mulberry, camphor, cotton, coffee, and numerous other trees and shrubs.

Nature of Losses: Being a general feeder, the insect attacks a great many varieties of plants, particularly tea, fruit, and other ornamental trees. Since it is so common and sometimes becomes so abundant, it causes considerable damage.

Life History: It produces only one or two generations a year and winters on the host plant as a larva in its case. Adults emerge in spring and again in autumn. Eggs are laid within the larval case to the number of 2,500 eggs for each female. These hatch in from one to three weeks, and the larval stage takes from nine to ten months or less, depending on the geographical location.



Control Measures: Destruction of the hibernating stage by hand picking is highly recommended, but should be put into effect soon after the leaves are gone in late fall. During the growing season, plants may be sprayed with arsenicals if the pest becomes abundant and cannot be controlled otherwise.

Natural Enemies:

Larval stage:

Exercistes albicincta Morley (Hym. Ichneumonidae)

Pupal stage:

Tachinids (Dip. Tachinidae)

References

General note:

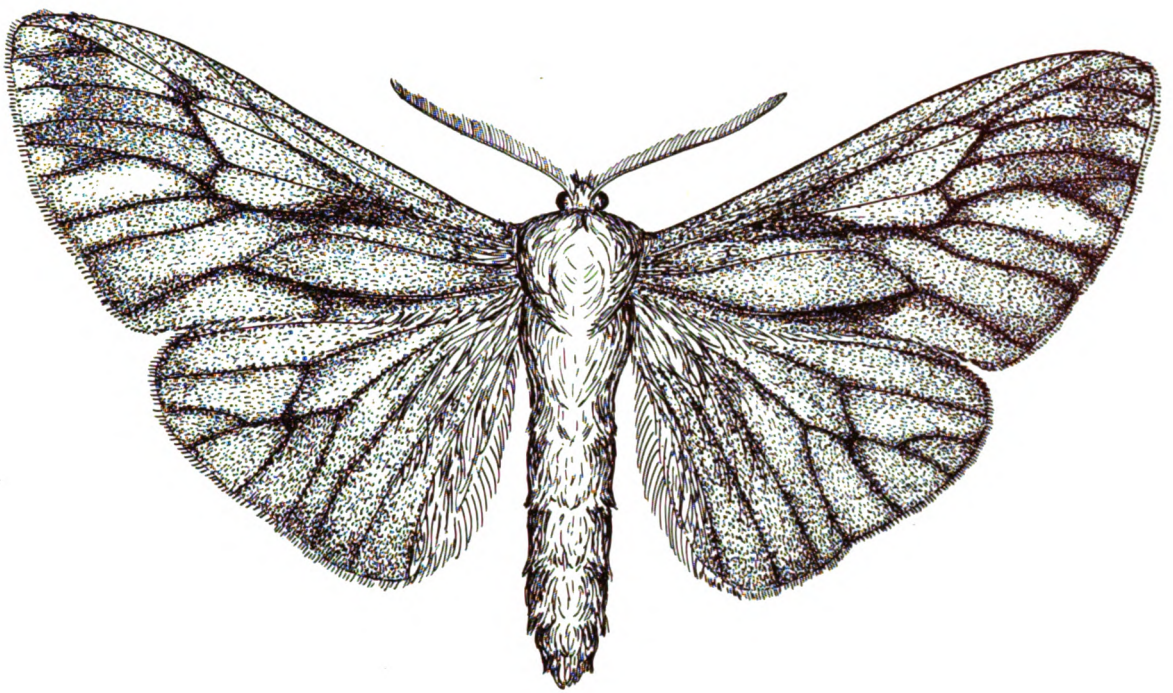
Maki 1916

Shiraki 1919

Sato 1935

Parasite:

Sonan 1922



Cryptothelea minuscula Butler
(Original)

57. Tea bagworm, Cryptothelea minuscula Butler, the female of which is worm-like and wingless, the male winged, with a wing spread of approximately 2.8 centimeters. The male is generally brown, hairy, active, but differs from that of the previous species by being smaller, bearing two lighter spots on the outer border of the front wing, and having the third median vein of the hind wing coalesced with the first cubitus halfway to the margin. The larva is brownish, generally resembling the previous one, though smaller.

Distribution: It occurs in China in Kwangtung, Formosa, Hunan, Chekiang, and Central China; it also appears in Japan.

Affected: Apple, peach, cherry, pear, jujube, chestnut, tea, oak, and many other plants.

Nature of Losses: This insect attacks many plants, particularly tea, and sometimes causes appreciable destruction.

Life History: There is one generation a year; the larva winters in the case; resumes feeding in spring, and becomes adult between May and June. Around the first part of July, the female generally lays some 800 to 3,000 eggs in the cocoon. These hatch about seven days later; the larvae mature in about 205 days, and spend twenty-one days in pupation. The longevity of the male is about two days; that of the female, sixteen.

Control Measures: Same as for the previous one.

Natural Enemies:

Larval stage:

Xanthopimpla sp. (Hym. Ichneumonidae)

Epiurus nankingensis Uchida (Hym. Ichneumonidae)

Theronia atalantae Poda (Hym. Ichneumonidae)

Exeristes albicencta Morley (Hym. Ichneumonidae)

Pimpla luctuosa Smith (Hym. Ichneumonidae)

Brachymeria fiskei Crawford (Hym. Chalcididae)

Chalcis mikado Cameron (Hym. Chalcididae)

Tachinids (Dip. Tachinidae)

Nematode

References

General note:

Sonan 1935

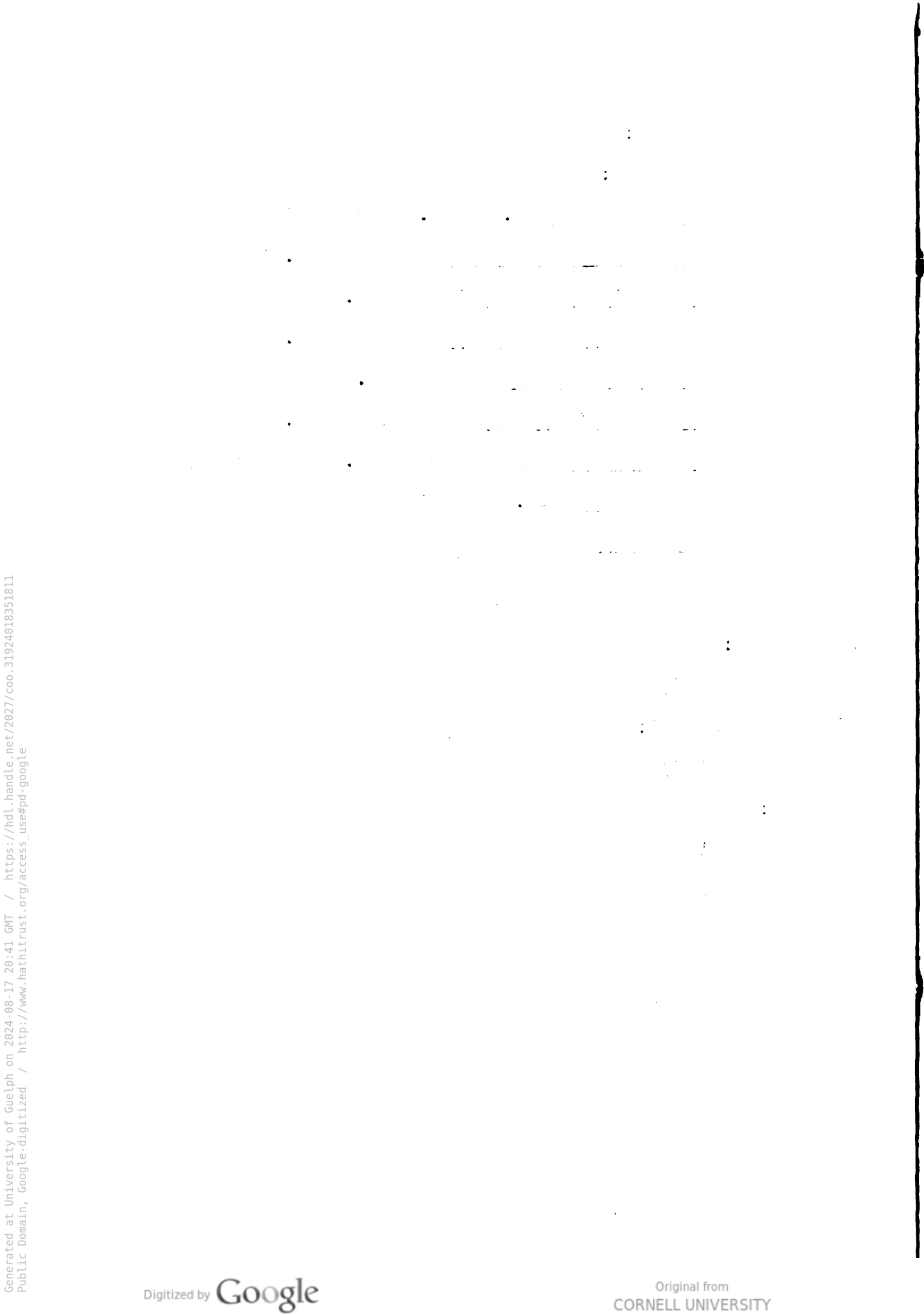
Biology and Control:

Wang 1937

Parasites:

Sonan 1930

Chu 1933



Occasional Pests

	Name	Distribution	Affected
58.	Acanthopsyche taiwana Sonan	1	Tea
59.	Acanthopsyche saccharivora Sonan	1	Sugar cane
60.	Acanthopsyche nigriplaga Wileman	1,2	Mulberry, Rubus parvifolia, Perilla nankinensis, Clematis
61.	Chalisides kondonis Matsumura	1	Citrus, persimmon, pear, loquat
62.	Clania pryeri Leech	1,2	Citrus, guava, tea, cotton, camphor, Acacia, and many other plants.
63.	Cryptothelea destructor Dudgeon	1	Tea, guava
64.	Cryptothelea formosicola Strand	1	Citrus
65.	Mahasena oolona Sonan	1	Tea
66.	Pachytelia unicolor Hufnagel	3	Apple, Citrus, persimmon, cherry, flowering cherry, peach, pear, tea, oak

FAMILY LYONETIIDAE

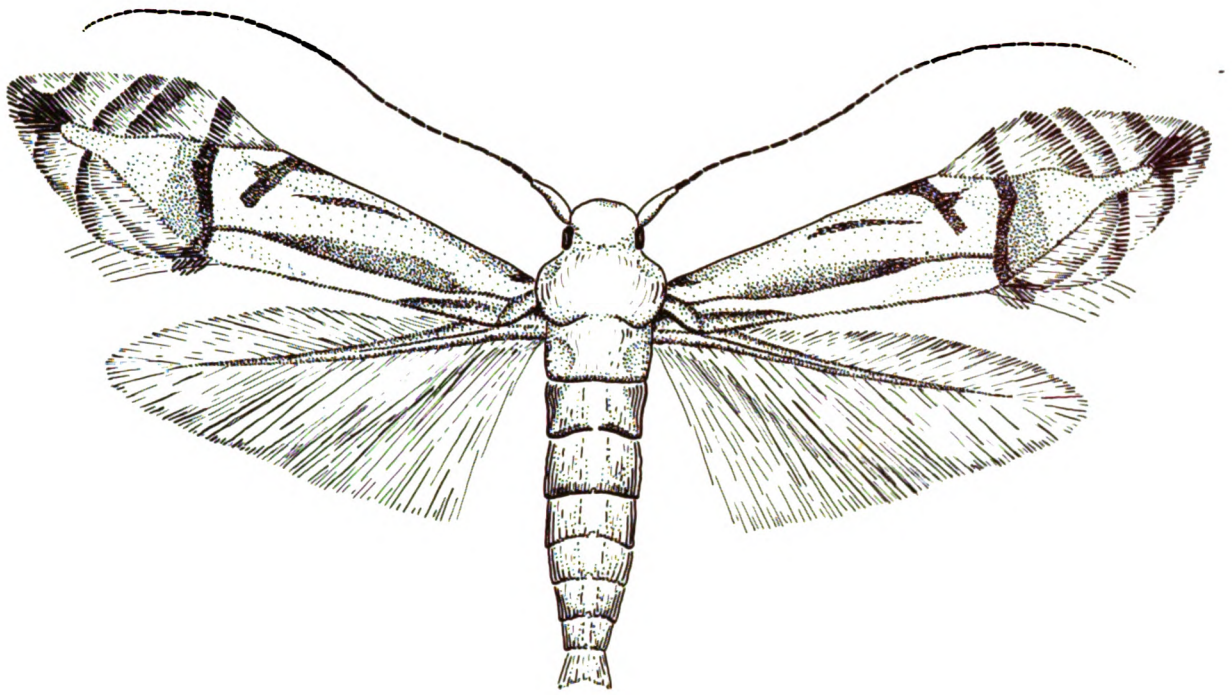
This is one of the smaller families of Microlepidoptera, comprised exclusively of some eighty genera of little moths which are often brilliantly colored. They are largely phytophagous feeders, although a few are known to be saprophagous, and others are defoliators, skeletonizing the leaves that have been spun together by the larvae. However, the family as a whole is regarded as of minor economic importance.

Occasional Pests

	Name	Distribution	Affected
67.	Leucoptera substrigata Meyrick	3	Sophora japonica
68.	Lyonetia clerkella Linne	1	Peach, apple, plum, birch
69.	Lyonetia sp.	1.	Apple, pear, peach, cherry

FAMILY GRACILARIIDAE

This is a close ally of the family Lyonetiidae, containing some 1,000 described species in the world. It contains minute moths, the color of which may be silvery, brown, golden or metallic. They are exclusively plant feeders as miners on leaves, bark, stems, fruits and seeds. Some of them attack leaves externally by webbing them together and skeletonizing afterward, but with the possible exception of the Citrus leaf-miner, these insects seldom cause enough damage to be significant.



Phyllcnistis citrella Stainton
(Original)

70. Citrus leaf-mining moth, Phyllcnistis citrella Stainton, grayish-white, with a wing spread between 0.4 and 0.5 centimeter. The front wing is yellowish with radiating blackish bands and spots.

Distribution: It is found in China in Kwangtung, Formosa, Liukiu, Szechwan, Hunan, and Cheklang; it also appears in Japan, India, Siam, Malaya, East Indies, Philippines, and Australia.

Affected: Citrus

Nature of Losses: This leaf-miner occasionally attacks young shoots but usually feeds on the upper surface of the leaves under the epidermal cells, making the leaves curl and retarding normal growth. Nursery trees are most susceptible to attack.

Life History: It probably has four or five generations a year, depending on the locality, hibernates as pupa in the cocoon, and appears as an adult the following spring. Eggs are deposited near the midrib on the lower side of the leaf. Upon hatching, the larva bores into the leaf and stays until it emerges at maturity to form a cocoon and pupate. However, the eggs and mines are generally found on the upper surface of the leaves in the humid tropics. Under summer conditions, a life cycle may be completed in about six weeks or less.

Control measures: Destruction of the hibernating stage by cleaning up fallen leaves may prove to be of some value in control. During the period of infestation, affected leaves

should be picked as soon as symptoms appear. Arsenical spray is recommended in an area where the pest is likely to be an annual threat.

References

General note:

Maki 1916

Biology:

Fletcher 1920

Kurisaki 1920

Clausen 1931

Oozi 1938

Occasional Pests

	Name	Distribution	Affected
71.	Gracilaria theivora Walsingham	1	Tea, willow
72.	Lithocolletis malivorella Matsumura	1,3	Apple, peach, cherry, pear
73.	Phyllocnistis saligna Zeller	1	Citrus

FAMILY OECOPHORIDAE

This is a large family including about 3,000 colorful microlepidopterous moths. Most of the members are phytophagous, externally attacking lower forms as well as higher plants; usually making webs, but rarely cases on leaves, inflorescence, and seeds; or injuring internally by mining into the leaves and shoots. Some are saprophagous, feeding on stored grains, cereal products, seeds, refuse, and decaying wood. Others are carnivorous, parasitizing scale insects.

Occasional Pests

	Name	Distribution	Affected
74.	Anchonoma xeraula Meyrick	1,2	Stored grains, grain products
75.	Borkhausenia inopisema Butler	3	Cotton
76.	Lactistica sp.	1	Tea
77.	Oecophora sp.	1	Cotton
78.	Psecadia isshikii Takahashi	3	Apple

FAMILY XYLORICTIDAE

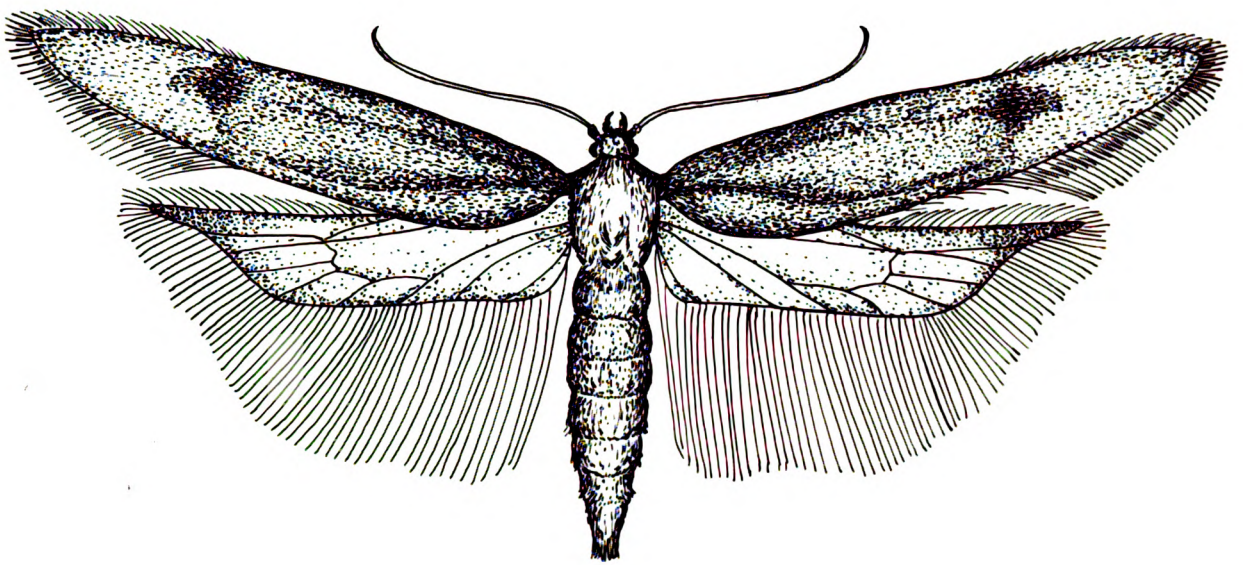
This family is composed largely of defoliators, which proceed in much the same fashion as the previous family, by webbing the leaves together to form a silken gallery, while others burrow into stems and bark. Six species have been reported as pests to useful plants, but no information is yet available regarding their biology. For the most part, they may be considered pests of minor economic importance.

Occasional Pests

	Name	Distributed	Affected
79.	Acria gossypiella Shiraki	1	Cotton, Citrus camphor, tea
80.	Athrypsiastis salva Meyrick	3	Mulberry
81.	Epimactis tolantas Meyrick	1	Citrus
82.	Linoclostis gonatiac Meyrick	1	Tea
83.	Odites malivora Meyrick	3	Apple
84.	Odites ricinella Stainton	3	Apple

FAMILY GELECHIIDAE

This family, well represented in many parts of the world, comprises approximately 3,700 species, including several famous pests such as the cotton boll moth, Angoumois grain moth, etc. In habits they resemble the previous two families, working as defoliators, rolling and webbing the leaves together; as leaf miners; as borers in seeds, fruits, buds, shoots, tubers, or other parts; or as gall-makers, producing malformations on stems. A few are known to be predaceous, one of which is said to be a pest of the lac culture in India.



Sitotroga cerealella Olivier
(Original)

85. Angoumois grain moth, Sitotroga cerealella Olivier, is yellowish-brown, with a wingspread of 1.3 to 1.8 centimeters. A dark line runs along the anal areas of the front wing and there is a spot on the center of the distal portion, but the hind wing is more or less yellowish-white.

Distribution: This pest probably exists all over China, but is recorded only in Formosa, Liukiu, Szechwan, Huna, Kiangsi, Kiangsu; it appears also in Japan, Europe, and North America.

Affected: Wheat, rice, barley, oats, buckwheat, corn.

Nature of Losses: It is essentially a pest of stored grains, although occasionally it harms plants in the field, especially in the south. In storage, its feeding is confined chiefly to grains, dry fruits, and other miscellaneous vegetable material. Usually this moth occasions about the same destruction as the rice weevil, ruining cereals by boring into the seeds. An infestation may be started from old infested seeds or from attacks by the moth before harvesting. It thrives and does particular damage in heated houses.

Life History: Customarily there are four or five generations a year, but under optimum conditions it will continue to multiply throughout the year. It winters as a larva in the seeds and emerges as an adult the following spring. The female deposits 100 to 400 eggs on the grain into which it bores, hatching after a period of one or two weeks. Under favorable circumstances, the life cycle may be

completed within five weeks, and the longevity of the adult varies from ten to fifty-three days, according to local temperature.

Control Measures: See the rice weevil.

Natural Enemies:

Eurytoma sp. (Hym. Chalcididae)

Pteromalus gelechiae Web. (Hym. Chalcididae)

Pteromalus pyrophilus Kollar (Hym. Chalcididae)

Trichogramma wanisens Westwood (Hym. Chalcididae)

Dibrachys boucheanus Rtz. (Hym. Chalcididae)

References

General note:

Anonymous 1936

Biology:

Harukawa & Kumashiro 1938

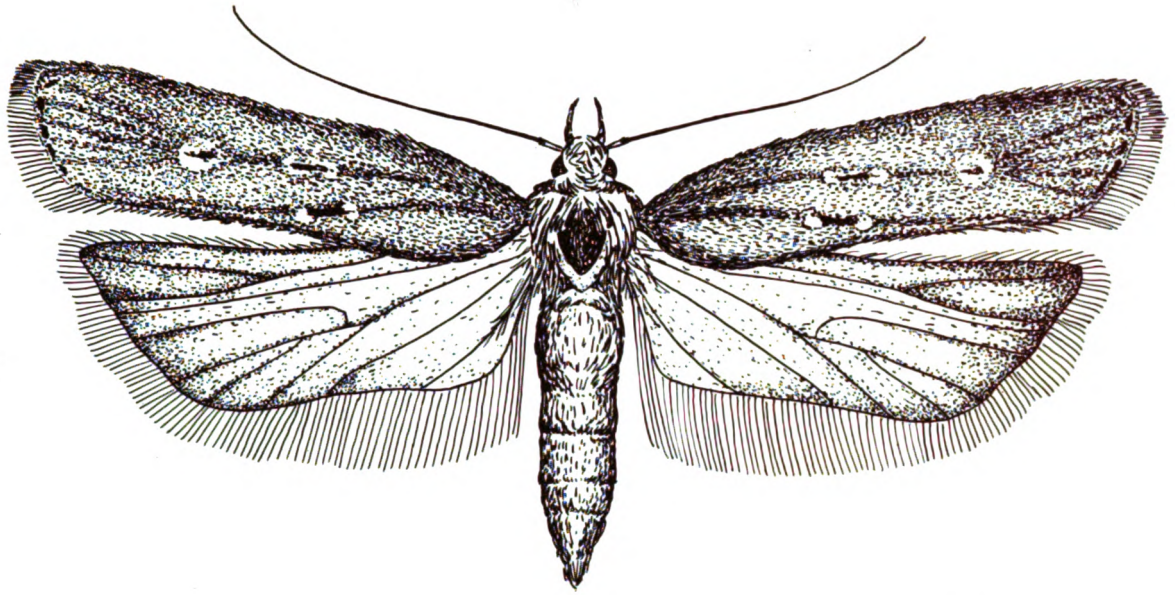
Biology & Control:

Back & Cotton 1930

Cotton 1942

Control:

Harukawa & Kumashiro 1937



Brachmia trianulella Herrich-Schaffer
(Original)

86. Sweet potato leaf roller, Brachmia trianulella Herrich-Schaffer, brownish, with a wingspread of 1.3 to 1.6 centimeters. A large,dark patch occupies a great portion of the prothorax. The forewing has an eye-spot near the center, and a row of five blackish spots located at the outer margin; the hind wing is uniformly whitish.

Distribution: It has been found in China in Formosa, Liukiu, Chekiang, and Shantung; it appears also in Japan and Europe.

Affected: Sweet potato, Ipomaea aquatica.

Nature of Losses: This insect is a defoliator, destroying leaves by webbing them together. Although it is common on sweet potato and other related plants, it seldom causes serious damage.

Life History: There are several generations a year, three or four being recorded in Chekiang. Winter hibernation takes place in the pupal stage, followed by the emergence of the adult between May and June. Eggs generally are deposited on leaves,and total twenty to eighty per female, with an average of forty. The egg, larval, and adult stages require 3 to 7, 16 to 31, and 4 to 29 days respectively. An adult female may survive from three to nineteen days.

Control Measures: For control on a small scale, insects may be collected by hand by trimming out rolled leaves. Commercial growers may protect plants with nicotine dust. During the winter, fields should be thoroughly cleaned so as to eliminate the potential source of infestation for the

following year.

References

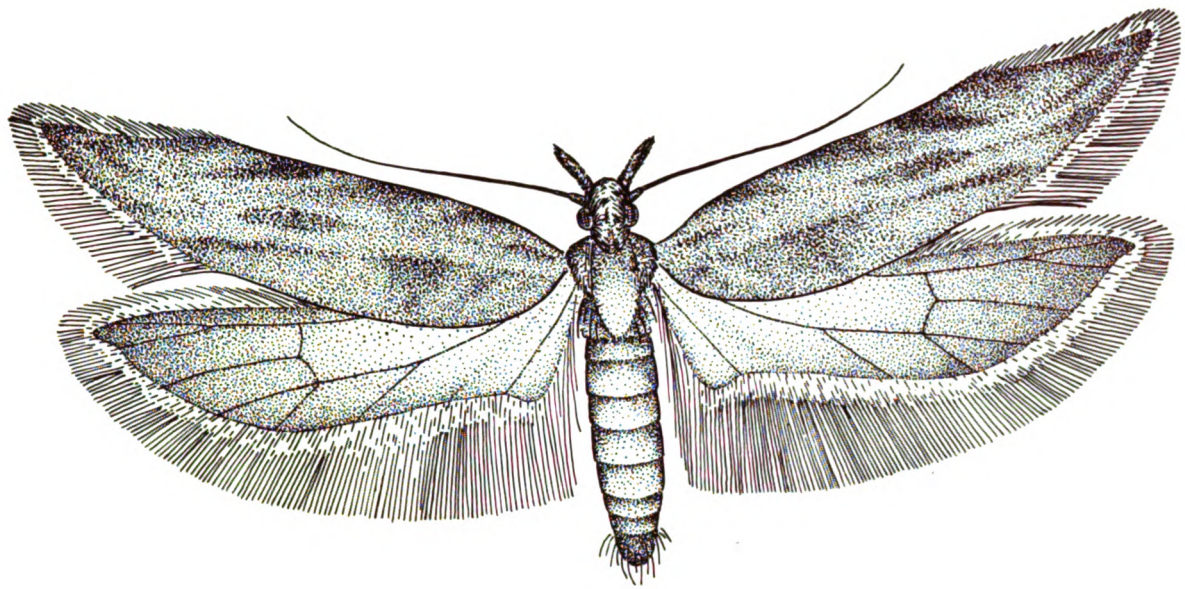
General notes:

Clausen 1931

Wong & Tao 1935

Biology:

Yu 1940



Anarsia lineatella Zeller
(Original)

87. Peach twig borer, Anarsia lineatella Zeller, has a wing spread of 1.5 centimeters. The entire moth is grey-brown; the front wing mottled with dark streaks, and the hind wing light brown. A fully mature caterpillar varies in color, but is generally reddish or pinkish with brownish-yellow head capsule, and measures about 1.0 or 1.3 centimeters.

Distribution: This cosmopolitan species commonly occurs in the Palaeartic and Nearctic regions, and is recorded in China in southern Manchuria.

Affected: Peach, plum.

Nature of Losses: This insect attacks twigs as well as fruits, thus killing the young buds, terminal shoots,and destroying the fruit crops generally. The first brood confines its work to twigs, the second to twigs and fruits, and the last to fruits. It is one of the most important peach pests of southern Manchuria.

Life History: Three annual generations appear in Manchuria where hibernation probably occurs in the larval stage beneath bark. The overwintered larvae mature and give rise to moths from which spring the new generation for the following year. Caterpillars emerge from eggs deposited on twigs and fruits, and bore into the host wherever they happen to be located.

Control Measures: The most effective prevention is accomplished by applying a delayed dormant spray of lime sulphur or oil emulsion. They may also be destroyed by the

removal of the old bark where hibernation occurs. Nicotine may be used when oil or lime sulphur are not desirable. During the growing season, spraying should be completed a few days after oviposition. Arsenical sprays are sometimes employed but less effectively.

References

General notes:

Kondo & Miyahara 1930

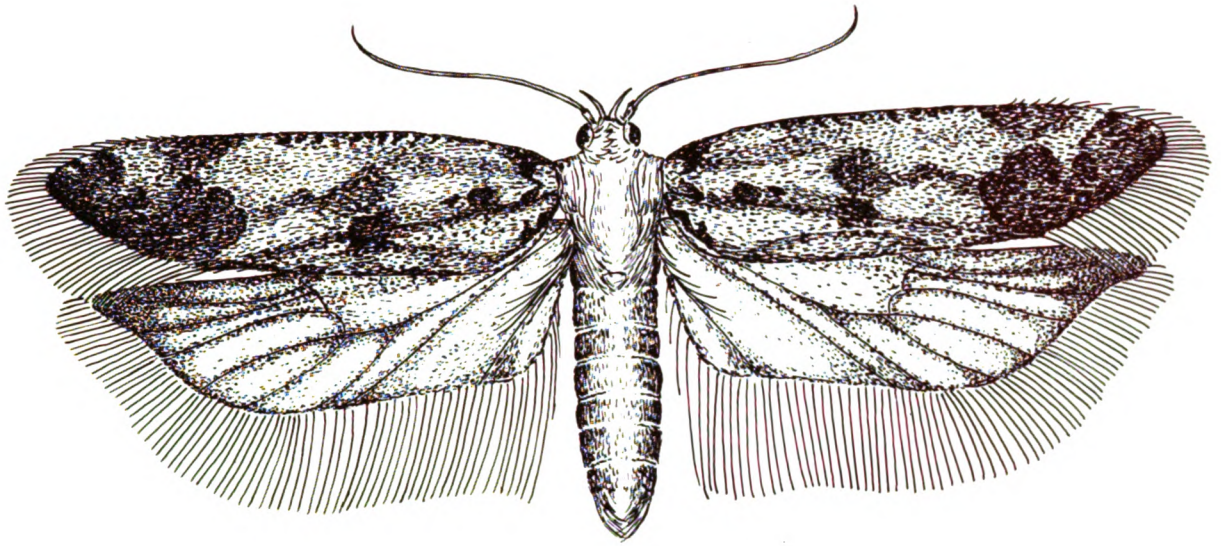
Bioloty & Control:

Clarke 1902

Duruz 1923

Control:

Jones 1936



Platyedra gossypiella Saunders
(Original)

88. Pink bollworm, Platyedra gossypiella Saunders, moth is grayish-brown and blackish, with a wing spread of 1.5 to 2.0 centimeters. The foundation of the forewing is grayish-brown and there are many irregular darker areas, but the hind wing is grayish-white with the tip slightly darkened; both are decorated with a long fringe along the outer and inner margins. The larva is pinkish with the exception of a blackish plate on the prothorax; each of the body segments is marked with crimson-red dorsally; and at maturity it achieves a length of 1.3 to 2.0 centimeters.

Distribution: This insect is found in practically all cotton producing regions of the world, including nearly all of China.

Affected: Cotton and a few other members of the Malvaceae.

Nature of losses: Injury is done during the larval stage when it burrows into the boll, destroying blossoms, seeds and lint. This pest is most severe in the coastal provinces of Po Hai and areas south of the Hwang Ho , especially along both sides of the Yangtze Kiang, where it creates considerable havoc every year. A serious outbreak was reported in 1932 along the costal section of the Gulf of Hangchow, where it destroyed some five or six million dollars worth of goods. American varieties are more susceptible to injury.*

* Woo (1926) estimated an annual loss amounting to 54,000,000 dollars, and 68,000,000 dollars estimated by Li (1931).

Life History: There are several generations a year, two being recorded in Chekiang and Kiangsu. The winter is passed as a larva in the cocoon,within the seeds in storage largely, on plant remains in the field, or beneath the ground surface. The fact that hibernation may be prolonged to two and a half years aids in its worldwide dissemination. The adult appears in July and again in September. A few days after emergence the female lays from 100 to 400 eggs on any part of the plant, but most often on the bolls. Incubation lasts about two weeks, when the larva drills into whatever part of the plant it finds itself on, develops into a pupa in about three or four weeks, and turns adult in about a month or more. Several to ten worms may be found in each boll during an extensive infestation.

Control Measures: In the field one may help to eradicate this pest by picking up dropped fruits and destroying old plant remains, or by plowing deeply and flooding the area afterwards. Spraying or dusting with arsenicals reduces the infestation materially, but will not insure absolute control. When crops are badly infested, they should be destroyed immediately. Since most of the insects hibernate in storage, the use of fumigation is highly profitable; this method has already been discussed under the rice weevil. Exposure of the newly harvested cotton to the hot sun for two or three consecutive days will cause the insects to congregate underneath it, where they can be collected at the end of each day. This effects about an 80 per cent control. This method is especially

practicable where fumigation cannot be applied. Rotation with cereal crops will eradicate the pest effectively.

Natural Enemies:

Chelonella pectinophorae Cushman (Hym. Braconidae)

Microbracon isomera Cushman (Hym. Braconidae)

Microbracon nigrorufum Cushman (Hym. Braconidae)

Microbracon onukii Watanabe (Hym. Braconidae)

Microbracon sp. (Hym. Braconidae)

Brachymeria euploeae Westwood (Hym. Chalcididae)

Brachymeria obscurata Walker (Hym. Chalcididae)

Dibrachys cavus Walker (Hym. Chalcididae)

Elasmus philippinensis Ashmead (Hym. Chalcididae)

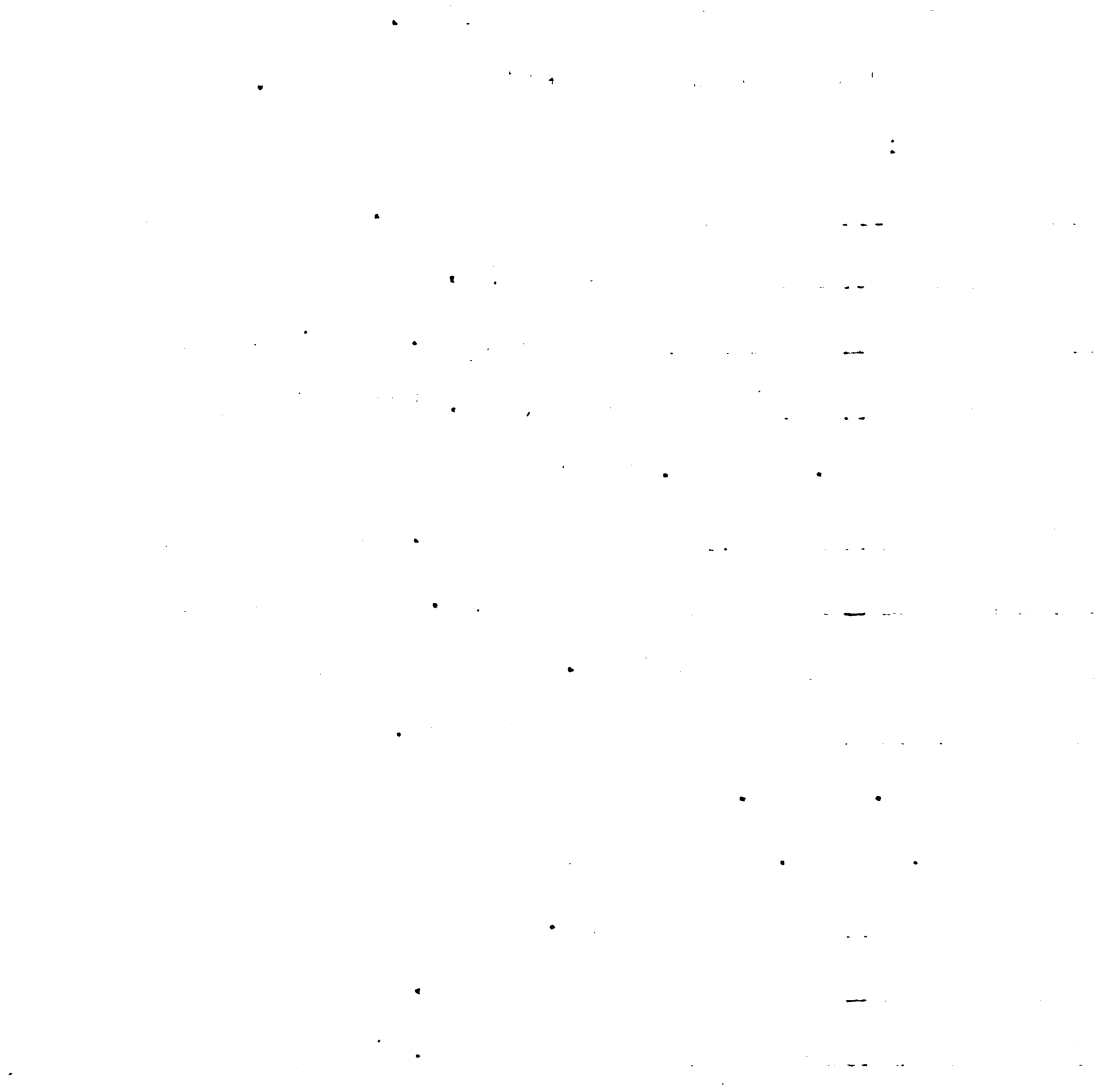
Eurytoma sp. (Hym. Chalcididae)

Pimpla sp. (Hym. Ichneumonidae)

Pristomerus taoi Sonan (Hym. Ichneumonidae)

Pristomerus vulnerator Panzer (Hym. Ichneumonidae)

Pristomerus chinensis Ashmead (Hym. Ichneumonidae)



References

General notes:

Anonymous 1932

Ma 1934

Woo 1935

Li 1936

Feng 1936

Hsu 1936a

Li & Chou 1937

Shiraki 1937

Biology:

Busck 1917

Li 1933

Biology and Control:

Loftin, McKenny & Hanson 1921

Control:

Woo 1926

Hsu 1936b

Su 1936

Li 1937

Parasites:

Chu 1935, 1936

Sonan 1936

Occasional Pests

	Name	Distribution	Affected
89.	Brachmia convolvuli Walsingham	3	Sweet potato
90.	Brachmia macroscopa Meyrick	1	Sweet potato
91.	Gnorimoschema helifa Lower	1	Tobacco
92.	Lecithocera formosana Shiraki	1	Citrus, tea
93.	Olegoresis citrella Shiraki	1	Citrus
94.	Psorosthicha zizyphi Stainton	1	Citrus

FAMILY COSMOPTERYGIDAE

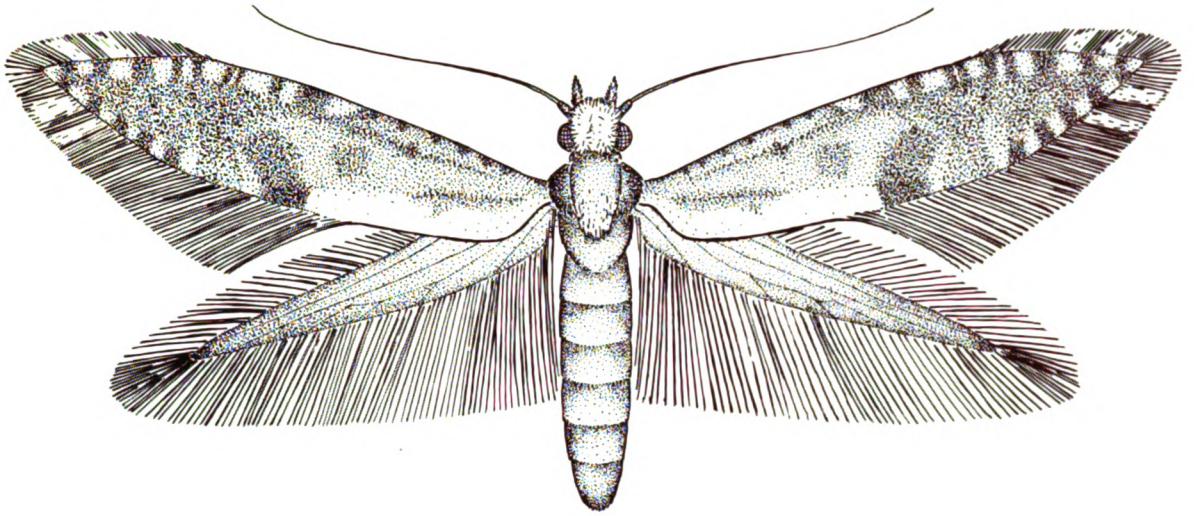
This is a microlepidopterious family composed of some 1,000 species of minute moths. Both front and hind wings are lanceolate, the latter being narrower and usually armed with a group of bristles on the costal edge. Biologically, the family is subdivided into three groups. Those called phytophagous include leaf miners, fruit and stem borers, or external feeders on leaves, shoots, flowers, and seeds; those called saprophagous feed as scavengers; and the predaceous group destroys insects.

Occasional Pests

	Name	Distributed	Affected
95.	Stagmatophora coriacella Meyrick	1	Cotton
96.	Pyroderces simplex Walsingham	1	Cotton

FAMILY YPONOMEUTIDAE

Included in this family are approximately 800 species that occur widely throughout the world, most of which are small and strikingly colored. They are exclusively plant feeders, some attacking leaves gregariously under spun webs, or burrowing though the leaf tissues as leaf-miners. Others injure fruits, shoots, and twigs as borers. Little is known about the economic status and biology of these insects in China.



Argyresthia conjugella Zeller
(Original)

97. Lesser apple fruit moth, Argyresthia conjugella Zeller, has a wing spread of 0.9 to 1.2 centimeters. The body is greyish-brown, the head and center part of the thorax whitish, the front wing greyish-brown mottled with dark brown, and the anal area yellowish white. The hind wing is uniformly greyish-brown. The mature caterpillar is pinkish or flesh colored with brown head-capsule, and measures about 0.6 centimeter.

Distribution: It has been reported from Manchuria and also from Japan, Fiji, Asia Minor, Europe, and North America.

Affected: Apple.

Nature of Losses: The larvae attack fruit alone, entering sometimes as many as twenty together, through the surface or by way of the calyx or the stem.

Life History: One generation is produced in Manchuria, wintering in the larval stage in cocoons on stems, under fallen leaves or under the soil. It pupates in April and the adults emerge a month later. The female has been observed to lay some thirty eggs, usually on the fruit.

Control Measures: Recommended measures include destruction of the hibernating larvae in winter or early spring, and the application of arsenical protectants during the first part of June when the larvae begin to emerge from the eggs.

References

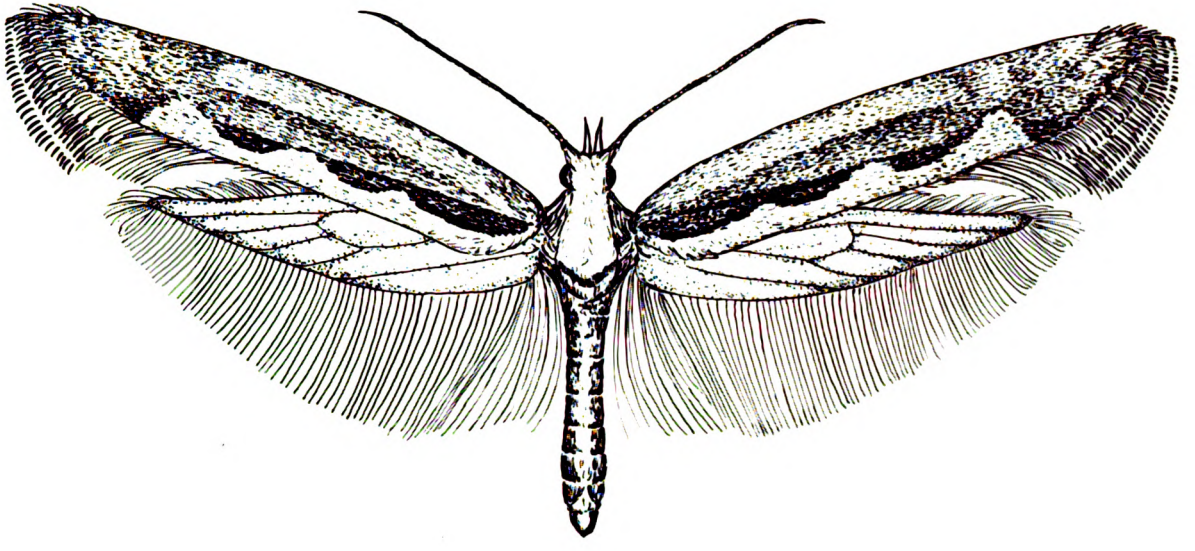
Biology:

Okamoto 1917

Arakama 1927

FAMILY PLUTELLIDAE

In this small family there are only about 200 described species which morphologically can be recognized from those of Ypononeutidae by possessing short porrect maxillary palpi, and also by having the prolegs of their larvae longer than wide. They are phytophagous, mostly attacking leaves externally within the simple webs they spin, as illustrated in the genera Plutella and Cerostoma, although a few of them have the habit of mining leaves and stems. Those of the Plutella feed exclusively on cruciferous plants.



Plutella maculipennis Curtis
(Original)

98. Diamond-backed moth, Plutella maculipennis Curtis, whitish brown, with a wingspread of 1.5 centimeters. The hind wingspread of 1.5 centimeters. The hind wing, head, and prothorax are grey-white, while the front wing is grey-brown mottled with dark wavy lines. The insect derives its common name from the diamond design which appears along the anal and cubital regions when the wings are at rest. The caterpillar is greenish, spindle-shaped, and measures about 0.8 centimeter.

Distribution: It is found practically the world over, wherever cabbage or its allies are grown. In China it is reported from Kwangtung, Formosa, Szechwan, Chekiang, Shantung, Shensi, and Manchuria.

Affected: Cabbage, turnip, radish, kale, broccoli, cauliflower, and other cruciferous plants.

Nature of Losses: This moth is essentially a defoliator. It feeds on the under surface of the leaf, in its early stages by mining superficially, and later by drilling holes. Its damage to vegetable crops and seedlings is a serious matter.

Life History: Many generations are produced yearly, seven having been recorded in Kwangtung. Under the most favorable conditions these insects may be seen the year around, but the number of generations decreases as one goes from south to north. The stage in which the insect winters also depends on climatic factors. The female lays 60 to 100 eggs on the underside of leaves, singly or in batches of two to six.

Upon hatching, the larva feeds gregariously on the underside of leaves, especially where the foliage is dense. It is very active and, when disturbed, tends to drop down from the plant on a thread. The egg, larval, and pupal stages require 3 to 5, 12 to 17, and 1 to 2 days respectively, though these figures may change in various sections of the country or even from season to season in the same locality. An adult life span covers 8 to 17 days and the entire life cycle from egg to adult is completed in three weeks.

Control Measures: Dusting or spraying with rotenone-containing material, pyrethrum, or arsenicals will yield satisfactory results, but attention is called to the fact that rotenone is not effective against the later instars. Arsenicals should be applied at least two or three weeks before harvest, but it is safer on short-season crops not to use them at all because of the danger in human and animal consumption.

References

General notes:

Wong & Tao 1936

Takahashi 1936

Biology:

Hoffmann 1936

Chen 1940

Control:

Walker & Anderson 1937

Chupp & Leiky 1944

FAMILY AEGERIIDAE[1]

This family contains about 900 species commonly called clear-wings because they lack scales. Most of them are borers in roots, stems, trunks of trees, shrubs and vines, or under bark; whereas others are gall-makers. Nearly 60 species are credited to the Chinese fauna, and three are known to affect economic plants.

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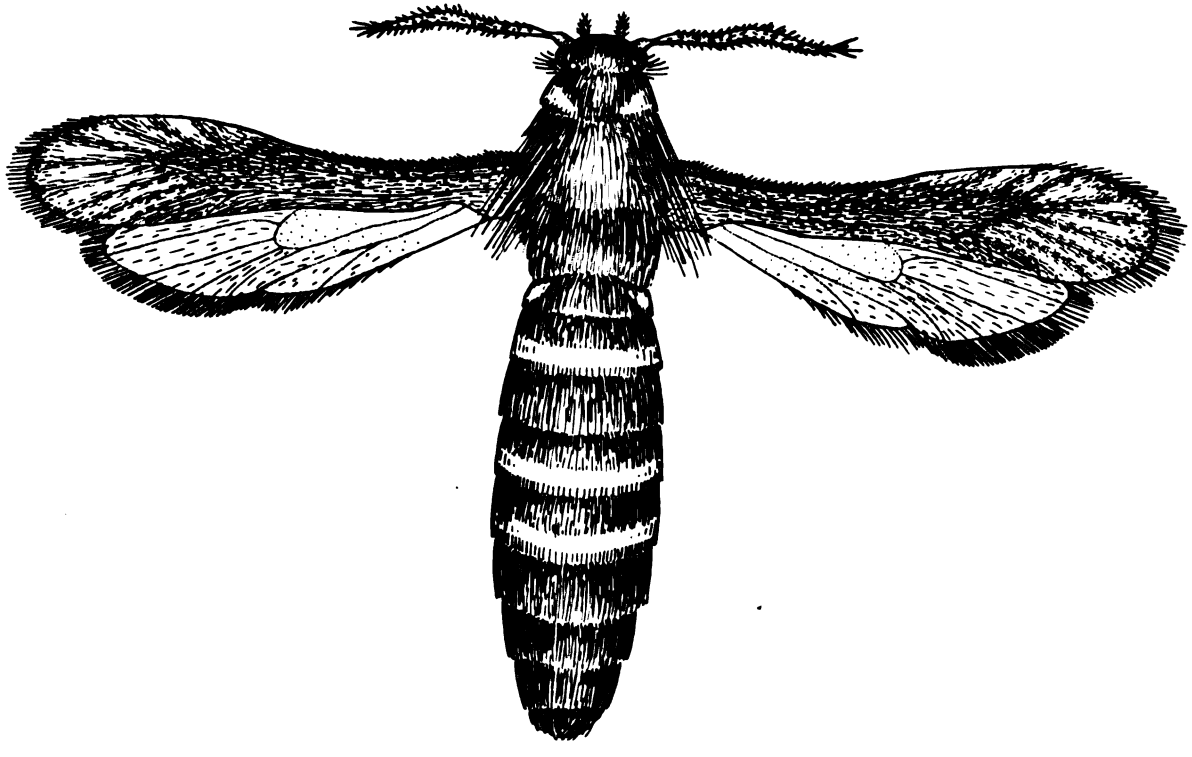
1. Syn. Sesiidae



Paradoxecia pieli Lieu
(Redrawn from Lieu)

99. Mulberry twig borer, Paradoxecia peili Lieu, is blackish, wasp-like, with a wing spread of 2.9 to 3.1 centimeters. The body is dark brown, brownish-black or bluish-black, marked with yellow bands; the front wing varies from bronze to purplish-brown and the hind wing is transparent. The two sexes are alike except that the male is smaller. The larvae are yellowish-white and measure 4.0 at maturity.

Distribution: It is recorded in Chekiang, Kiangsu, and probably elsewhere.

Affected: Mulberry.

Nature of Losses: This is one of the most important mulberry pests. In Chekiang and Kiangsu it damages 4 per cent of the trees. About 30 per cent of the leaf buds on affected twigs wither, resulting in low production of leaves and occasionally in eventual death of the plant.

Life History: There is one brood yearly which hibernates in the immature larval stage on infested twigs and resumes feeding in the spring. The larvae pupate about the end of May and the adults emerge in June when the female lays 93 to 138 eggs on the underside of the main leaf rib. The larvae bore into the twig by way of the leaf petioles. The egg, larval, pupal, and adult stages last from 9 to 21, 316 to 313, 28 to 34, and 3 to 4 days respectively.

Control Measures: Winter pruning is of definite value in eradicating this pest. During the growing season the holes bored in the twigs may be filled with petroleum, cotton-seed oil, tung oil, or nicotine sulphate; of these, petroleum

is the most effective.

Natural Enemies:

Two dipterous flies.

References

General note:

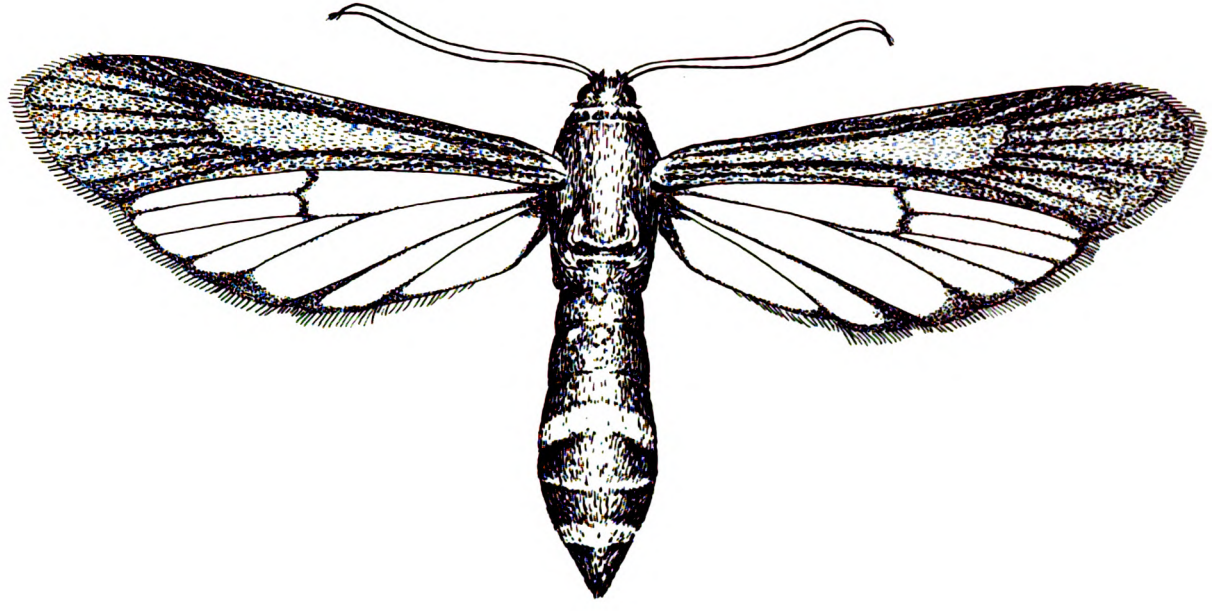
Lieu 1934, 1935a

Biology:

Lieu 1935b

Biology and Control:

Chu & Chin 1934, 1936



Paranthiene regalis Butler
(Original)

100. Grape-stem borer, Paranthiene regalis Butler, is blackish with a wing spread of 4.0 centimeters. The forewing is brown except for a yellowish-orange base, and the hind wing is transparent. There are orange markings on the head and thorax, and the abdomen has three unequal orange bands, the first of which is broad.

Distribution: It is found in China in Kiangsi and Kiangsu; it also appears in Japan.

Affected: Grapes.

Nature of Losses: This pest attacks the stem of the grape vine and decreases the vitality of the host.

Life History: No work has been done in China on the biology of this insect, though it probably resembles the foregoing species in having but one generation a year and wintering in the immature larval stage.

Control Measures: The same recommendations as for the previous species are suggested for this borer.

References

General notes:

Matsumura 1932

Occasional Pest

	Name	Distribution	Affected
101.	Aegeria hector Butler	3	Apple, cherry, peach, pear, flowering cherry

FAMILY OLETHREUTIDAE[1]

This family contains about 2,000 species, most of which are small moths, generally brown or gray, mottled with bands and spots of other colors. The second cubitus of the front wing arises before two-thirds of the discal cell, and the upper surface of the basal portion of the cubital vein of the hind wing is generally covered with long hair. Some are defoliators, attacking leaves exposed, in webs, and in rollers; and others are borers of roots, fruits, and seed pods.

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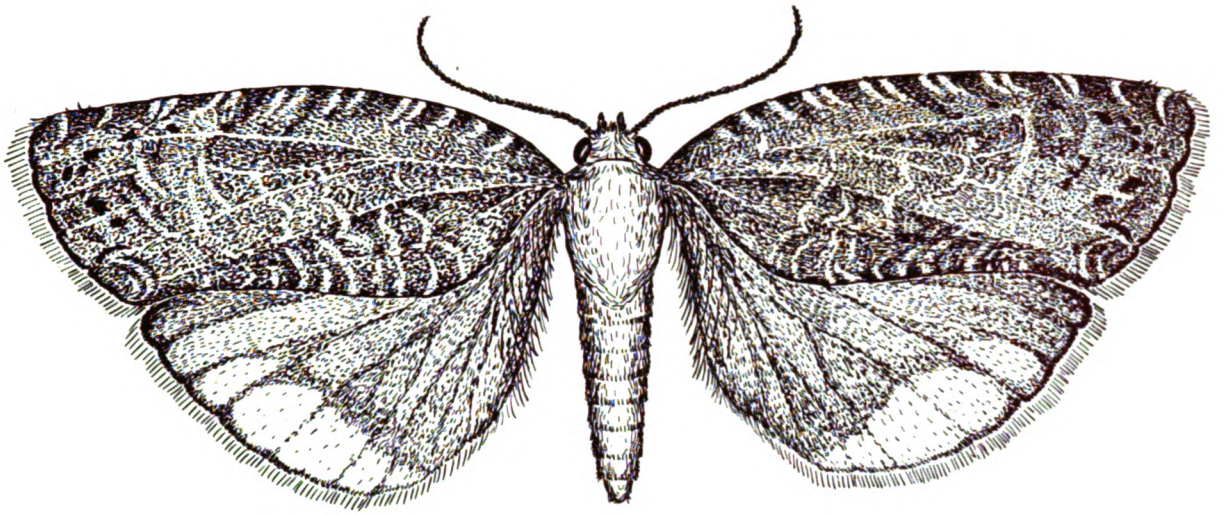
1. Names used by other authors: Eucomidae, Graphalithidae, Epiblemdae.



Grapholitha molesta Busck
(Original)

102. Oriental fruit moth, Lapeyresia molesta Busck, is blackish-brown, with a wing spread of 1.0 to 1.3 centimeters. The front wing is dark with both costal and anal areas patterned with paler, slanted and wavy bands, and an eye-like design at the anal angle; the hind wing is uniformly gray-brown, except in the male where the outer margin is more or less blanched. The caterpillar is pinkish, and at maturity measures 1.2 centimeters.

Distribution: This moth has nearly cosmopolitan distribution, having been spread through commerce. It is found in China in Formosa, Chekiang, Hopeh, Shantung, Manchuria; it also appears in Korea, Japan, Australia, Europe and North America.

Affected: Pear, peach, apple, cherry, flowering cherry, loquat, persimmon, Cydonia vulgaris, and possibly many other fruits.

Nature of Losses: This is a pest of numerous varieties of fruit, especially pear, peach, and apple. Injury is produced by the larvae which burrow in terminal shoots and fruit, causing the shoots to die back and the fruit to rot after harvest, even though it appeared sound when picked.

Life History: There are four generations in Hopeh and three in Manchuria. It hibernates as a full-grown larva in cocoons under rubbish, in the topsoil, or among plants near the orchard, and pupates in the spring. In Hopeh, the first through the fourth broods appear in April, mid-June, late July and August respectively, but in Manchuria the first brood

begins a month later. The first generation larva is essentially a twig borer, entering the young shoots through leaf petioles below their base or elsewhere, while that of later broods attacks fruit by boring into the core and seeds. During a period of from seven to twelve days the female lays as many as 200 eggs, though the average is below 100, depositing them singly on leaves and fruit. The larva gnaws into either the shoot or fruit and matures after completing four or five instars. The egg, larval, pupal, and adult stages cover 5 to 12, 12 to 20, 8 to 12, and 8 to 18 days respectively. The entire life cycle takes one to two months, depending on the breeding season.

Control measures: Because of the deep burrowing tendency of the larvae, it is difficult to reach them effectively with insecticides. One of the best means of preventing future infestation is destroying the hibernating stage, and other wild hosts in the same vicinity. Fair control may be achieved by spraying or dusting with larvicide or ovicide, such as oil, nicotine, or their combination, for three applications, providing the life cycle is followed closely. Parasitizing constitutes a last resort, but although there are sixty known parasites of this insect in Korea or Japan, there is no conclusive information about any in China. Of the egg parasites, Trichogramma minutum Riley is the most powerful destroyer; it is widely distributed in Korea and Japan, and probably appears in China. This species has been utilized to good effect for years in the United States, but that the

same would hold true in China remains problematical, pending further investigation.

References

General notes:

Arakawa 1927

Biology:

Snapp & Swingle 1929

Cagle 1930

Kondo & Miyahara 1930

Peterson & Haeussler 1930

Biology and Control:

Peterson & Haeussler 1926

Weiswander 1936

Oda 1937

Chang & Lin 1939

Parasites:

Peterson 1930

Haeussler 1940

103. Apple fruit moth, Lapeyresia inopinata Heinrich, is similar in color and size to the Oriental fruit moth, but differing markedly in having the valves of the male genitalia stout, whereas those of the aforementioned species are narrowly constricted.

Distribution: In China it occurs in Manchuria, and it is also reported in Japan.

Affected: Apple, plum, pear, Crataegus.

Nature of Losses: This is a serious pest of the apple, particularly in Manchuria. The larvae feed on the fruit, concentrating on the fleshy portion alone.

Life History: There are two generations annually, hibernating in the mature larval stage in cocoons on the host. Adults appear first toward the end of May or early July, and again in July and August. In six days a female lays an average of 22 eggs in the depression on the top of the fruit. During the growing season the egg, larval, pupal and adult stages require about 4 to 5, 12 to 47, 9 to 15, and 7 days respectively. The activity of the moth is confined to early evening and the hours just before dawn.

Control Measures: Reasonable success may be attained by the destruction of the wintering cocoons and by spraying with 4 pounds of lead arsenate to 100 gallons of water plus a pint of nicotine sulphate soon after oviposition.

Natural Enemies:

Larval stage:

Phaedroctonus sp. (Hym. Ichneumonidae)
Mesochorus sp. (Hym. Ichneumonidae)

References

Taxonomy:

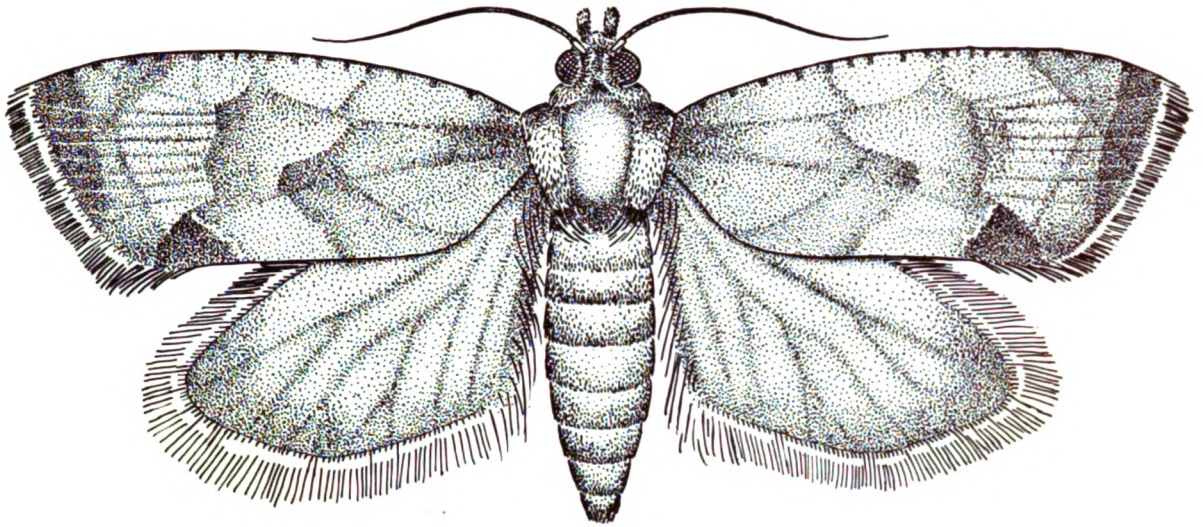
Heinrich 1928

General notes:

Kondo & Miyahara 1930

Biology and Control:

Takizawa 1936



Argyroploce illepida Butler
(Original)

104. Lychee fruit moth, Argyroploce illepida Butler, is reddish-fawn with a wing spread of about 2.0 centimeters. The front wing is shaded with a darker tone of the same color, and there is an obvious dark spot on the anal and cubital area; the hind wing is uniform in color. The larva varies from light yellow to grayish-white with a rosy or greenish tinge, and at maturity measures about 1.5 to 1.9 centimeters.

Distribution: It is widely distributed, being found in China in Kwantung and perhaps in other nearby provinces. It also appears in India, Ceylon, Indo-China, the East Indies, Australia, and Hawaii.

Affected: Lychee and probably other fruit.

Nature of losses: There are but few food plants reported; the only one in China being the lychee. The larvae bore through the fruit into the seeds by way of the funicle, and pave the way for disease. Besides, their excrement renders the fruit unfit for human consumption.

Life History: The life history of this moth resembles that of the Oriental fruit moth. The eggs are deposited on the surface of the fruit; the larvae bore in and eventually leave the fruit to pupate in cocoons on the twigs of the lychee; whereas on other hosts, pupation may occur within the host. The adults appear about seven to fourteen days later, and at the time of emergence, the pupae are almost entirely protruding from the cocoon.

Control Measures: Same as for the preceding fruit moth.

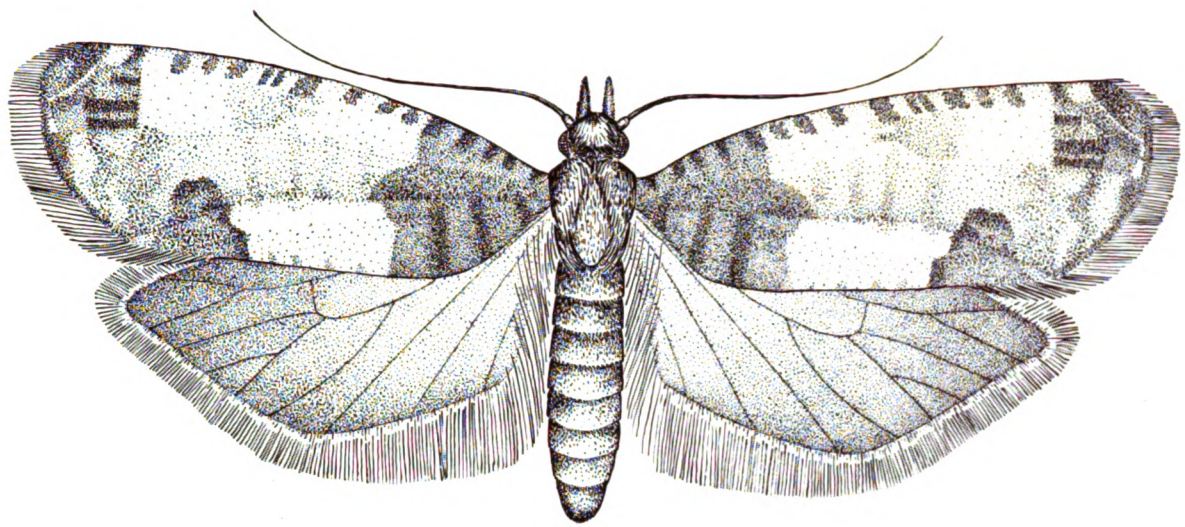
References

General notes:

Swezey 1908, 1935

Fletcher 1920, 1932

Fullaway 1927



Spillonota ocellana Fabricius
(Original)

105. Apple bud moth, Spilonata ocellana Fabricius, has a wing spread of about 1.5 centimeters. The entire insect is grayish-brown,with the exception of the center portion and part of the outer margin of the front wing which are ashy-white, slightly mottled with various shades of ashy brown. Some individuals show a darker coloration. There are also three or four dark dashes on the apex and two similar ones on the anal angle. The mature caterpillar is pinkish, has a black head capsule and thoracic plate, and attains a length of 1.0 to 1.3 centimeters.

Distribution: In China it has been recorded in Chekiang and possibly all over the section north of the Yangtze River to Manchuria. It also appears in Korea, Japan, Eastern Siberia, India, Europe, and North America.

Affected: Pear, apple, cherry, plum, and probably other fruits.

Nature of Losses: The larvae attack buds principally, or occasionally foliage and fruit.

Life History: A single generation is produced annually, hibernating particularly in flower buds in the larval stage. With the approach of April, when the new development of growth is in full swing, the feeding of the overwintered larvae is resumed for a period of two weeks or longer. Pupation lasts about twenty days, beginning in late April and June, and the adults emerge from mid-May to the latter part of June. An average female lays up to one hundred eggs, placing

them singly on leaves and young shoots. Their incubation period lasts about twelve days. Going through six instars, the larvae complete this generation in the spring of the following year.

Control Measures: Protect the young leaves and buds by two applications of arsenical sprays; the first before the buds open in the spring, and the second during the first part of June.

References

General notes:

Clausen 1931

Biology and Control:

Porter 1924

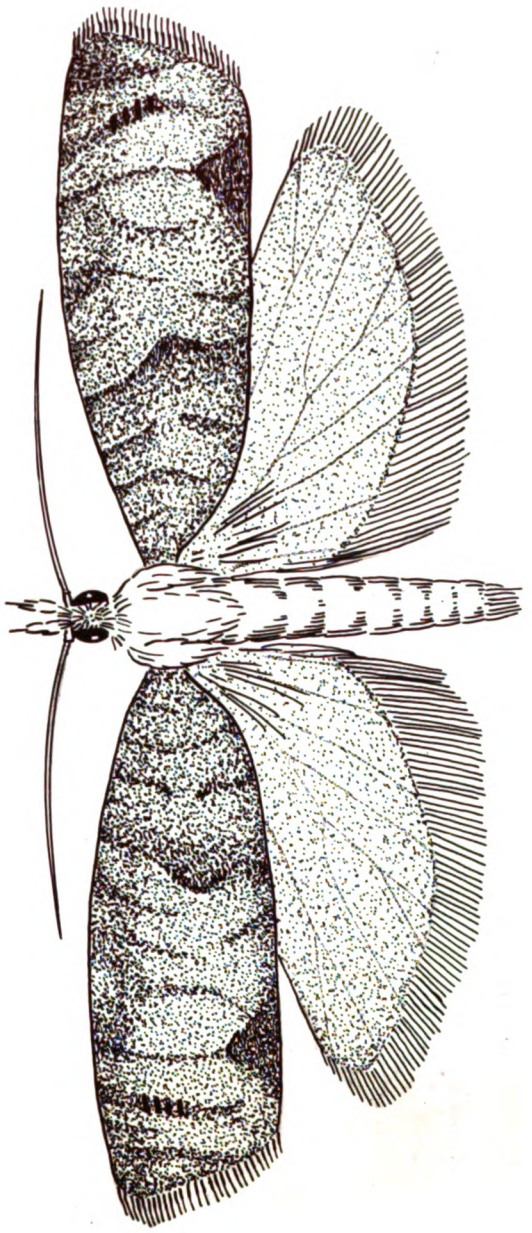
Muramatsu 1927

Chang & Lin 1939

Biology:

Frost 1927

Mustafa & Janjua 1940



Eucosma prognathana Snellen
(Original)

106. Fruit Eucosma, Eucosma prognathana Snellen, is greyish-brown, having a wing spread of approximately 1.5 centimeters. The front wing has a number of cross-bands, a dark triangular patch on the distal portion of the inner margin, and three black dashes on the outer border. The hind wing is whitish with long hairs on the cubital area.

Distribution: It occurs in China in Manchuria.

Affected: Apple, peach, cherry, Mespilus cuneata.

Nature of Losses: This insect does double damage by injuring the fruit of the apple and M. cuneata just below the surface, and also by rolling up the leaves of the peach and cherry. In some years infestation of the first class may affect as much as seventy or eighty per cent of the total crop.

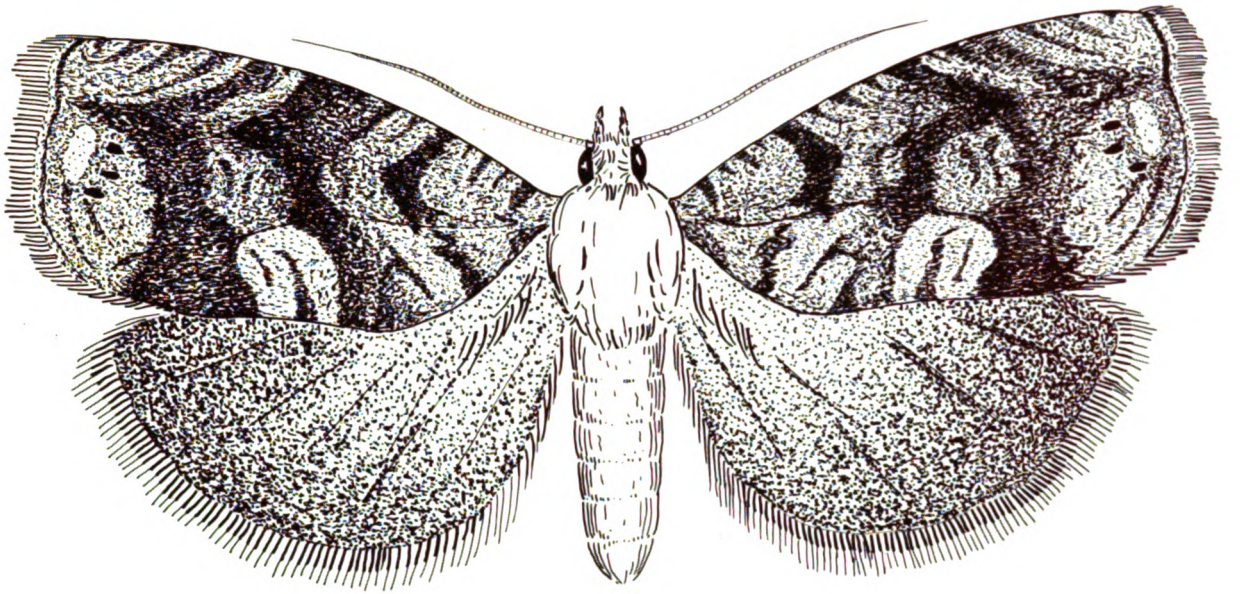
Life History: Two generations have been recorded in southern Manchuria, overwintering in the larval stage in the cocoon. Adults appear from mid-May to June, and again between July and September. The first generation injures leaves and the later fruit, their eggs being deposited according to their respective feeding habits.

Control Measures: Arsenical sprays may be applied at three intervals: the first to destroy the larvae in the latter part of April or the first of May; the second between May and June; and the last from July to September. The last two applications shortly after oviposition.

References

Biology:

Kondo & Miyahara 1930



Lapeyresia glycinivorella Matsumura
(original)

107. Soybean pod-borer, Lapeyresia glycinivorella Matsumura, is yellowish-black with a wing spread of 1.3 to 1.4 centimeters. The head and thorax are dull yellow; the abdomen dark brown; the ground color of the front wing greyish-yellow or yellowish-brown mottled with dark zigzag bands, and there are three dark spots on the lower part of the outer margin. The hind wing of the male is dark, becoming lighter toward the base, whereas that of the female is paler. The mature larvae are orange-yellow and measure 0.6 to 0.9 centimeter.

Distribution: It is widely distributed in China, being common from Chekiang to Manchuria. It is also found in Korea and Japan.

Affected: Soybean, Lupinus

Nature of Losses: This is the most important pest of the soybean, particularly in Manchuria where the soybean is one of the main crops. Damage done is entirely confined to the fruit where the larvae bores into the pod and seeds. It extracts an enormous annual toll, the highest being about 90 per cent of the whole crop. Injury is most severe on varieties whose pods are hairy, large, and well-formed at the time of oviposition. Dense planting increases the danger of infestation. One larva is commonly found in each pod, although there are sometimes two, each of which has the power to destroy one to three seeds.

Life History: This insect produces one generation annually, wintering as a mature larva in the cocoon under the topsoil at a depth of 1.0 to 2.0 centimeters. Pupation takes place in July

and lasts eleven to thirteen days. The adults appear from July to September, when the females lay over 200 eggs each, with an average of 165, depositing them mostly in ones or twos during afternoons on young bean pods. Usually the pods so selected are large and hairy. The larvae emerge after seven or eight days, wander about or immediately bore into the pod and reach the seed. They complete five instars before maturity, and leave the host eighteen to twenty-three days after entrance; at this time, just before harvest, they spin their cocoons and stay under the surface of the soil until the following summer, thus completing the life cycle for the generation. Adult life expectation is usually about twelve to fourteen days.

Control Measures: No remedy is yet known to save crops when infestation is already present, so that the best control lies in preventive measures which include destroying the overwintering larvae by winter and spring plowing and crop rotation. Besides, the bean can be more or less protected by three applications of spray or dust with arsenicals, applying at intervals of two weeks beginning in the first part of July.

Both Ichneumonid, Pristomerus chinensis and Phanerotoma planifrons are effective parasites of the larvae. The former is widely distributed in China, Korea, and Japan, and is also known to be a parasite of the Oriental fruit moth.

It produces one brood yearly, the adults being most common in late July and early August. The female deposits eggs in the body of the borer larvae before they gnaw into the host. The parasitic larvae winter there, leaving at pupation during the end of July and early August, a stage that lasts nine days. The average life of a male is eighteen days and that of a female, thirty-two. The latter parasite has nearly cosmopolitan distribution, being found from Formosa through Manchuria. Other hosts are the Oriental fruit moth, mulberry pyralid, and other species of lepidopterous insects. One generation is produced annually, the adults appearing abundantly during the last of July and the first of August. The female oviposits in the eggs of the borer, and pupation lasts eight days outside the host. Under artificial conditions adults may survive fourteen to twenty-two days.

Natural Enemies:

Bracon abscissor Nees (Hym. Braconidae)

Chelonus pectinophorae Cushman (Hym. Braconidae)

Microdus glycinivorellae Watanabe (Hym. Braconidae)

Phanerotoma planifrons Nees (Hym. Braconidae)

Pristomerus chinensis Ashmead (Hym. Ichneumonidae)

References

General notes:

Karuja	1939

Variety differences:

Tsuda	1936
Uchida & Okada	1937a
Okada	1938a, 1938b
Nakayama	1939

Biology:

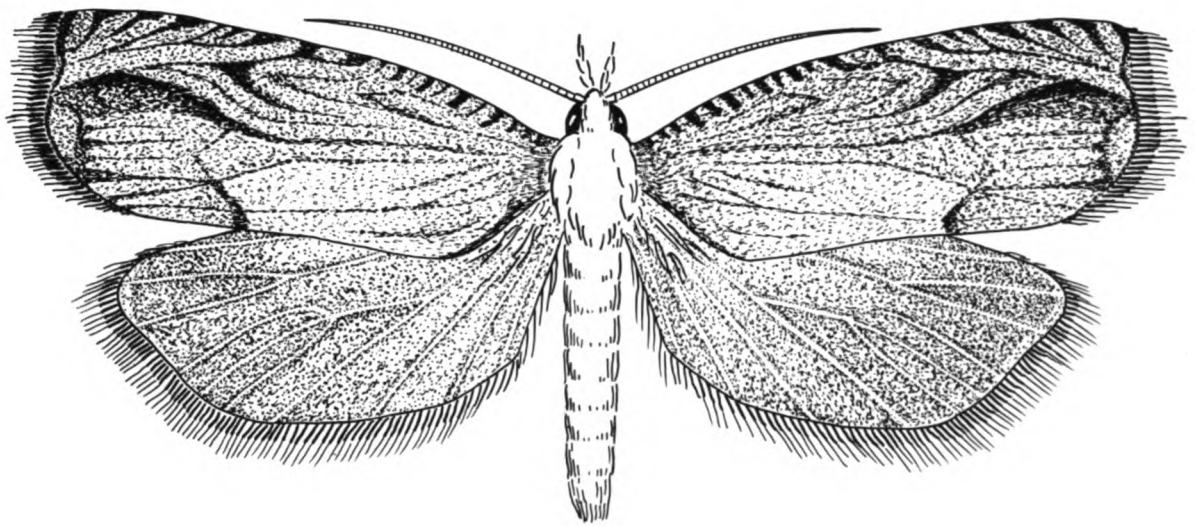
Uchida & Okada	1937b
Kuwayama	1938
Okada	1940

Biology and Control:

Kuwayama	1928
Uchida & Okada	1940

Natural enemies:

Watanabe	1938, 1939
Okado & Oike	1940a, 1940b
Uchida	1940



Eucosma schistaceana Snellen
(Original)

108. Sugar-cane Eucosma, Eucosma schistaceana Snellen, has a wing spread of about 1.8 centimeters. The front wing is brownish-grey with confused black lines and streaks, including a black edge with white at the base, and a black streak from the middle of the costal margin to the outer margin below the apex. The full-grown caterpillar is violet-white, tinged with grey or a reddish color; the head and thoracic plate are light bfown; it measures about 1.7 centimeters.

Distribution: In China it has been found in Kwangtung, Formosa and Kiukiu; it also appears in the East Indies.

Affected: Sugar-cane.

Nature of Losses: This is a grave pest of sugar-cane in China due to the boring propensity of the larvae which weakens the vitality of the plant, subjecting it to easy breakage by the wind. Certain varieties of cane are more susceptible to the inroads of this pest than others, particularly those with abundant foliage. Canes of two to three feet are preferred to younger ones of less than eight inches. Dead heart is a common symptom among young plants, as their growing points are seriously injured by the borer.

Life History: This insect has five generations a year, and breeds continuously through all seasons. In warm months oviposition lasts about six to eight days, or in December nineteen days, during which time a female lays a total of 200 to 600 eggs with an average of 240. These are deposited singly on the under surfaces of the leaves and sometimes on the stalk;

the larvae attack the foliage first and then bore into the stem.

Control Measures: Successful control may be attained by prevention: the use of worm-free seed-cane; clean cultivation; extirpation of the wild hosts. While, during the peak of the oviposition period, plants may be protected by one or two coverages of lead arsenate or cryolite. After infestation is present, the following measures are suggested: removal of infested stalks; crop rotation, and the utilization of parasites. Notes have been made on the egg parasite, Trichogramma australicum Girault, to the effect that the percentage of parasitism is about 20 the year around, and about 35 at its highest point in September. This may give some promise of biological control if the parasite is cultivated and multiplied artificially. Other measures may be taken for the sake of protection, such as the application of ovicide and larvicide at the proper intervals in the insect's life cycle.

Natural Enemies:

Trichogramma australicum Girault (Hym. Chalicididae)

Trichogramma nana Zhnter (Hym. Chalicididae)

Apanteles flavipes Cameron (Hym. Braconidae)

Chelonus pectinophorae Cushman (Hym. Braconidae)
(Chelonella nitobei Sonan)

Angitia lineata Ishida (Hym. Ichneumonidae)

Xanthopempla stemmator Thunberg (Hym. Ichneumonidae)

References

General notes:

Snellen 1890, 1891

Hadden 1928

Ijima 1935a

Takano 1935

Chan 1936

Takahashi 1938a, 1938b

Yashiro 1939

Biology:

Ijima 1935b, 1938

Biology and Control:

Clausen 1931

Control:

Takahashi 1938c

Natural enemies:

Sonan 1932

Takano 1934

Takahashi 1939

Occasional Pests

	Name	Distribution	Affected
109.	Aneylis mandarinana Walsingham	3	Pear
110.	Argyroploce illepida Butler	1	Lychee
111.	Enarmonia funesta Filip'ev	3	Peach
112.	Eucosma lechriapis Meyrick	3	Apple
113.	Evetria buoliana Schiffermüller	(?)	Pine
114.	Evetria duplana Hübner	(?)	Pine
115.	Exartema morivora Matsumura	(?)	Mulberry
116.	Lapeyresia pomonella Linnaeus	3	Apple
117.	Laspeyresia trasias Meyrick	3	Sophora japonica
118.	Laspeyresia sp. Stephens	3	Prunus salicina Lindley
119.	Lobesia aeolopa Meyrick	1	Tea (seed only)
120.	Peronea crocopepla Meyrick	3	Peach
121.	Thiodia azukivora Matsumura	2	Phaseolus angularis, red bean

FAMILY TORTRICIDAE

There are in this family some 1,500 species, exclusively leaf-rollers, many of which are destructive pests of useful plants. They resemble the preceding family, but differ in the absence of long hair along the cubital vein of the hind wing. Nearly 30 species are injurious to fruit trees and shrubs in China.

122. Citrus leaf roller, Adoxophyes privatana Walker, is yellowish-brown, with a wing spread of 1.5 to 2.0 centimeters. It resembles the medial-banded leaf roller, but differs in the absence of the basal mark on the front wing. The full-grown larva is dull green; head yellow; thoracic plate brown; and measures about 2.0 centimeters.

Distribution: It is widely distributed, being found in China in Formosa, Liukiu, and Chekiang. It also appears in Korea, Japan, India, Ceylon, Burma, Malaya, East Indies, and Fiji.

Affected: Citrus, cherry, pear, tea, mulberry, willow, poplar, elm, birch, rose.

Nature of Losses: This is essentially a southern pest of Citrus and tea, although it attacks other plants as well. In the case of oranges, it causes great concern to the orchardist; for besides defoliating the trees, the larvae sometimes injure the fruit near the petioles.

Life History: This insect produces four or five generations annually and hibernates in the larval stage. The adult appears from April through October, when the female deposits 300 eggs on the average, in about three masses on the underside of the old leaves. The egg stage comprises about seven to thirteen days, and the larval about twenty-one, during which time five instars are completed.

Control Measures: During an epidemic period, larvae and

pupae may be exterminated by gathering the spun leaves. Egg collecting is profitable for control on a small scale, but one's range is naturally limited to the trees one can reach. Another recommended measure is the application of petroleum extract, of pyrethrum emulsion, nicotine, derris, or arsenicals. Lastly, the introduction of biological control through the use of parasites is worth investigation, since many parasites on this insect have been observed.

References

General notes:

Clausen 1931

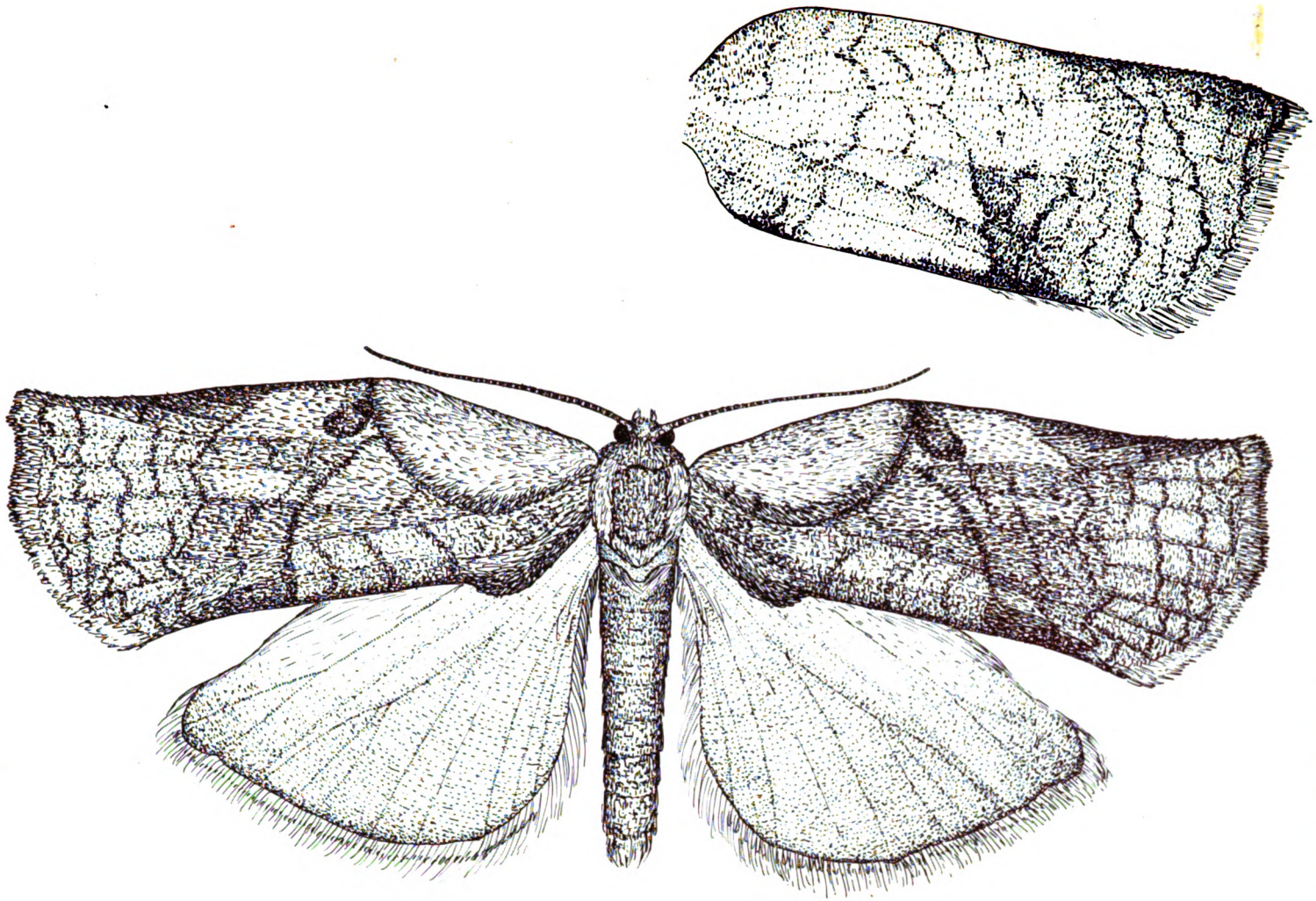
Shiraki 1934

Biology, Control, Natural enemies:

Nawa 1936

Natural enemies:

Kamiya 1941



Homona menciana Walker
(Original)

123. Tea leaf roller, Homona menciana Walker, is brownish, with a wing expansion of 1.9 to 2.5 centimeters for the male; and 2.3 to 3.5 for the female. The front wing of the male has a more prominent color pattern than that of the female, and is decorated by a fold on the costal margin. The larvae of this species are greenish with a dark brown head and when full grown, attain a length of 2.0 centimeters.

Distribution: This insect is widely distributed, being found in China in Kwangtung, Formosa, Hunan, Chekiang, and Shantung. It is also recorded in Japan, India, East Indies, and the Philippines.

Affected: Apple, pear, cherry, peach, flowering cherry, Citrus, tea, mulberry, rose.

Nature of Losses: This leaf roller works sporadically, doing considerable damage to cultivated plants; at times ruining up to 50 per cent of the tea crop.

Life History: Four or five generations are produced annually, and it appears the year around in Formosa. It winters as full-grown larva, and pupates the following spring in the webbed leaves. Eggs are laid in a yellow mass, containing from 20 to 200 on the upper side of mature leaves. Incubation takes about two days; and a life cycle in summer may be completed in about thirty days, or forty in colder weather.

Control Measures; Similar to that for the Citrus leaf roller.

Natural Enemies:

Larval stage:

Epiurus meniana Uchida (Hym. Ichneumonidae)

Eulemneria homonae Sonan (Hym. Ichneumonidae)

Phytodiaetus capuae Moore (Hym. Ichneumonidae)

Pimpla homonae Sonan (Hym. Ichneumonidae)

Pupal stage:

Anomalon discoidellum Sonan (Hym. Ichneumonidae)

Cambrus homonae Sonan (Hym. Ichneumonidae)

Iseropus heichinus Sonan (Hym. Ichneumonidae)

Nesopimpla narangae Ashmead (Hym. Ichneumonidae)

References

General notes:

Clausen 1931

Biology and Control:

Shiraki 1919

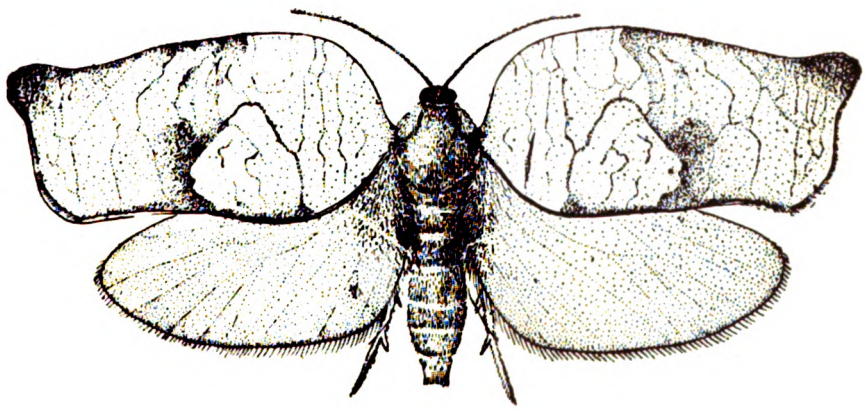
Control:

Nawa 1936

Parasites:

Sonan 1922, 1930

Chu 1934



Cacaecia asiatica Walsingham
(After Chen & Wang)

124. Asiatic leaf roller, Cacoecia asiatica Walsingham, is yellowish-brown, with a wing spread of 2.5 to 3.0 centimeters. Both sexes resemble the tea leaf roller, but differ in having three bands on the underside of the forewing. The mature caterpillar is yellowish-green shaded with red; head reddish-black; thoracic plate yellowish-red; and measures about 1.8 to 2.7 centimeters. The wintering larvae, however, are wrinkled, reddish, and somewhat shorter, ranging from 1.5 to 1.9 centimeters.

Distribution: It has been found in China in Kwangtung, Szechwan, Hunan, and Chekiang. It also occurs in Korea, and Japan.

Affected: Citrus, pear, apple, plum, prune, pomegranate, mulberry, tea.

Nature of Losses: It is a general feeder; though it prefers Citrus in Chekiang where it also attacks other economic plants by rolling their leaves together.

Life History: Four generations appear annually in Chekiang, hibernating as mature larvae within the rolled leaves. The adult emerges at more or less monthly intervals from May through September. In five to ten days a female usually lays 170 eggs, but sometimes over 300, in masses on the under surface of the leaves. During the growing season, egg, larval, pupal, and adult stages require respectively about 5 to 10, 24 to 28, 6 to 8, and 9 days. A life cycle is thus completed in 45 to 55 days.

Control Measures: Same as for the Citrus leaf roller.

References

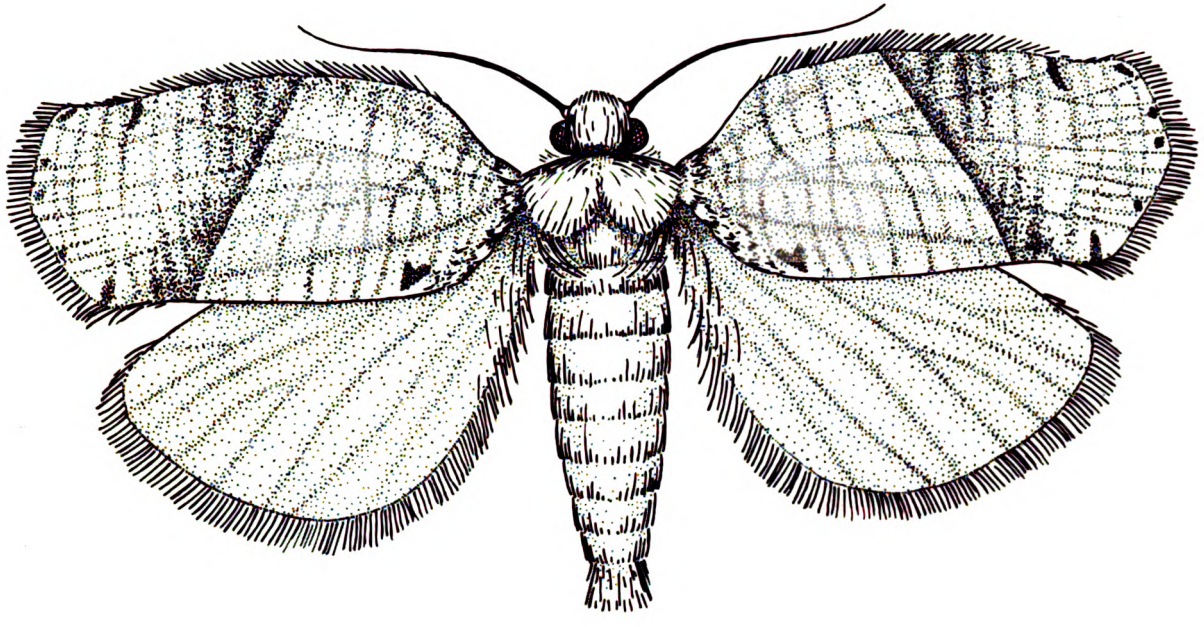
General notes:

Loh 1936

Biology and Control:

Anonymous 1935

Chen, Loh & Wang 1935



Adoxophyes fasciata Walsingham
(Original)

125. Medial-banded leaf roller, Adoxophyes fasciata Walsingham, is yellowish-brown, with a wing spread of 1.7 to 2.1 centimeters. It resembles the previous leaf roller and Asiatic leaf roller superficially, but differs in having the front wing patterned with a broad, oblique, medial band; v-shaped marks at the apical and basal regions; and a simpler general design. A mature caterpillar is yellowish-green shaded with red; head yellowish-red; thoracic plate yellow; and measures about 1.7 centimeters.

Distribution: In China, it is known in Formosa, Huna, and Chekiang. It also occurs in Japan, India, and Malaya.

Affected: Citrus, apple, cherry, peach, pear.

Nature of Losses: In general, the injury caused by this pest is identical with that of the Asiatic leaf roller.

Life History: Six generations are produced in the environment of Chekiang; the winter being passed in the pupal stage, and adults emerging in April, when the females deposit from 60 to 200 eggs each, with an average of 150. The egg, larval, pupal, and adult stages last respectively from 5 to 12, 18 to 27, 6 to 8, and 6 to 9 days. A generation may be completed in 37 to 48 days; a shorter cycle than that of other species.

Control Measures: Same as that for the Citrus leaf roller.

References

General notes:

Shiraki 1919

Clausen 1931

Loh 1936

Biology and Control:

Chen, Loh & Wang 1935

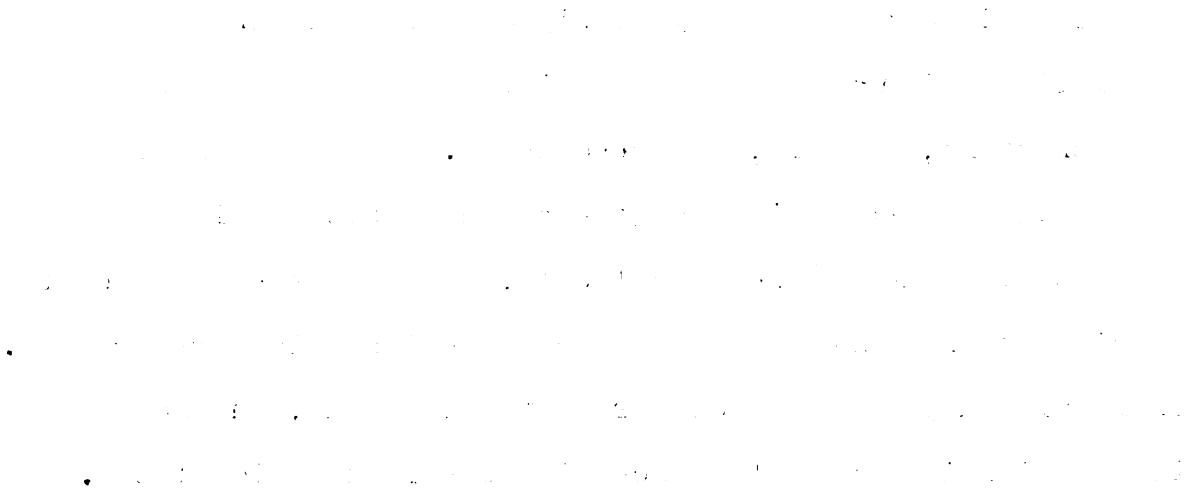
Occasional Pests

	Name	Distribution	Affected
126.	Acalla formosana Shiraki	1	Citrus
127.	Cacoecia circumclusana Christoph	3	Apple, pear, peach cherry
128.	Cacoecia crataegana Hübner	3	Apple, pear, mulberry, oak, birch
129.	Cacoecia ingentana Christoph	3	Apple, pear, cherry, tea, Citrus
130.	Cacoecia longicellana Walsingham	3	Apple, pear
131.	Cacoecia minor Shiraki	1	Mulberry
132.	Cacoecia piceana Linné	3	Pine, juniper
133.	Cacoecia unimaculata Shiraki	1	Turnip
134.	Cacoecia sorbiana Hübner	3	Apple, cherry
135.	Cacoecia xylosteana Linné	2,3	Apple, pear, cherry, willow, balsum poplar oak, elm
136.	Capua congruana Walker	1,2,3	Apple
137.	Capua grotiana Fabricius	3	Oak

	Name	Distribution	Affected
138.	Homona gossypi Matsumura	1	Cotton
139.	Homona sp.	1	Citrus
140.	Oligoresis citrinella Shiraki	1, 2	Citrus, tea
141.	Pandemis heparana Schiffermüller	3,4	Peach, cherry, pear, apple
142.	Pandemis ribeana Hübner	1,2	Apple, cherry, flowering cherry, pear, prune, plum, peach, mulberry, poplar, willow, maple, Liquidambar formosana, oak, elm, birch, hazel
143.	Tortrix dumetana Treitschke	1,3	Apple, plum, oak, poplar, willow, alder elm, birch, honeysuckle
144.	Tortrix sinapina Butler	3	Apple, pear, peach plum

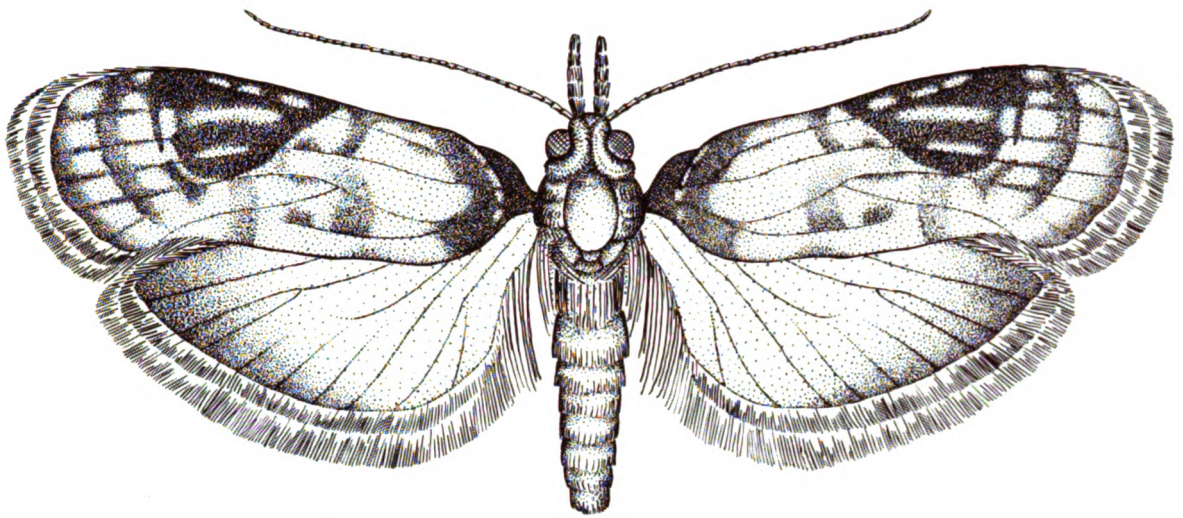
FAMILY PHALONIIDAE

This is a small family highly developed in the holarctic region and composed of internal feeders which live on stems, flowers, and seed heads. They differ from the previous species in that the second cubitus arises close to the end of the discal cell, and from the subsequent species in that the first and second median veins are present. There are only a few species reported in China, and no information is available concerning their economic status.



FAMILY CARPOSINIDAE

This family is small consisting of approximately 130 species, but is well represented in the Australian Region. It includes mostly fruit borers, besides gall makers, stem borers, and leaf miners. They may be differentiated from the foregoing family by lacking the first and second median veins in the hind wing. In China only a few are recorded, among which two are injurious to fruit.



Carposina sasakii Matsumura
(Redrawn from Yago & Ishikawa)

145. Lesser fruit moth, Carposina sasakii Matsumura, ash-brown has a wing spread of 1.5 to 2.0 centimeters. The ground of the front wing is largely ash-white shaded with strong brownish markings along the base, costa, discal cell and outer margin, whereas the hind wing is uniformly greyish. The mature caterpillar is orange red, paler on the ventral side, head light brown, and measures 1.3 to 1.5 centimeters.

Distribution: It is widely distributed, being found in China, in Chekiang, and Manchuria. It is also reported from Korea and Japan.

Affected: Pear, peach, apple, jujube, Mespilus cuneata, Cydonia vulgaris.

Nature of losses: This is one of the most devastating enemies of fruit; particularly pear, peach, and apple in Chekiang and Manchuria. Like that of other fruit moths its larva lives its entire life in the fruit, rendering it unfit for commercial purpose. The infested fruits are usually covered with a gummy exudation.

Life history: Three annual generations have been observed in Chekiang, two in Manchuria. The insect hibernates as a larva in a cocoon underground and pupation follows for about ten days in May and June. In the south the adults appear at the end of May to June and again in August. A female is capable of laying close to 200 eggs, about three to a fruit, which are deposited in depressions on the fruit. Upon

hatching, the larva worms its way into the host, occasionally migrating from one fruit to another. Under favorable conditions a life cycle from egg to adult can be completed in about a month; and during the growing season the egg, larval, pupal, and adult stages continue about 6 to 8, 13 to 17, 7, and 7 to 18 days, respectively.

Control measures: Successful control lies largely in eradicating the overwintering larvae and pupae through winter plowing and frequent shallow cultivation during the growing season. Dropped fruit should be collected consistently.

The fruit can also be coated with four applications of ovicide such as summer oil, nicotine sulphate, or the combination of the two, at weekly intervals; the first two being applied a week apart soon after the formation of the fruit, and the remaining two about 40 days later, also a week apart.

References

General notes:

Clausen 1931

Biology:

Arakawa 1927

Muramatsu 1927

Kondo and Miyakara 1930

Toyoshima 1930, 1931

Biology and Control:

Okamoto 1921

Anonymous 1935

Biology and Control: (continued)

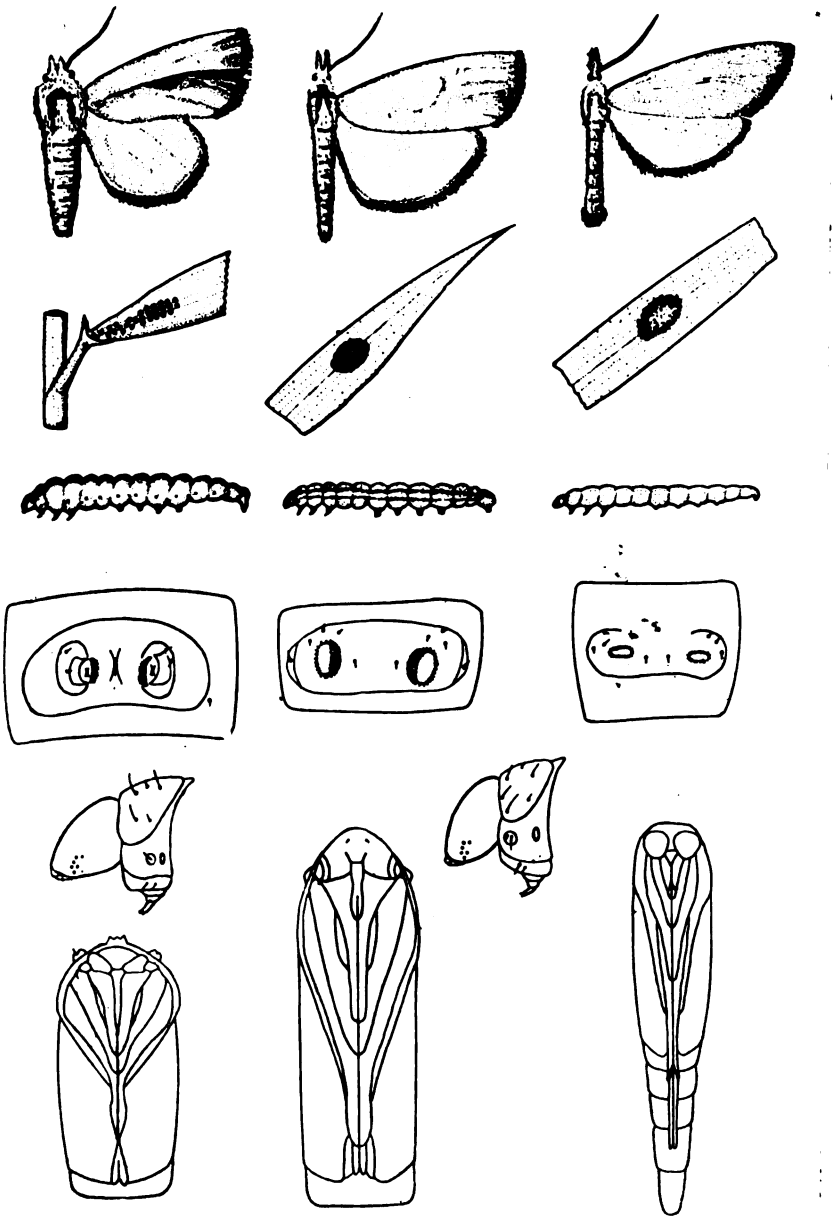
Yago and Ishikawa 1936

Control:

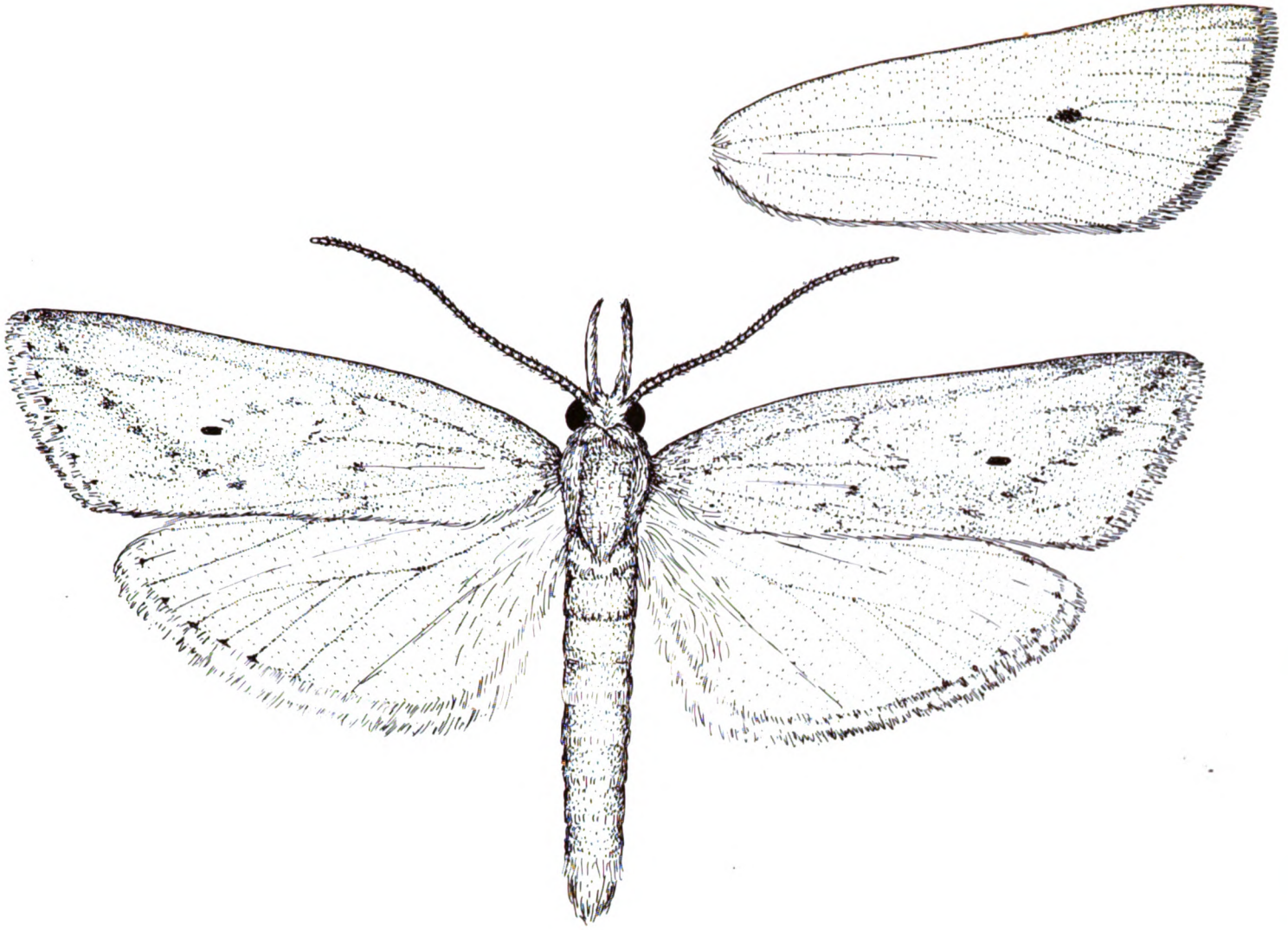
Toyoshima 1934

FAMILY PYRALIDIDAE

This is one of the three largest families of lepidoptera, constituting some 10,000 species in the world's fauna, of which about 1,500 are expected to be found in China though only half this number have been actually recorded. They are small or medium sized moths, varying from dull to brilliant coloration. However, some exotic forms may occasionally reach nearly thirteen centimeters in length. The larvae have been classified into three types according to their modes of feeding: phytophagous, saprophagous, and predacious. The nucleus of the entire group, including several of the worst pests that commonly occur on staple crops, belong to the first type and are terrestrial, living as defoliators on leaves and as borers in shoots, stems, fruits, and seeds. The second group includes those associated with beeswax, stored grains, dried fruits, and zoological specimens; and the last type is represented by about two species that are known to attack scales in the New World.



Rice borers
(After Tsai)



Schoenobius incertellus Walker
(Original)

146. Three-brooded rice borer, Schoenobius incertellus Walker, has a wing spread of 2.0 to 3.0 centimeters. The female is orange yellow with a black spot at the base of the first and second cubitus of the front wing, whereas the male is yellowish-brown. Besides the usual black spot, there is a continuous slanting line along the outer portion; and on the margin a row of seven dots, each of which is placed at the tip of a vein. The hind wing of both sexes is white tinged with yellow towards the outer border. The mature caterpillar is light yellow and measures about 2.5 centimeters.

Distribution: It is commonly found in the entire regions south of the lower Hwang Ho, including Hainan, Formosa, Liukiu Islands. The same species also occurs in Japan, India, Ceylon, Burma, Malaya, Indo-China, Siam, E. Indies, and Philippines. Being indigenous to the tropics, its northern limit lies within the north latitude of 35° where the average annual temperature is above 14° C. and the winter temperature not lower than -3.5°C.

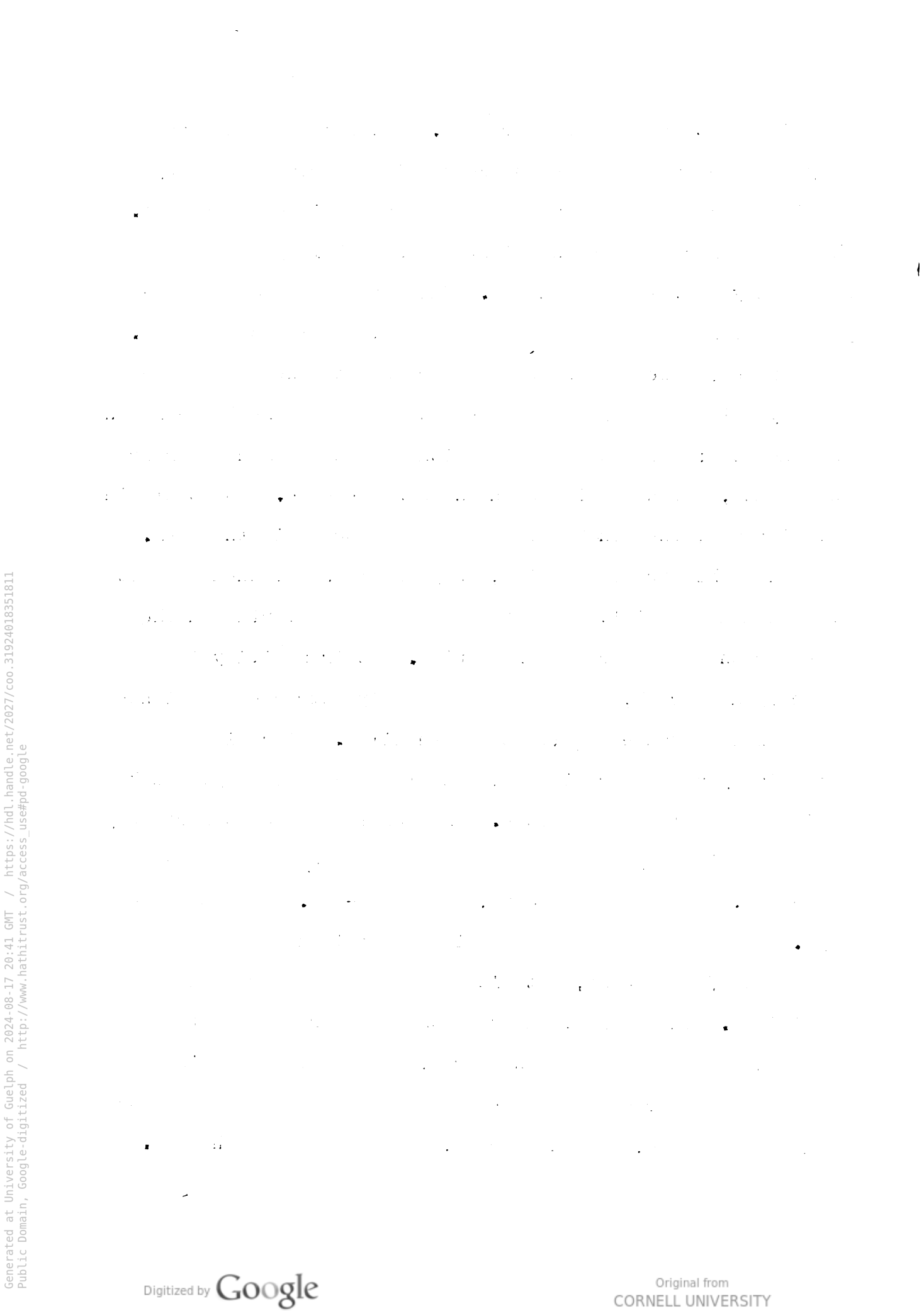
Affected: Rice.

Nature of losses: This is a first rate pest in China as well as in Japan, India, and other southern countries. It raids approximately 15 to 20 per cent of the entire crop annually, and some 70 or 80 per cent during a violent outbreak. Tsai (1936) estimated the financial loss due to rice borers in epidemic years as 1,200,000,000 dollars, with this species playing the major role in destruction. Areas that

come under the constant threat of the borer are generally along the coast, river basins, islands, and inland centers of transportation; specifically Kwangtung, Kwangsi, Formosa, Liukiu, Honan, Chekiang, and Kiangsu. Injury is usually in the stem, although the young larva occasionally attacks leaves either superficially or internally before boring. Three or four shoots of rice are likely to be affected in the larval life. A single larva is usually present in a stem, though there are sometimes as many as two or three, so frequently a surprisingly large number occurs in each plant hill during a serious infestation. Young seedlings that are unable to sustain the onslaught are blasted in about three to five days following the first entrance, but the mature plants that survive are greatly stunted and produce deformed grains known as "white ear" or "false head". The degree of injury, however, is closely related to farming practices and the variety of rice. As to the latter, early varieties and those of the japonica type are more susceptible to the borer, with the late glutinous type next, and the indica type most resistant. An outbreak is likely to occur following muggy autumn weather or a warm, dry winter. In double cropping areas, the last crop suffers the greatest damage as the pest population reaches its climax; but in the areas where a single crop is grown annually, the heaviest loss is observed among the late crop.

Life history: Three to six generations are produced yearly, depending on the geographical location. Kwangtung is recorded as having five, Formosa six, Liukiu four to five, Chekiang three or four, and Kiangsu three. Hibernation takes place during the larval stage in the remaining stubble near the roots; pupation occurs in the spring within the stem, from which stage adults eventually appear to lay eggs for a new colony. One or two days after liberation, the female oviposits in the evening between seven and ten o'clock, laying eggs on the underside of the leaves about three inches from the tip near the midrib. The eggs number from one to six clusters, but usually one to three; each cluster contains from 20 to over 100 eggs, generally between 50 and 60. The capacity of egg laying varies with different broods and, given other environments, even differs within the same brood. This also holds true with the size of the egg cluster as was illustrated in Nanking where the first brood had an average of 39 eggs in a group, the second 47, and the last 101. During the growing season, the egg, larval, pupal, and adult stages cover 3 to 15, 20 to 25, 4 to 20, and 7 to 21 days, respectively. A life cycle from egg to adult may be completed in about a month under favorable conditions. Newly hatched caterpillers either crawl about or are suspended on silken threads from the leaves, and are wafted on wind currents from this center to neighboring plants within a radius of three or four feet. About 86 to 98 per cent of these worms will manage to bore into the host during

the first two days after emergence. Several days afterward they come out and enclose themselves in a portable case by rolling up a piece of leaf and then gnawing it off the host. They then proceed down the plant to the water by means of which they travel to new hosts. This phenomenon may be repeated several times depending on the available food supply. The larvae of the various broods burrow into the stem immediately below the surface of the water between the leaf-sheath and the stem; and into other portions of the stem not far from the ground, often working down through the base. On completing five instars, they change to pupae in a cocoon in the stem. Preceding the eve of pupation, they chew a hole, then seal it with silken material, or leave a thin skin covering on the hole for the emergence of the adults. Their activity is strictly nocturnal, and they are strongly attracted to lights even for a distance of five to seven miles. Since it is essentially a southern insect, both larva and pupa have weak resistance to low temperature. One hundred per cent mortality is reached if they are exposed to a temperature between -5° and -12°C. for one to two days, or 0° to -5°C. for two to ten days. The death toll of larvae in hibernation usually runs from 50 to 70 per cent, but fluctuates with meteorologic conditions. In general, muggy autumn and warm dry winter assist the development of the borer; the first permitting slow maturing larvae to become sufficiently advanced to withstand winter cold, and the second, lowering the death rate.



Control measures: In the case of this pest, insecticides are generally ineffective, so principal control measures are, in order of importance: eradication; protection; and immunization.

By far the best means of combating the borer are eradicative methods, consisting of mechanical and biological measures. The mechanical measures include the methodical destruction of the hibernating stage by winter plowing, low cutting, stubble digging, moth collecting, and the removal of injured stems. Winter plowing destroys a portion of the hibernated pest. Whether or not the result compensates for the cost of operation is an open question. Besides, plowing by animal power after harvest or during winter months is difficult, if possible at all. Low cutting at harvesting is highly desirable, since it reduces the larvae that are prepared for dormancy by about 85 per cent. Stubble digging promises a good control, but is objectionable because it involves tremendous labour, especially in clay soils. Flooding for two consecutive months insures total mortality, but its usage is restricted to low lands where water is accessible; its effect on the future utility of the soil must also be considered. Egg collecting is recommended for seed beds and fields, where it will be the most effective; possibly, however, with the exception of the seed beds, it does not seem likely to be worthwhile. For this purpose seed beds are laid out with paths four feet wide between strips, so the eggs can be easily gathered and seedlings

carefully examined before transplanting. Moth collecting is effective if it is done before or during the oviposition period. This is accomplished by a light trap, or by sweeping a net over the seed beds. Light traps have been used profitably under Chekiang conditions from the middle of August to the end of September, particularly during the first week of the moths' emergence. The removal of the injured stems also cuts down the infestation somewhat. Biological measures consist of crop rotation, elimination of volunteer rice, and the utilization of natural enemies. Hence, since rice is the only known food plant, the continuance of systematic rotation could reduce the pest population to such a low level that it would not be a threat to food production. In order to accomplish this, it will be necessary to group the endemic areas together according to their climatic conditions, biological data, and economic features, upon which basic plans may be made for drafting a rotation system. As far as economic factors permit, rotation possibly is better applied in the spring to exterminate the first generation of the borer, thus intercepting the vital chain of the year's primary cycle. If possible, early and late plantings should not be mixed, as this would provide a continuing food supply. In areas of occasional injury, the employment of cultural practices such as low cutting, egg collecting in the seed beds, and sporadic rotation may be sufficient to keep the pest at bay. In all cases, the volunteer rice must be extirpated during the quarantine period. Lastly,

comes the utilization of natural enemies which constitute a continuous check on the insect. Among many known parasites, the egg devourers, Trichogramma japonicum Ashmead and Phanurus beneficiens Zehntner, destroy a total of 15 to 75 per cent of the eggs, with an approximate average of 40 per cent. They should be properly protected so that their association will be of great significance in control. The former species is distributed widely in China, and also in Japan, India, E. Indies, and Philippines, parasitising from 14 to 45 per cent of the host. The latter species occurs in south China, including Formosa, and also is found in Japan and E. Indies, parasitising at the rate of 1 to 30 per cent of the host.

The protective methods are secondary measures, which if applied successfully, can enable the crop to escape damage. These are: regulation of the sowing date, disinfestation with contact larvicide, and insertion of tobacco stems in the soil. Regulating the sowing date may prove to be useful, since the laying period of the female is comparatively short. The main obstacle to this method is that it involves an infinitely detailed knowledge of the biological complex of the borer-host relationship, with reference to various localities under different climatic conditions. The use of protectants is only occasionally recommended. Inserting tobacco stems by the side of the rice plants at the rate of 40 or 50 pounds per acre is said to be effective under a certain condition. Tobacco stem used at this rate is not

likely to inhibit the development of the borer, but rather to give a stimulating effect to the rice crop. If more tobacco stems are applied, the nicotine content released therein may be strong enough to kill larvae during their migration from plant to plant. Perhaps the vapor of the nicotine which arises from the water may act as a fumigant that is fatal to the borer, and repellent to the moth. In any case two or three applications are required for each seasonal crop, involving enormous labor problems. Moreover, a cultivator using this treatment cannot permit the water to escape from his field until the process is completed, thus indirectly preventing neighboring fields from being flooded during this period. In this connection, DDT may be a promising material for trial.

The immunizational methods include breeding resistant varieties of rice and improving nutrition. The former is hard to achieve consistently, since it is an expensive process and depends for success on variable ecological factors. Nutrition is a plant health problem, for when proper fertilizer is applied the vitality and toughness of the plant are increased and the probability of insect attack is indirectly diminished.

Natural enemies:

Egg stage:

Trichogramma japonicum Ashmead (Hym. Chalcididae)

Trichogramma austrilicum Girault (Hym. Chalcididae)

Tetrastichus schoenobii Ferriere (Hym. Chalcididae)

Egg stage: (continued)

Phanurus beneficiens Zehntner (Hym. Scelionidae)

Phanurus dignus Gahan (Hym. Scelionidae)

Phanurus rowani Gahan (Hym. Scelionidae)

Phidole noda Smith (Hym. Formicidae)

Paederus idae Lewis (Col. Staphylinidae)

Arachnids (Acarina)

Larval stage:

Amauromorpha schoenobii Viereck (Hym. Ichneumonidae)

Amauromorpha metathoracia Ashmead (Hym. Ichneumonidae)

Angitia chilonis Cush. (Hym. Ichneumonidae)

Centeterus alternecoloratus Cush. (Hym. Ichneumonidae)

Cremastus shiraki Sonan (Hym. Ichneumonidae)

Cremastus biguttulus Munakata (Hym. Ichneumonidae)

Eriptermus akoensis Shiraki (Hym. Ichneumonidae)

Trathala flavopedes Shiraki (Hym. Ichneumonidae)

Apanteles ruficrus Haliday (Hym. Braconidae)

Chelonus munakatae Munakata (Hym. Braconidae)

Microbracon chinensis Szepligeti (Hym. Braconidae)

Microbracon sp. (Hym. Braconidae)

Shirakia dorsalis Matsumura (Hym. Braconidae)

Stenobracon trifasciatus Szepligeti (Hym. Braconidae)

Stenobracon maculata Matsumura[1] (Hym. Braconidae)

Elasmus albopictus Crawford (Hym. Chalcididae)

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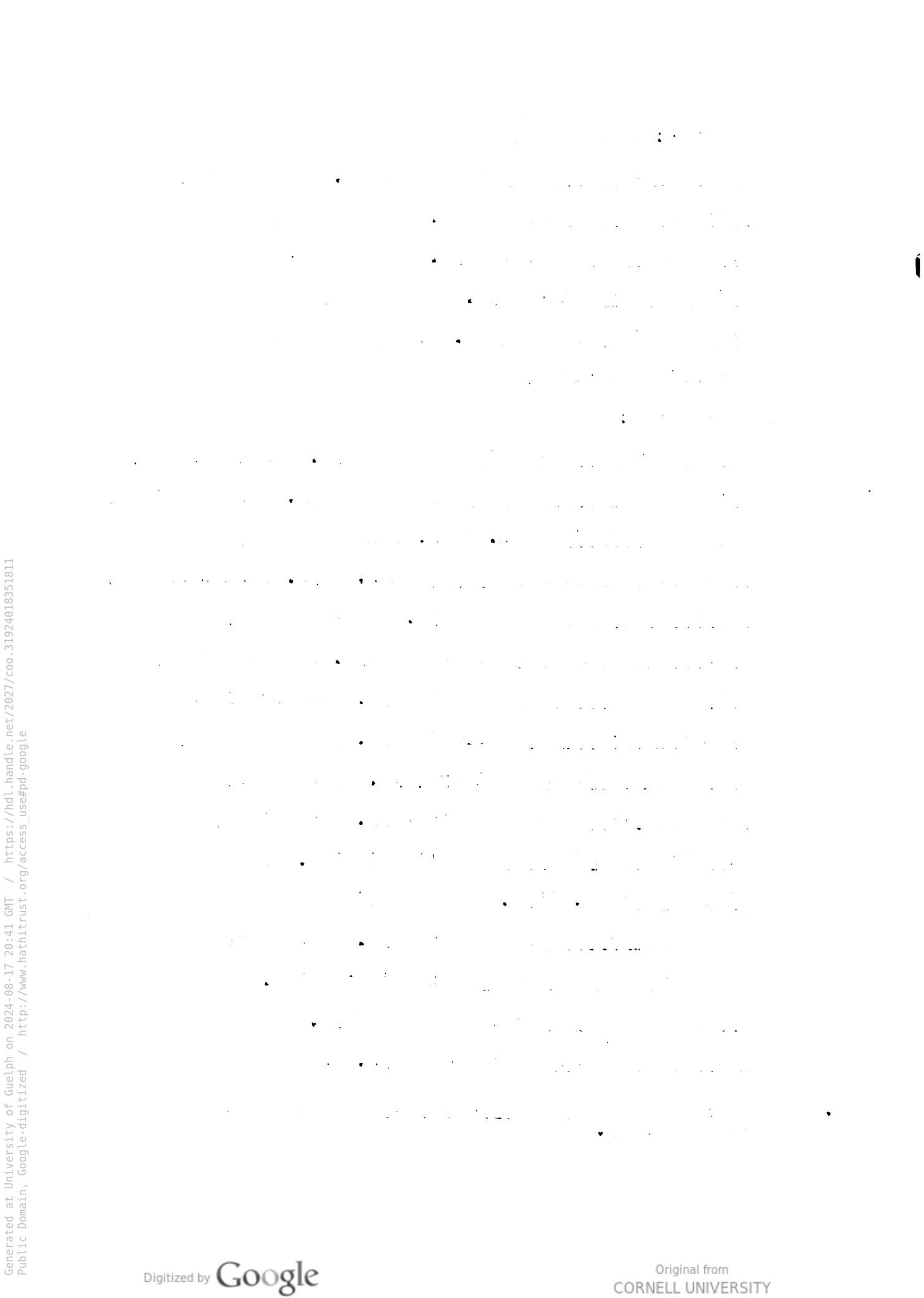
1. Possibly same as Stenobracon nicevillii Bingham, but differs slightly.



Larval stage: (continued)

Eupteromalus sp. (Hym. Chalcididae)

Tetramorium guineense Fabricius (Hym. Formicidae)

Anatrichus erinaceous Loew (Dip. Chloropidae)

Megaselia sp. (near *M. fungicola* Coq.) (Dip. Phoridae)

Proreus simulans Stal (Derm. Forficulidae)

Carabus sp. (Col. Carabidae)

Paederus mixtus Sharp (Col. Staphilinidae)

Paederus idae Lewis (Col. Staphilinidae)

Phidole noda Smith (Hym. Formicidae)

Pyroderus formosanus Matsumura (Arachnoidea Attidae)

Gordius sp. (Nematoda Gordiidae)

Adult stage:

Cicindela chinensis DeGeer (Col. Cicindelidae)

Cicindela aurulenta Fabricius (Col. Cicindelidae)

References

General Notes:

Fey 1928

Hadden 1928

Wang 1931

Takahashi 1932

Kinoshita and Yaki 1932

Tsou 1934

Huang 1940

Kawada 1940

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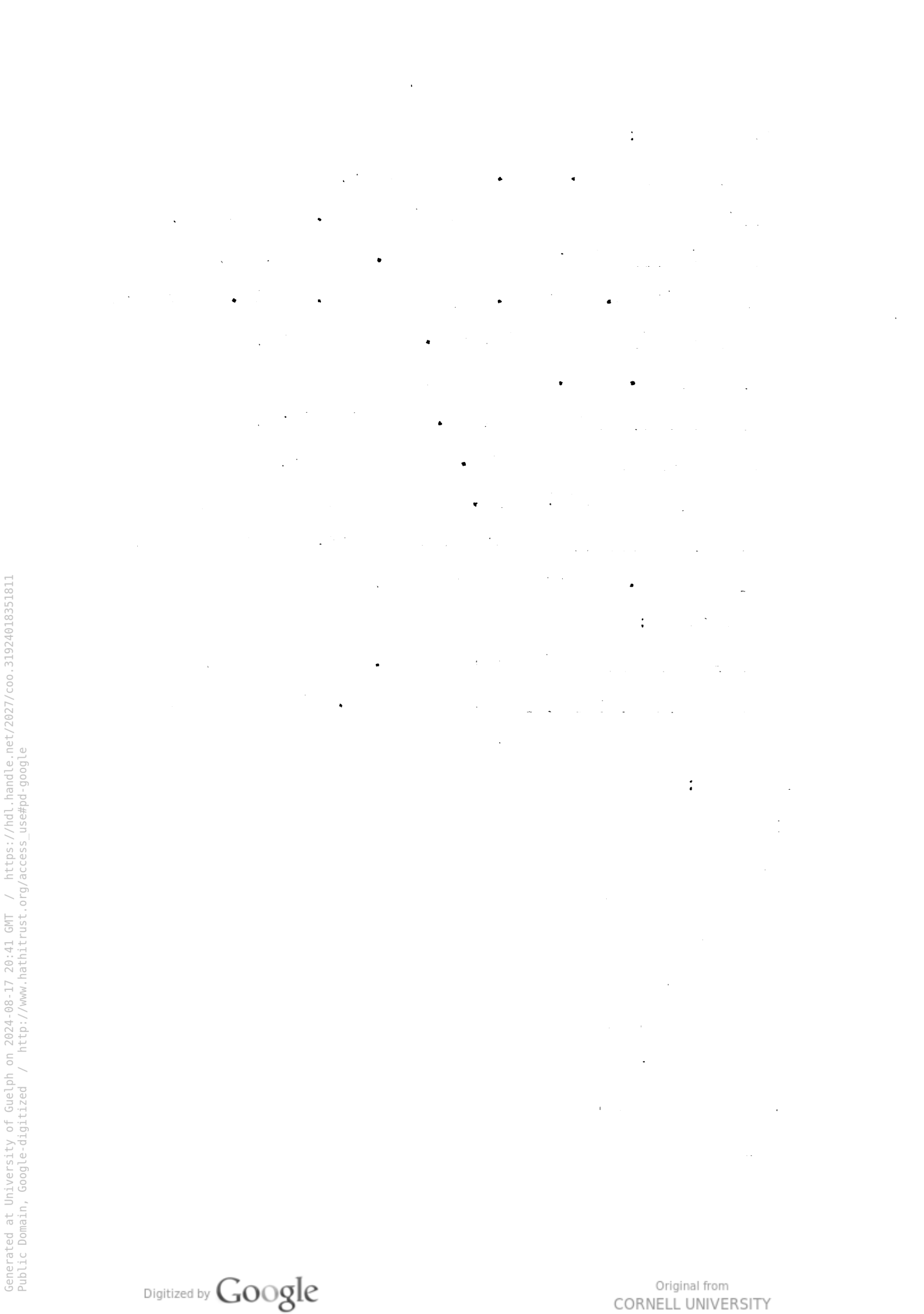


Biology:

Anonymous 1929

Shibata and Yaki 1933

Tsai 1935

Liu 1936

Shiraki 1937

Biology and Control:

Shiraki 1917

Tsou 1925

Fey 1926

Tsai 1932, 1936

Li 1936

Ramakrishna Ayyar and Anantanarayanan 1937

Chu 1938

Control:

Misaka 1932, 1938

Tong 1933

Chen 1935, 1937

Fu 1936

Liu 1936

Liu and Chen 1937

Huang 1940, 1941a, 1941b, 1943

Woo and Huang 1941

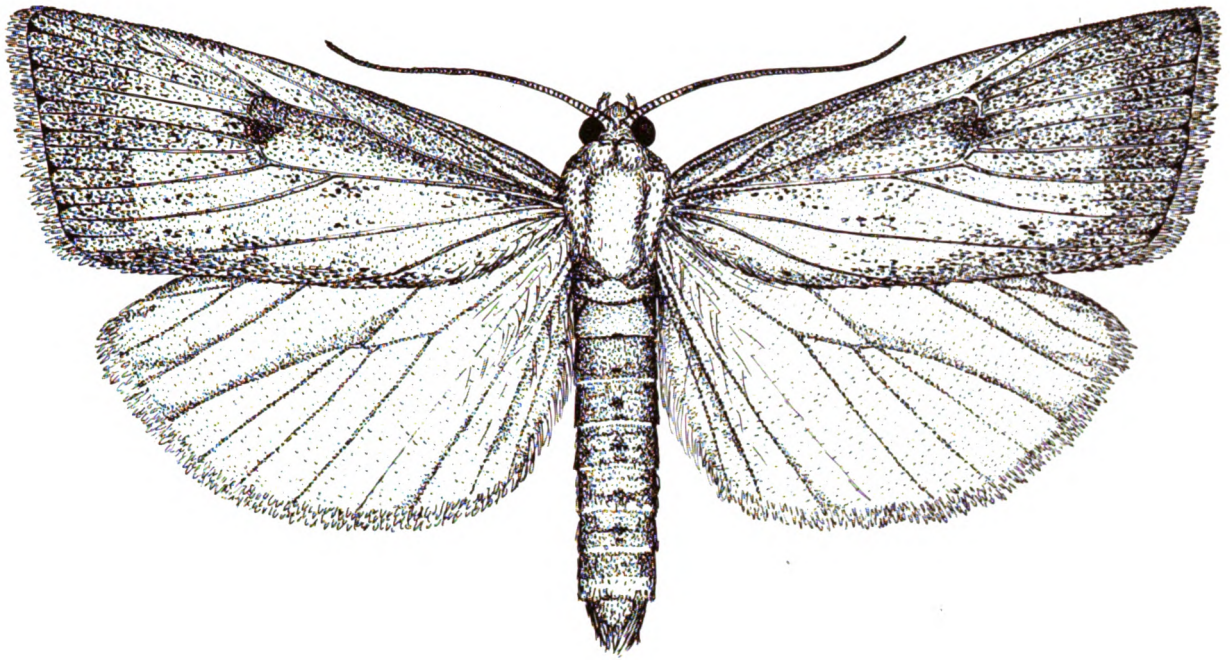
Epidemiology:

Tsai 1934, 1935

Huang 1941

Parasites and Predators:

Kuwana	1929
Sonan	1929, 1930
Watanabe	1932
Chiu	1937
Ishii	1939



Chilo simplex Butler
(Original)

147. Two-brooded rice borer, Chilo simplex Butler, has a wing expansion of 2.5 to 3.0 centimeters. The general coloration of the moth is grayish-brown. The outer portion of the front wing of the male is dark with six blackish spots on the margin, but that of the female has seven. In both sexes a dark blotch lies on the discal portion of the cell of the same wing in between the second and third medial veins. The hind wing is uniformly grayish-white. A mature caterpillar is light brown with five striking chocolate, longitudinal bands, and measures from 2.0 to 2.5 centimeters.

Distribution: This widely distributed insect is found all over China, including Formosa and Liukiu. It also occurs in Korea, Japan, India, Burma, Malaya, Siam, Indo-China, East Indies, Philippines, and Hawaii. Being a northern insect, it appears to be most abundant in regions 25° to 40° north latitude, especially in places where the annual temperature ranges between 6° and 17°C. It tends also to frequent highlands towards the south.

Affected: Rice, millet, corn, arrow-head, sugar cane, Zizania aquatica, Panicum crus galli, Andropogon Halepensis, and other gramineous plants.

Nature of Losses: A major pest of rice, it ranks next only to the three-brooded rice borer. Its influential areas in China include Kwangtung, Formosa, Kiangsi, Hopeh, Hunan, Chekiang, and Anhwei. Destruction runs into millions of

dollars annually. The general nature of injury is similar to that of the foregoing species, but differs in that twenty or thirty larvae are often gathered together to attack a single plant; in one extreme instance as many as 118. Infestation is therefore confined to limited areas, more often along the sides of the field. The quality of the grain may also be affected. Okamuia (1933) stated that the vitamin B content of the injured rice had been a little less than in normal plants.

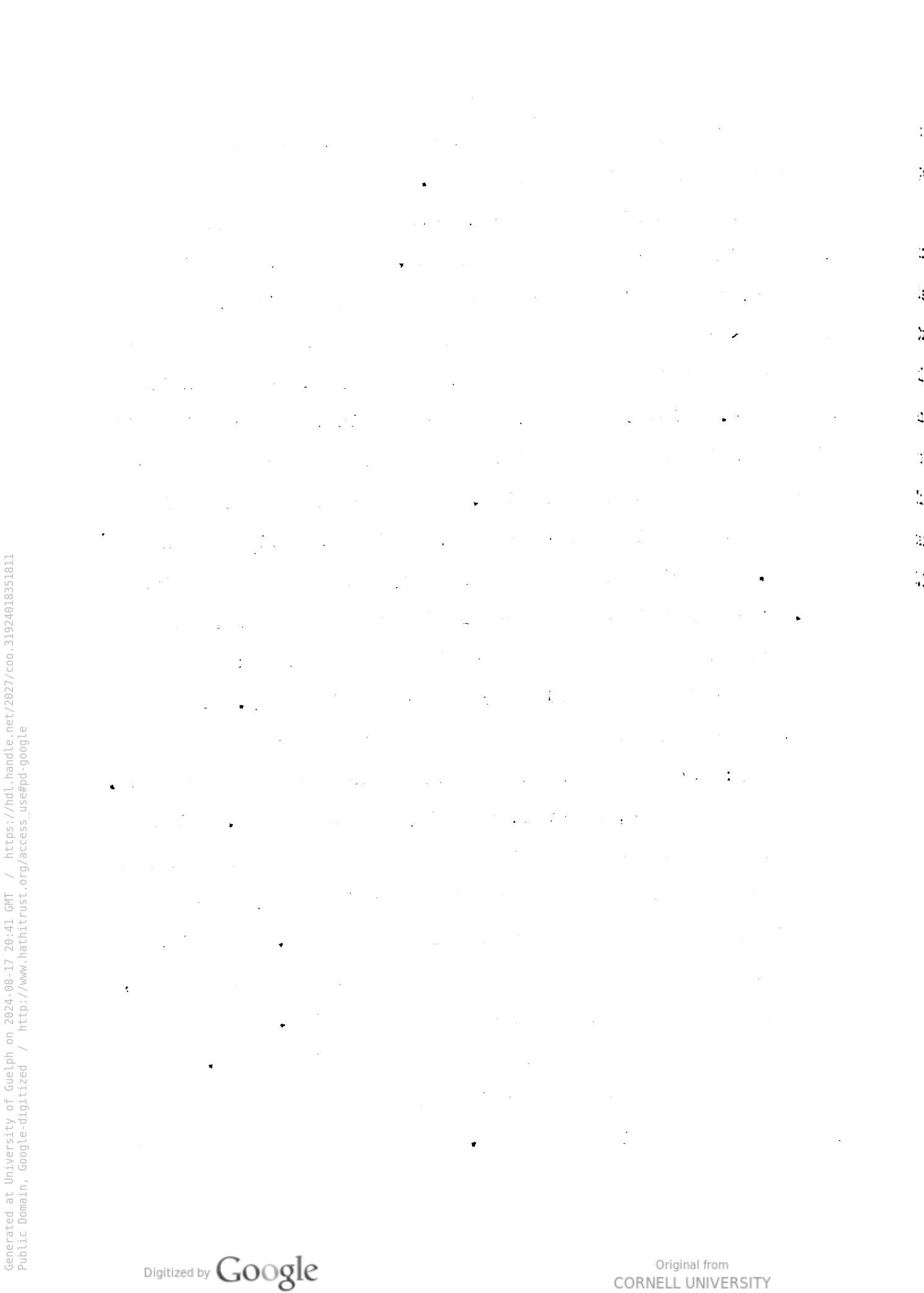
Life History: One to five generations are produced annually in China: Kwantung has recorded five generations; Formosa four; Liukiu three to four; Chekiang two; Kiangsu two; and Manchuria perhaps one to two. The winter is passed as mature larvae largely among straw piles, or in the stubble of late rice and other concealed places. Pupation follows in the succeeding spring or early summer. After liberation, moths soon begin to lay eggs for a new generation. They deposit a total of 200 to 900 eggs in clusters, numbering from two to over ten, commonly five or six, each of which contains 30 to 170 eggs or more. They are placed either on the upper surface of the leaves near the tip, or on the leaf sheaths. Under Kiangsu conditions, the former is the general location of the eggs of the first brood, and the latter the location of the second brood. Larvae of the first three instars are gregarious, but the later instars disperse individually. A large number of these larvae, but more

commonly two to four, may be concentrated on a single plant. A few days after the first entrance into the stalk of rice, these larvae come out from the old plant, migrating to other stalks within a radius of five feet. This phenomenon occurs a few times, depending on the health of the subjugated hosts. During migration these insects travel from one plant to another by crawling from stem to stem. Those of the early generations pupate in cocoons among leaf sheaths, the later ones in stubble and straw piles. The egg, larval, pupal, and adult stages require from 5 to 11, 27 to 48, 5 to 15, and 4 to 16 days, respectively. A life cycle from egg to adult may be completed in approximately forty days under proper conditions. Moths of all generations are strongly attracted to lights, and the females are chemotactic to food plants and honey. Harukawa, Takato, and Kumashiro (1936) notedthe decrease of the percentage of emergence to be in proportion to the increase of excessive moisture. In all cases, both excessive moisture and aridity retard the day of emergence. The latter tends to diminish the per cent of transforming larvae and the rate of emergence of hymenopterous parasites. The percentage of parasitism was markedly higher among small larvae.

Control Measures: Because of the broad acceptance of gramineous host plants, the borer is difficult to control. General methods involved here are similar to those of the previous one, but differ in some specifications. The chief

emphasis is still upon eradicative methods, which include mechanical and biological measures.

Of the mechanical measures, perhaps the destruction of hibernating larvae is most important. Unlike the previous species, this pest hibernates mostly in straw piles, and therefore steps should be taken to prevent them from spreading to the fields by screening the barns just before their emergence. Winter plowing, stubble digging, and flooding will aid control somewhat, but involve too much labor to compensate for the cost of operation. Egg collecting is sometimes recommended for infested seed beds during the oviposition period. Seedlings should be carefully examined before planting. The partial submergence of rice seedlings for 24 hours kills around 50 per cent of the first brood larvae; complete submergence increases this percentage considerably. In any case, temperature is an important factor in determining mortality: the higher the temperature, the better the results. Higher temperature, however, also injures the plant. Light traps have been used effectively in Japan, but whether or not they will give the same results in China is mainly an economic question, for petroleum is an imported material. The light traps should be between three and five feet above the ground, depending on the height of the crop at the time. About 10-candle power are required for each acre of rice field. Biological measures such as rotation and natural enemies are useful in eliminating the borer. The same important parasites



of the three-brooded paddy borer are major enemies of this pest.

Protective methods are of great value in combatting the insect during the growing season. The most important of all is the use of insecticides in the form of spray or dust. Dust of nicotine-containing material or of pyrethrum is particularly effective. Tobacco dust containing 5 per cent sulphur and 15 per cent lime at 200 to 300 pounds to an acre gives good control. Nicotine sulphate and soap will also do the job. This nicotine material will partially affect all of the egg parasites. A solution of pyrethrin at a concentration of 0.009 per cent kills all the eggs.

Natural Enemies:

Egg stage:

Trichogramma japonicum Ashmead (Hym. Chalcididae)

Tetrastichus schoenobii Ferriere (Hym. Chalcididae)

Phanurus beneficiens Zehntner (Hym. Scelionidae)

Carabus sp. (Col. Carabidae)

Arachnids

Larval stage:

Cremastus biguttulus Mumakata (Hym. Ichneumonidae)

Cremastus shirakii Sonan (Hym. Ichneumonidae)

Epiurus nankingensis Uchida (Hym. Ichneumonidae)

Apanteles flavipes Cameron (Hym. Braconidae)

Bracon onukii Watanabe (Hym. Braconidae)

Chelonus munakatae Munakata (Hym. Braconidae)

Larval stage: (continued)

Microbracon chinensis Szepligeti (Hym. Braconidae)

Microbracon onukii Watanabe (Hym. Braconidae)

Microgaster russata Haliday (Hym. Braconidae)

Shirakia dorsalis Matsumura (Hym. Braconidae)

Shirakia schoenobii Viereck (Hym. Braconidae)

An undetermined species of Carabidae (Col. Carabidae)

Pupal stage:

Xanthopimpla pedator Fabricius (Hym. Ichneumonidae)

An undetermined species of Carabidae (Col. Carabidae)

References

General Notes:

Hadden 1928

Wang 1931

Hsu 1933

Okamura 1933

Chen and Chang 1937

Yashiro 1940

Biology:

Anonymous 1927

Katsumata 1931

Doke 1936

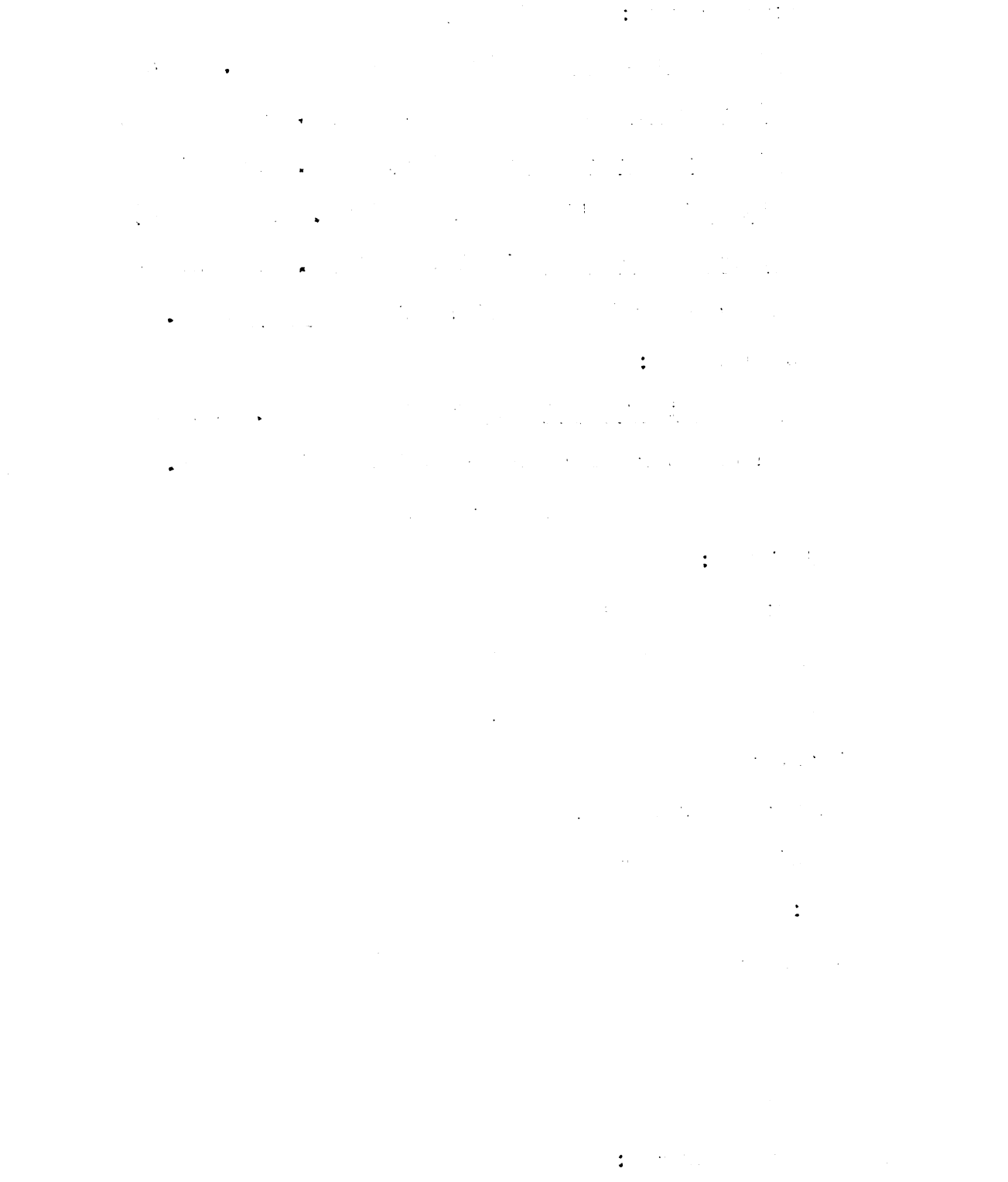
Yatomi 1936

Biology and Control:

Shiraki 1913

Tsou 1929

Tsai 1936



Control:

Anonymous 1936

Harukawa 1926

Kaneno 1927

Misaka 1932, 1938

Onoe and Iwasaki 1932

Liu 1933

Liu and Ma 1933

Ozaki 1934

Kaburagi 1936

Morino, Homma, et al 1936

Sawa 1937, 1938

Kuwazuka, Ogusa, and Ando 1940

Light Trap:

Wang 1933

Kaburaki 1936

Kono 1936

Kaburagi 1938

Okazaki 1938

Kaburaki, Kamito, et al 1939

Submergence:

Sawa 1937, 1938

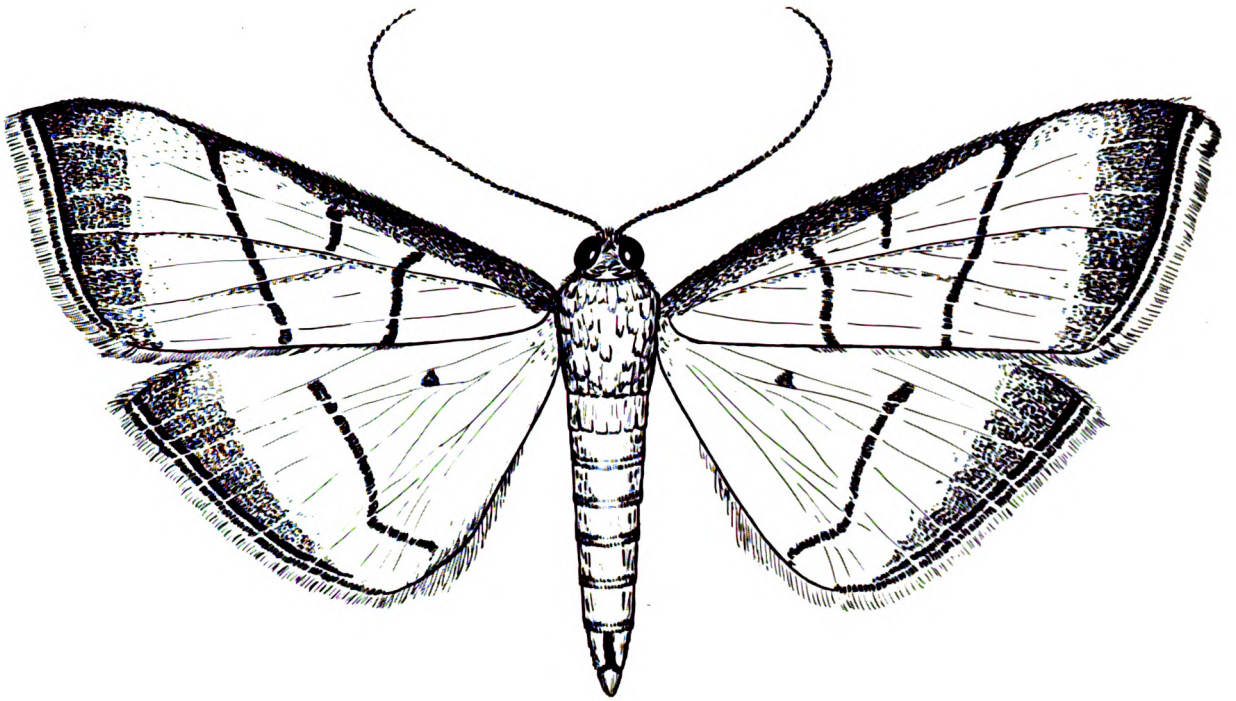
Parasites and Predators:

Takano 1933

Okada and Maki 1934

Parasites and Predators: (continued)

Chu	1934
Fukaya	1938
Ishii	1938
Hama	1938, 1939
Iyatomi	1941



Cnaphalocrosis medinalis Guenee
(Original)

148. Rice leaf roller, Cnaphalocrocis medinalis Guenee, has a wing expansion of 1.7 to 2.0 centimeters. The color of the moth is brilliant yellow, with the costal area of the front wing and the outer border blackish. There are two black lines running through the entire wing, and a short one on the cross vein. The hind wing is similar, with less complete lines. A full grown caterpillar is yellowish and attains a length of 1.5 centimeters.

Distribution: Its occurence in China extends from Formosa to Manchuria, being recorded in Kwantung, Hainan, Formosa, Liukiu, Szechwan, Kiangsi, Chekiang, Kiangsu, and Manchuria. The same is found in Korea, Japan, India, Siam, Burma, Malaya, Indo-China, East Indies, and Philippines.

Affected: Rice, wheat, barley, sugar cane, and other gramineous plants.

Nature of Losses: This leaf roller is a minor pest of cereal, especially rice, causing some occasional damage.

Life History: Formosa has six or seven generations annually, whereas Chekiang has two, and Manchuria possibly one. Hibernation occurs in the mature larval stage. Under Chekiang conditions the first generation of adults appears from June to July, and the second in August. Eggs are deposited in clusters on the upper surface of the leaf, arranged in two rows of three or four eggs each. Upon hatching, the caterpillars begin to web the leaves together on the sides of the leaf blade and attack the surface thereof. Pupation takes place within

the rolled leaves in a thin whitish cocoon.

Control Measures: The destruction of the larvae which have withstood the winter can be accomplished by destroying weeds and other hosts near the fields. However, this may not be so easy to do, because the larvae feed on a vast variety of plants. During the period of infestation rolled leaves may be collected and destroyed.

References

General Notes:

Clausen 1931

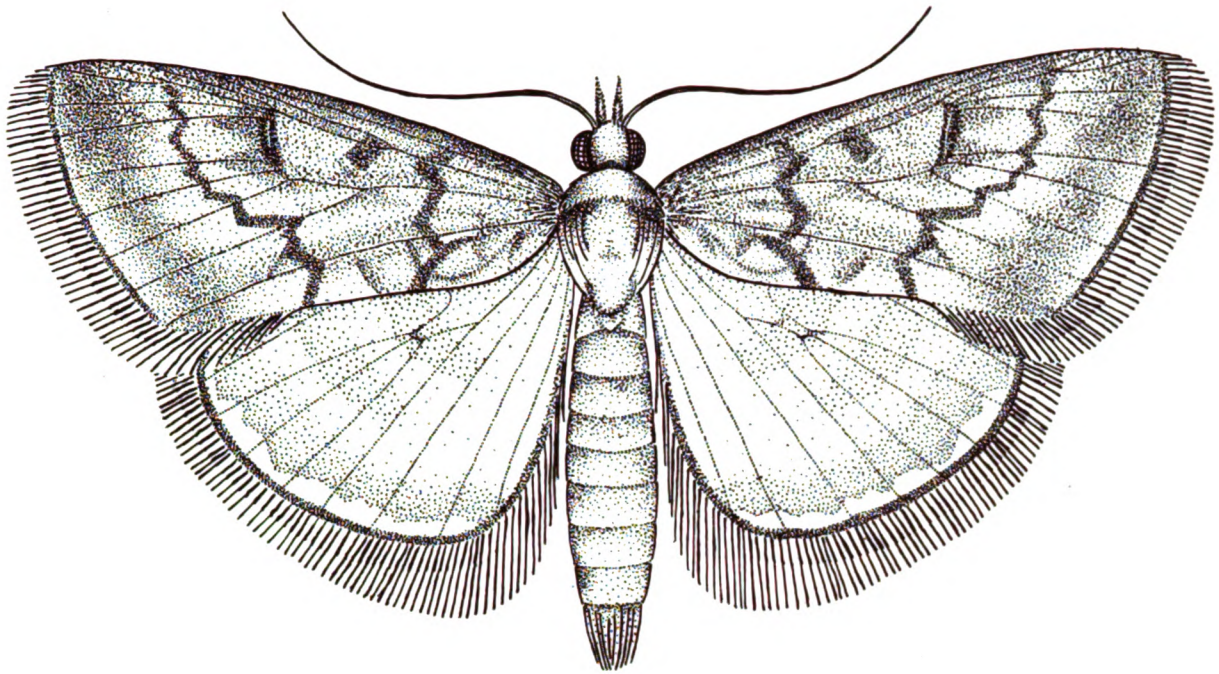
Hsu 1933

Yashiro 1940

Biology:

Shiraki 1913

Li 1940



Pyrausia nubilalis Butler
(Original)

149. European corn borer, Pyrausta nubilalis Hubner, has a wing spread of 2.2 to 3.0 centimeters. Both sexes are straw yellow mottled with darker bands, but the male is smaller and its pattern is more pronounced in color. A fully grown larva is greyish-white to light brown, dorsally marked with conspicuous brownish or reddish spots, and measures from 2.0 to 3.0 centimeters.

Distribution: This cosmopolitan species is a northern insect which occurs largely in the temperate zones of Asia, Europe, Africa, and North America. It probably is found throughout the greater part of China, but its endemic center has been in the areas north of Hwang Ho along the coastal section, all through Kirin and the basin of Heilung Kiang.[1] This species is also distributed in the eastern world in Korea, Japan, Siberia, N. India, Philippines, Guam, and Asia Minor.

Affected: Corn, millet, sorghum, apple, raspberries, cotton, and numerous other economic plants and weeds. A total of more than 200 food plants have been recorded.[1]

Nature of Losses: It is a serious pest of corn, sorghum, and millet on the coastal areas falling within the bounds of 35° to 45° north latitude, including the provinces of Shantung, Hopeh, Jehol, Liaoning, and Kirin. It becomes a pest of major importance of cotton in areas south of Hwang Ho, particularly Hunan and Hupeh. During the year 1929, heavy infestations were reported from Liaoning, Kirin, and

Heilungkiang. In the first two provinces, severe damage was inflicted on corn, sorghum, and millet, and the percentage of infestation ranged from 74 to 100, 20 to 56, and 10, respectively. Sweet corn and sweet sorghum are most susceptible to attack. At the Heilung Kiang basin, apples and the stems of raspberries were affected more than any other hosts. An outbreak was reported among the cereal crops of Hopeh in 1933 and again in Laioning in 1939. This pest is essentially a borer in roots, stems, fruits, and seeds, but its young caterpillars sometimes injure foliage. Wind-breakage, stunting, frass excrement deposited on feeding areas, and premature dropping of fruits are the common signs of injury. Infested fruits and seeds are rendered useless for human consumption. Although no figure for the losses from this borer is yet available, it is presumed to amount to millions of dollars annually.

Life History: One to five generations are reported each year, with five in Kwangtung, Hainan, and Formosa and decreasing northward at the rate of one generation to every 5° of latitude. In America, two distinct biological races have been found but whether a similar situation exists in China is not known. The winter is passed in larval form in stalks of the hosts and pupation commences during spring or early summer. Upon adulthood, each female lays about 300 to 600 eggs or more, arranged in 5 to 10 clusters or more, on the underside of plant leaves. Records show that as many as 1934 eggs and 36 clusters

were put forth by one female. This stage lasts approximately seven to ten days. Upon emergence, the larvae superficially attack leaves, husks, tassel, ears, stalks, and other parts, later boring into the plant. A large number of larvae, usually from one to five, are frequently present in each badly infested plant. The boring habit of the larvae is believed partly due to the necessity of obtaining a more suitable, moist environment, for dryness retards growth. The humidity is one of the leading factors governing the natural dissemination of the pest and the density of its population. Its active larval life covers six instars for a period of about 20 to 40 days. During the growing season, a life cycle from egg to adult may be completed in 30 to 40 days in multivolted areas.

Control Measures: The destruction of the hibernating larvae is accomplished by burning plant refuse, winter plowing, and proper treatment of the infested stalks. Crop rotation and the utilization of natural enemies should not be neglected in long range control program. Soybean and other legumes are the best alternating crops with corn. No insecticides are found to be very effective. Much research has been done on borer-tolerant varieties of cereals, but no totally resistant strains have yet been discovered though differences in infestation have been observed among different varieties. This phenomenon, however, perhaps may well be caused by insect preferences rather than the genetic nature of the host. It is difficult to obtain an absolutely resistant strain, but it is quite possible to

produce through intensive selection strains that are less susceptible in given localities.

Natural Enemies:

Egg stage:

Trichogramma evanscens Westwood (Hym. Chalcididae)

Trichogramma sp. (Hym. Chalcididae)

Larval stage:

Angitia (Inareolata) Punctoria Roman (Hym. Ichneumonidae)

Cremastus biguttulus Mumakata (Hym. Ichneumonidae)

Phaeogenes eguchii Uchida (Hym. Ichneumonidae)

Limneria alkae Ell. & Sacht (Hym. Ichneumonidae)

Pristomerus vulnerator Panzer (Hym. Ichneumonidae)

Theronia atalantae Poda (Hym. Ichneumonidae)

Trichomma cnaphalocrocis Uchida (Hym. Ichneumonidae)

Apanteles thompsoni Lyle (Hym. Braconidae)

Apanteles sp. (Hym. Braconidae)

Bracon atricornis Smith (Hym. Braconidae)

Macrocentrus abdominalis Fabricius (Hym. Braconidae)

Macrocentrus gifuensis Ashmead (Hym. Braconidae)

? Microbracon hebetor Say (Hym. Braconidae)

Geromasia senilis Mg. (Dip. Tachnidae)

Pupal stage:

Brachymeria euploeae Westwood (Hym. Chalcididae)

Brachymeria sp. (Hym. Chalcididae)

Xanthopimpla punctata Fabricius (Hym. Ichneumonidae)

Xanthopimpla stemmator Thunberg (Hym. Ichneumonidae)

References

General notes:

Vereschagin 1931

Li V Chan 1937

Kariya 1939

Biology:

Babcock 1927a, 1927b

Roubaud 1929

Kozhanchikov 1938

Biology and control:

Kuwayama 1930

Resistant varieties:

Chorine 1929

Hsu 1935

Patch 1943

Patch, Hulbert, et al 1942

Parasites:

Cartwright 1933

Clark 1934

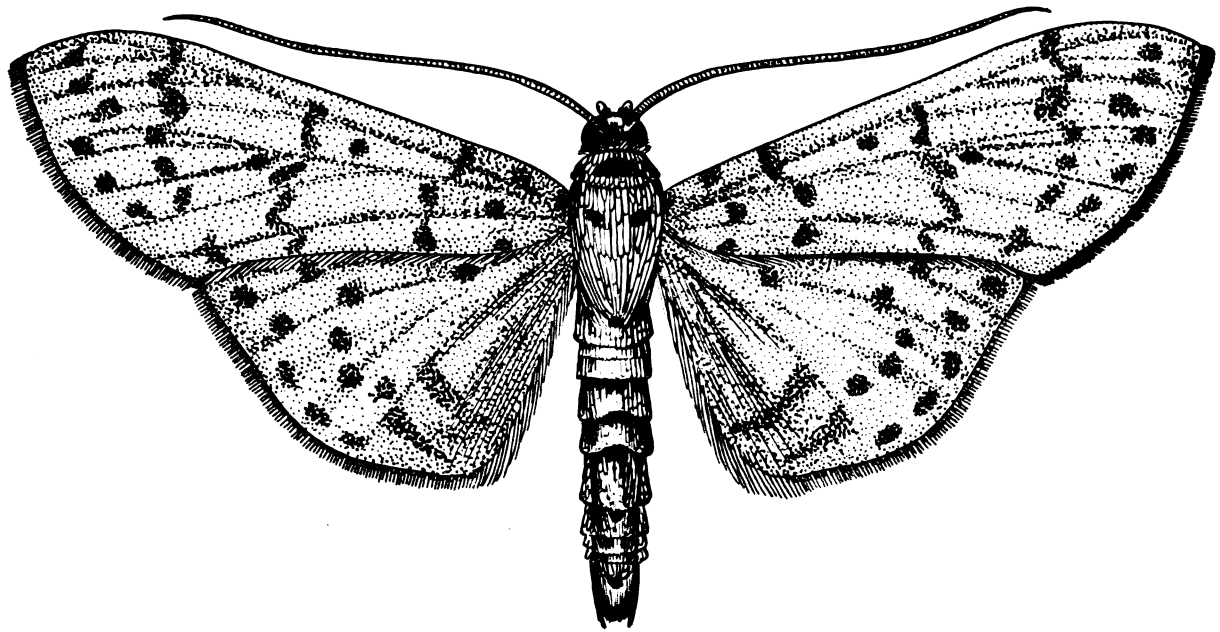
Uchida 1935

Chu 1937

Watanabe 1937

Lune 1938

Salt 1940



Dichocrocis punctiferalis Guenee
(Original)

150. Peach fruit moth, Dichocrocis punctiferalis Guenée, has a wing expansion of 2.5 to 3.0 centimeters. The foundation color of body and wings is straw yellow marked with black spots which gives a leopard-like appearance. A full-grown caterpillar is reddish-brown speckled with black warts, has both head and thoracic plate dark brown, and measures between 1.3 and 2.0 centimeters.

Distribution: This widely distributed species is found in China from Kwangtung to Manchuria, including the islands of Hainan, Formosa, and Liukiu. It is also known to occur in Korea, Japan, India, Ceylon, Burma, Malaya, Indo-China, East Indies, the Philippines, and Australia.

Affected: Peach, Citrus, pear, apple, cherry, fig, mango, persimmon, pomegranate, loquat, chestnut, numerous other plants.

Nature of Losses: This species is a general feeder, attacking a great diversity of hosts varying from herbaceous to woody plants. While a complete survey is still not available in China, it is evident that its economic work has been chiefly in fruit orchards, particularly the peach orchards. Injury is due generally to its concealed feeding habit of tunnelling stems, buds, and fruits, though in China it is only known to occur on fruits. Late varieties suffer more damage, as the density of the pest population attains the highest degree late in the season. Most of the infested fruits are rendered useless by direct attack, or indirectly by rotting diseases.

Life History: It seems to have two generations yearly, hibernating in the last instar larval stage in a silky cocoon in crevices, among rubbish, or under topsoil, and pupating the following year. Adults are liberated in spring and early summer, and again in midsummer. Eggs are deposited on fruits in clusters, each containing seven or eight, and upon hatching, the larvae mine into the fruits.

Control Measures: Control measures consist of eradicative and protective methods. The former includes the destruction of overwintering larvae and the collection of dropped fruit in which are the active larvae. The latter consists of the application of stomach insecticides, such as arsenicals, two or three times; or dusts impregnated with mineral oil of 100 viscosity by the Saybolt test, applied several times at intervals of a few days. This dust is used only as an irritant to insect, not as poison, and should not be used on steaming hot days. If arsenicals are used for stone fruits, a corrective material must be employed, for they are sensitive to arsenical injury.

References

General notes:

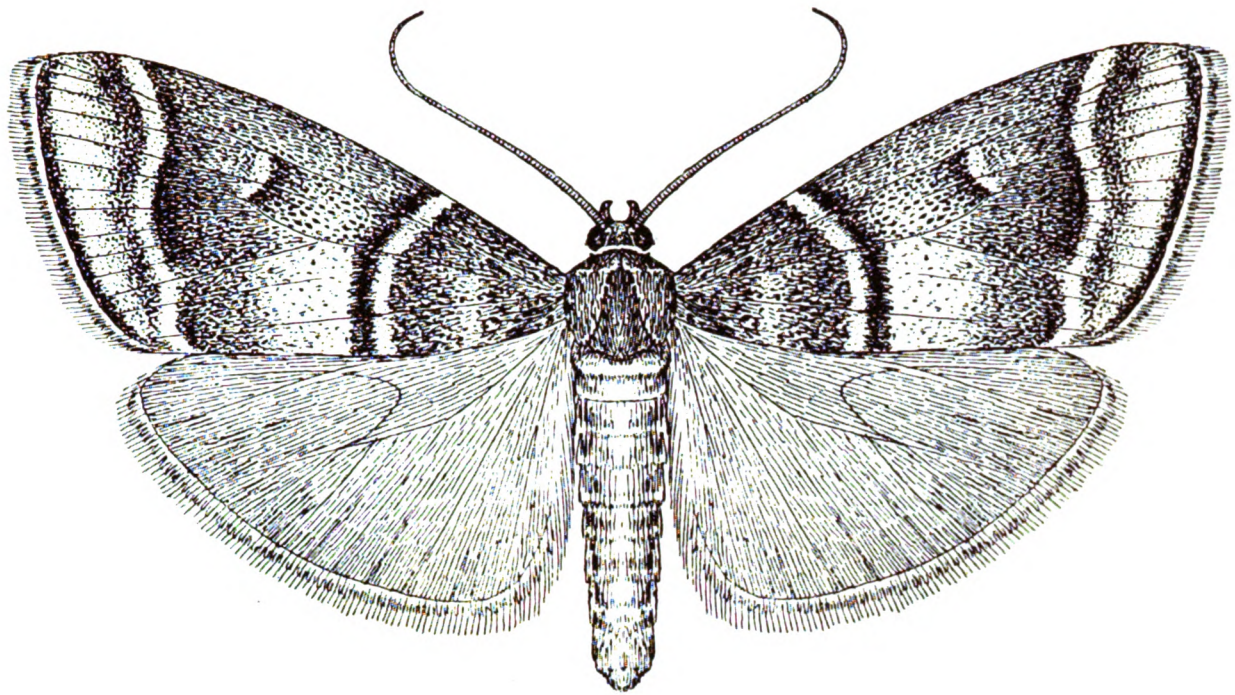
Maki 1916

Clausen 1927

Kondo & Miyakara 1930

Biology and Control;

Anonymous 1935



Nurmonia pirivorella Matsumura
(Modified Esaki, et al)

151. Pear fruit moth, Numonia pirivorella Matsumara, has a wing spread of 2.0 to 2.5 centimeters. The general coloration of the moth is grey, and the front wing has two defined, darker bands between which there is a dark condensation through the medial area, giving the effect of three bands. The mature larva is purplish-grey, head dark brown, thoracic plate yellowish-grey, and measures from 1.7 to 2.0 centimeters.

Distribution: It is widely distributed, being found in China in Szechwan, Hopeh, and Manchuria. The same species occurs in Korea, Japan, and Siberia.

Affected: Pear, peach?

Nature of Losses: It is a serious pest of pear in China as well as in Korea and Siberia. Its endemic center lies in the areas between 35° and 50° north latitude where pears are largely grown. The larva of this pest is a borer, destroying buds, fruits, and new shoots. Severe losses are inflicted on fruit crops in some years.

Life History: It has one to two generations annually; the areas south of Kirin have two and possibly there are more in the far south, but Kirin, northern Laioning, and Heilungkiang generally have only one. Hibernation takes place in the immature larval stage in buds, around mid-August, and feeding is resumed the succeeding spring. It attacks flower buds, but later drills into young fruits. Pupation takes place within the infested fruits, followed in the first part of June by the emergence of the adult, ready to oviposit eggs for a new

generation. These eggs are deposited on fruits; the larvae hatch and immediately bore into the fruits. They grow and mature with the adults of the first generation, appearing between the end of July and the first half of August. The eggs of the second generation are laid on or near the buds in August, and give rise to larvae that prepare to winter in the buds. During the growing season the egg stage covers about 7 to 14 days, larval 35 to 50, and pupal 8. In a single-brood area, the development of the old brood continues so far into the summer that there is just enough time to start a new generation before winter hibernation.

Control Measures: The prompt destruction of infested flowers and fruits will be of some aid in checking the pest, but a greater degree of control is achieved by the use of insecticides such as arsenicals. Several applications are required during the entire season: the first in the spring, about the beginning of May, just before the larvae resume their normal feeding; the second a week later; the third after the formation of the young fruit; the fourth soon after the eggs are deposited on the fruit between the first week of June and July; and the last application during the first week of August, closely following the oviposition period. A heavier dosage may be of some advantage for the first and last applications since there is less chance of producing plant injury then. For the one-brood area, the employment of all the foregoing applications except the fourh, will give

adequate protection.

References

Taxonomy:

Gerasimov 1929

General notes:

Gerasimov 1926

Clausen 1931

Biology:

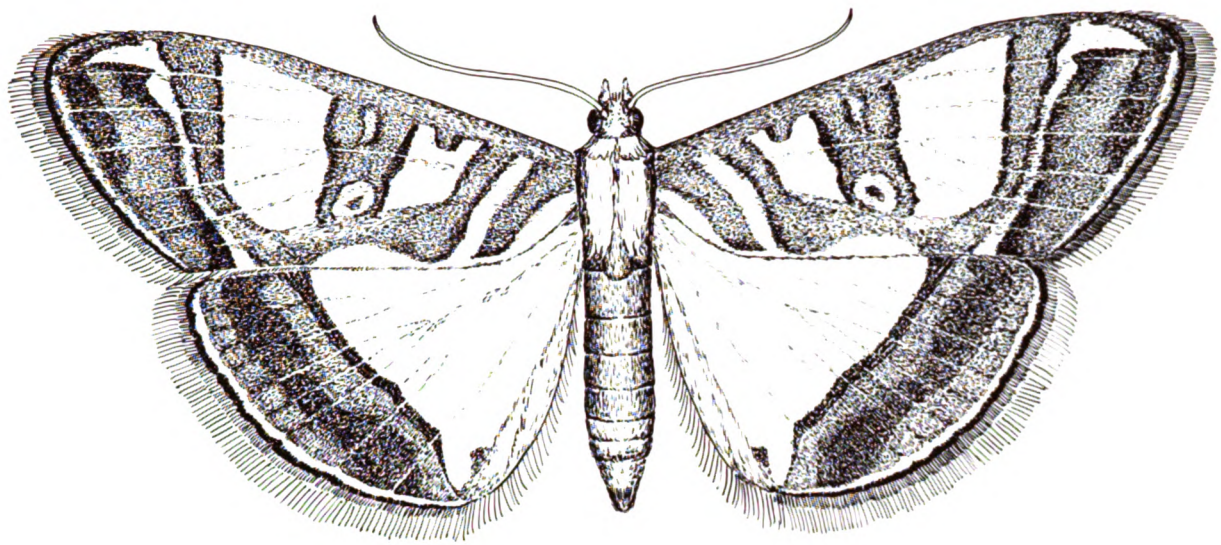
Muramatsu 1927

Kondo & Miyahara 1930

Biology and Control:

Kruilova & Mevzos 1930

Chang & Lin 1939



Glyphodes pyloadis Walker
(Original)

152. Mulberry leaf roller, Glyphodes pyloalis Walker, has a wing expanse of 2.0 to 2.4 centimeters. The central portion of the collar and thorax and the dorsal side of the abdomen are brown, but the ventral side of the body and other appendages are white. The ground color of the forewing is white mottled with three broad brownish bands which are slightly shaded with metallic sheen along the base, medial, and outer border, leaving a number of isolated white spots and stripes. The hind wing is largely white but the outer border is brown. The young larvae are greenish, at maturity somewhat pinkish, and measure between 1.5 and 2.4 centimeters.

Distribution: It is widely found in China throughout the entire section south of Hwang Ho, but is actually recorded in Kwangtung, Hainan, Fukien, Formosa, Liuliu, Szechwan, Kiangsi, Chekiang, and Kiangsu. It is also reported from Japan, India, Ceylon, Burma, Indo-China, and East Indies.

Affected: Mulberry.

Nature of Losses: Since this leaf roller is one of the major insect pests of mulberry trees in China, it causes great concern to the silk industry. The insect is known to attack leaves of the host, feeding superficially on the underside of the leaves during the first two instars, but in the later instars rolling them together to form a protective shelter in which to feed. Badly infested trees may be completely defoliated. The extent of damage varies from year to year, but generally infestation is most severe in autumn.

Life History: It produces many generations yearly, depending on the geographical locations. Formosa is credited with ten, Kwangtung and Fukien possibly have a similar number, whereas Chekiang and Kiangsu are reported to yield four regularly and sometimes five. The larva hibernates in cocoons between crevices, under rubbish piles, or in other concealed shelters. In spring, it pupates and then produces adults in the second half of May and the first half of June in Chekiang and Kiangsu, or in Formosa during the latter part of April. Each female lays a total of 200 to 500 eggs on the under surface of the leaves, either singly or in clusters of two to four or more. These eggs are often deposited on the first fourteen leaves, and more commonly between the second and the fifth. Considering its egg-laying capacity, a female may well make use of some fifty to over one hundred leaves. The larvae, after having finished six instars, become pupae and eventually transform into adults. The egg stage covers from 3 to 7 days, larval 10 to 18, pupal 5 to 12, and adult 4 to 10. A life cycle from egg to adult stage during the growing season may be completed in 20 to 25 days in Formosa, and 25 to 30 in Chekiang and Kiangsu. These figures vary from season to season according to the weather.

Control Measures: This pest can be satisfactorily controlled by eradicative measures which concentrate mainly on the destruction of hibernating larvae, but include clean cultivation, collection of infested leaves, and the utilization

of natural enemies. The overwintering larvae can be destroyed by the normal procedure through inspection of their hiding grounds on each tree, but more effectively by intentionally providing them with hibernating places in advance, then collecting and exterminating them. In carrying out the latter plan, a layer of straw is wound around the trunks in September and October in Chekiang and Kiangsu, and a month or so later in Formosa and nearby localities. The great majority of the larvae will manage to make their way into the straw, which is then collected before spring and can be either burned or properly disposed of in the parasite protected screen field house. During the first two instars, petroleum extract pyrethrum emulsion spray has been proved to be effective in combating this insect.

Natural Enemies:

Larval stage:

Apanteles helerusiae Wilkinson (Hym. Braconidae)

Cedria paradoxa Wilkinson (Hym. Braconidae)

Chelonus pectinophorae Cushmen (Hym. Braconidae)

Macrocentrus abdominalis Fabricius (Hym. Braconidae)

Macrocentrus philippinensis Ashmead (Hym. Braconidae)

Phanerotoma planifrons Nees (Hym. Braconidae)

Epiurus nankingensis Uchida (Hym. Ichneumonidae)

Meteorus japonicus Ashmead (Hym. Ichneumonidae)

Xanthopimpla punctatus Fabricius (Hym. Ichneumonidae)

a dipterous fly

a nematode

Pupal stage:

Two species (Hym. Braconidae)

Eight species (Hym. Chalcidae)

Three species (Hym. Ichneumonidae)

References

General note:

Chu, Chin, et al 1935

Biology:

Tsiang 1933, 1934

Biology and Control:

Maki 1916

Chen 1933

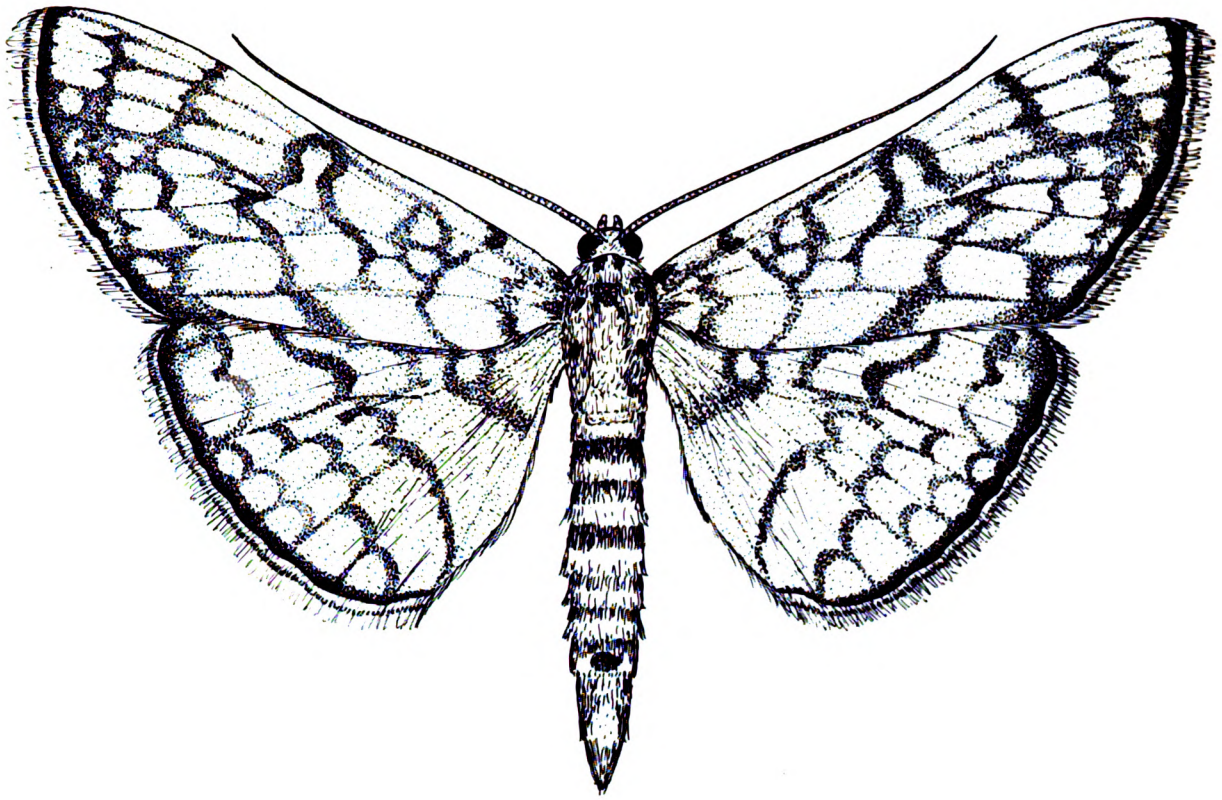
Parasites:

Chu 1934, 1936

Rohwer 1934

Uchida 1934

Watanabe 1937, 1939, 1940



Sylepta derogata Fabricius
(Original)

153. Cotton leaf roller, Sylepta derogata Fabricius, has a wing spread of 2.5 to 3.0 centimeters. Basically, it is yellowish-white, the body being marked with brownish spots and bands and the wings mottled by a complicated brownish network. A fully mature larva is pink or green shaded with pinkish color, and attains a length of approximately 2.5 centimeters.

Distribution: This widely distributed pest is found all over China, including the islands of Hainan, Formosa, and Liukiu. Its occurrence has also been reported from Korea, Japan, Siberia, India, Ceylon, Burma, Malaya, Indo-China, East Indies, Philippines, Fiji, Hawaii, and Africa.

Affected: Cotton, cotton tree, Hibiscus syriacus, H. mutabilis, Malva sylvestris, Sterculia platanifolia, Ochroma pyramidale.

Nature of Losses: It is primarily a pest of the members of the family Malvaceae of which cotton is a preferential host. American and late varieties of cotton are most susceptible to its inroads. It attacks leaves in the main but sometimes injures young shoots and blossoms as well. Plants are often completely defoliated by this destructive creature. More than 500 larvae were collected from a plant. Its home in China is apparently located in areas falling between 25° and 40° north latitude, especially along the basins of the lower Yangtze Kiang and Hwang Ho. Heavy outbreaks were reported in 1930 and 1935 in Kiangsu where it had destroyed a large per cent of the crop.

Life History: Two to six generations are produced yearly in China, for Formosa has six, Kiangsu four, and the coastal provinces of Po Hai possibly two to three. It winters during the larval stage, following which the adults appear about the middle of April in Formosa and the first part of May in Kiangsu. Each female lays from 70 to 200 eggs on the underside of the leaves. The larvae, on emerging from the eggs, undergo five instars of development to acquire maturity. The egg, larval, and pupal stages range from 3 to 5, 16 to 24, and 6 to 9 days respectively, under growing season conditions. A life cycle from egg to adult may be completed in about thirty days.

Control Measures: Destroying the over-wintering larvae by burning plant refuse is recommended. This step is of paramount importance, for it will eliminate the primary source of a new infestation. During the growing season, other operations are helpful, such as the use of arsenical insecticides, the collection of rolled leaves, and light traps.

Many parasites have been observed on this pest, and a large number may be bred from a single larva. Since there are differences in resistance exhibited between varieties of cotton, it is possible to escape a certain per cent of the usual damage by selecting early and resistant varieties.

Natural enemies:

Larval stage:

Apanteles opacus Ashmead (Hym. Ichneumonidae)

Meteorus japonicus Ashmead (Hym. Ichneumonidae)

Larval stage: (continued)

Six undetermined hymenopterous flies

Two undetermined dipterous flies

Euborellia pollipes Shiraki (Derm. Forficulidae)

Pupal stage:

Epiurus persimilis Ashmead (Hym. Ichneumonidae)

Xanthopimpla punctata Fabricius (Hym. Ichneumonidae)

References

General Notes:

Woo and Hsu 1935

Li and Chou 1937

Shiraki 1937

Mitono 1940

Biology:

Shiraki 1911

Biology and Control:

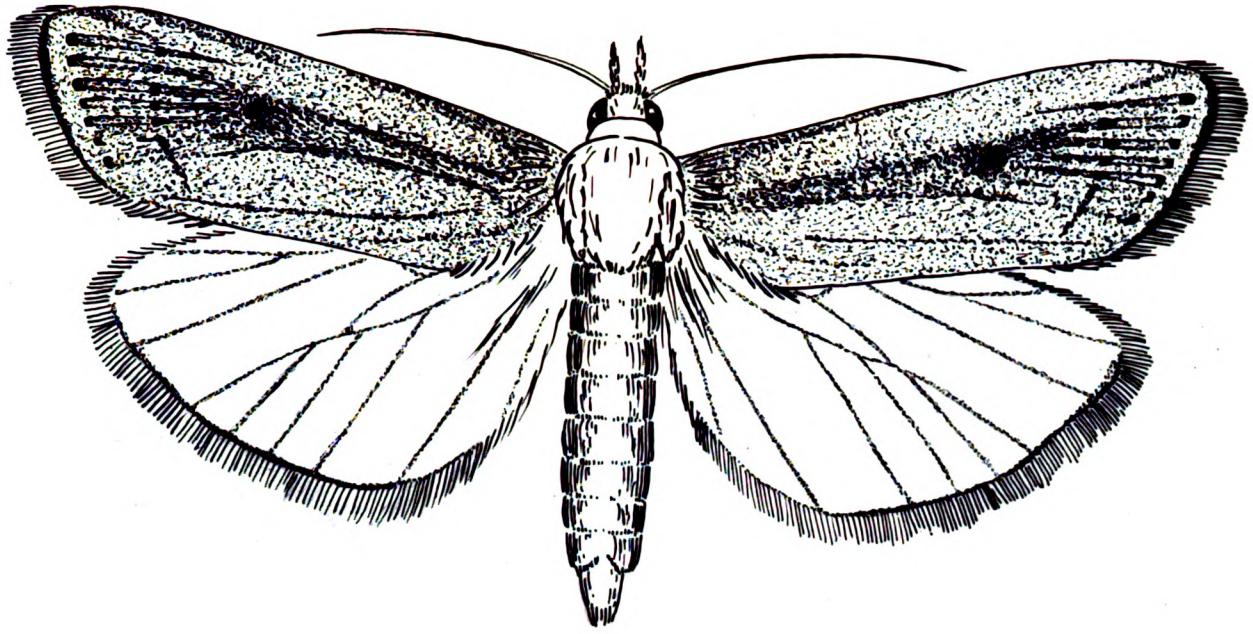
Li 1935

Control:

Fukuda 1937

Parasites:

Uchida 1935



Chilo infuscatellus Snellen
(Original)

154. Yellow sugar cane borer, Chilo infuscatellus Snellen has a wing spread of 2.0 to 3.0 centimeters. It is similar in appearance to Chilo simplex, but differs in having the forewing dark brown, the male provided with a prominent streak along the cell, and a slanting line located near the outer border, whereas the other species has a series of spots much closer to the cell or no transverse marking. A mature larva is yellowish-brown, decorated with five longitudinal rosy bands, and measures from 2.0 to 3.0 centimeters.

Distribution: Its occurrence in China presumably extends over the entire area south of Yangtze Kiang, although only Formosa has recorded it. It is also found in East Indies.

Affected: Sugar cane, rice.

Nature of Losses: This is essentially a pest of sugar cane, and its destruction has been confined almost entirely to young plants one to two feet high. The entrance of the borer is made through the leaf-sheath into the stem, destroying the growing point, and resulting in the common symptom of dead heart. Because of the migratory behavior of the larvae, a single individual may affect other plants within a distance of five or six feet.

Life History: Five generations are produced annually in Formosa, and other nearby provinces possibly have a similar figure. It winters as a caterpillar in the stem of the host, and in the spring pupates in the tunnel. In Formosa, the adults of the over-wintering generation are liberated between

the latter part of January and the middle of February, but the first of the new generations comes out in March and April, the second from May to June, the third from July to August, and the last from September to November. A female deposits some 250 yellowish eggs in batches, each containing thirty to fifty eggs which are arranged in three to five rows on the leaves. The egg, larval, and pupal stages cover 8, 35 to 50, and 8 days respectively.

Control Measures: Same as for the sugar cane Eucosma.

Natural Enemies:

Egg stage:

Trichogramma australicum Girault (Hym. Chalcididae)

Trichogramma nana Zehntner (Hym. Chalcididae)

Phanurus beneficiens Zehntner (Hym. Scelionidae)

Larval stage:

Apanteles flavipes Cameron (Hym. Braconidae)

Microbracon chinensis Szepligeti (Hym. Braconidae)

Stenobracon maculata Matsumura (Hym. Braconidae)

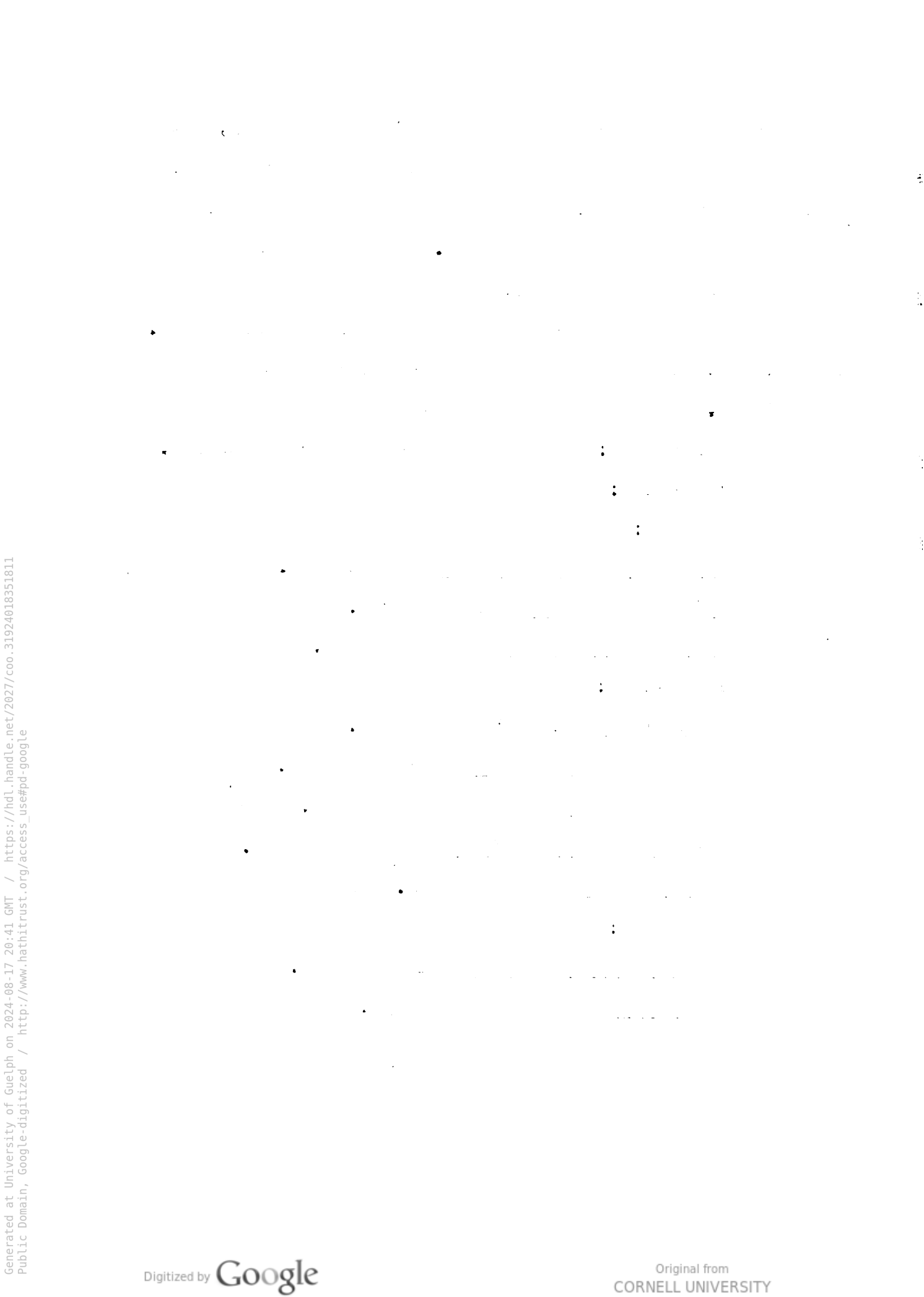
Stenobracon trifasciatus Szepligeti (Hym. Braconidae)

Angitia lineata Ishida (Hym. Ichneumonidae)

Pupal stage:

Xanthopimpla stemmator Thunberg (Hym. Chalcididae)

Gambrus rufithorax Uchida (Hym. Ichneumonidae)



References

General Notes:

Ishida 1923

Hadden 1928

Biology:

Dammerman 1929

Matsumura 1932

Takahashi, H. 1938, 1939

Control:

Takahashi, S. 1938c

Parasites:

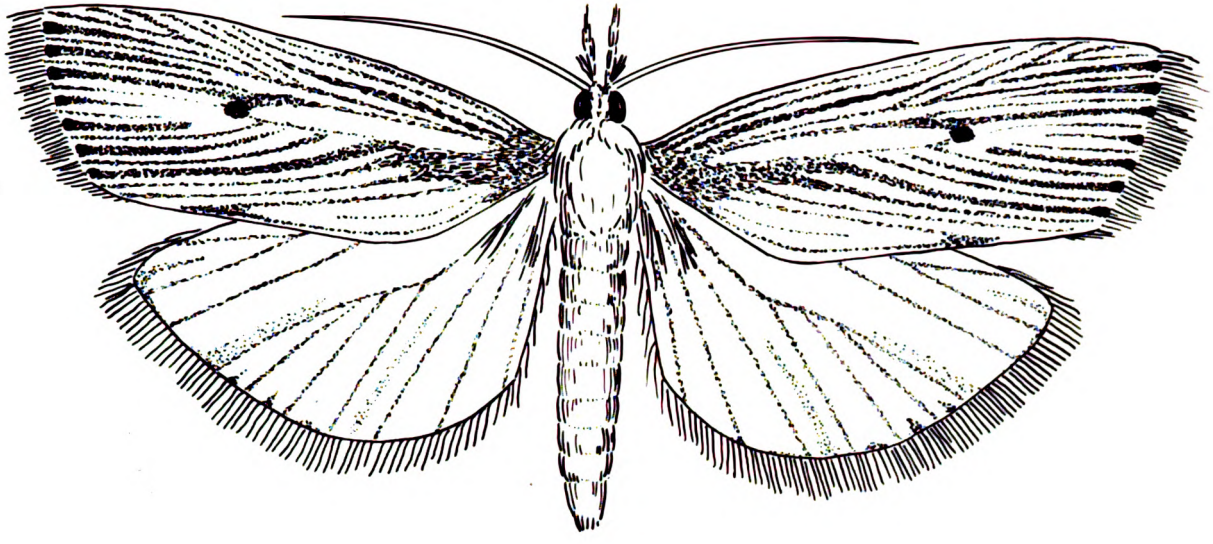
Sonan 1929

Matsumura 1930

Uchida 1931

Takano 1934

Takahashi 1939



Diatraea venosata Walker
(Original)

155. Striped sugar cane borer, Diatraea venosata Walker, has a wing expanse of 3.0 to 4.0 centimeters. The male is of a light greyish-brown color while the female is paler. Both have their front wings marked with numerous pale brown streaks along and between the veins and two spots on the outer portion of the cell. The hind wings are uniformly greyish-brown or greyish-white tinged with yellow. Structurally, this species differs from the two brooded paddy borer in the absence of an ocellus. A fully mature caterpillar is yellowish-brown characterized by four purplish or reddish longitudinal stripes, the head and thoracic plate are brown, the body provided with many dark tubercles, and it measures from 3.5 to 4.0 centimeters.

Distribution: In China, it has been recorded in Kwangtung, and Formosa, and is also found in India and East Indies.

Affected: Sugar cane, rice, and possibly other close allies.

Nature of Losses: This is one of the major insects of sugar cane plantations in Formosa as well as in India and East Indies. The general nature of injury is the same as that of the previous species except that it occurs more frequently on canes two to three feet in height. Dead heart is found most often in plants with a minimum length of two feet. In Formosa, about 75 per cent of the sugar cane plants were infested with this worm during the year 1934. Windbreakage appears to be a common sign of infestation among older plants.

Life History: There are four or five generations a year

in Formosa, and presumably a similar number in nearby provinces. Hibernation occurs principally in the larval stage, followed by pupation in the succeeding spring. The general life cycle and habitat of this insect are probably identical with those of the yellow sugar cane borer.

Control Measures: The same methods as recommended for the sugar cane Eucosma.

Natural Enemies:

Egg stage:

Trichogramma australicum Girault (Hym. Chalcididae)

Phanurus beneficiens Zehntner (Hym. Scelionidae)

Larval stage:

Apanteles flavipes Cameron (Hym. Braconidae)

Angitia lineata Ishida (Hym. Ichneumonidae)

Cremastus biguttulus Mumakata (Hym. Ichneumonidae)

Mesostenus longicornis Ishida (Hym. Ichneumonidae)

Pupal stage:

Xanthopimpla stemmator Thunberg (Hym. Chalcididae)

Gambrus rufithorax Uchida (Hym. Ichneumonidae)

References

General Notes:

Hadden 1928

Matsumura 1930

Chan 1936

Biology:

Takahashi, H. 1938, 1939

Control:

Subramniam and Ramiah 1935

Parasites:

Ishida 1927

Uchida 1931

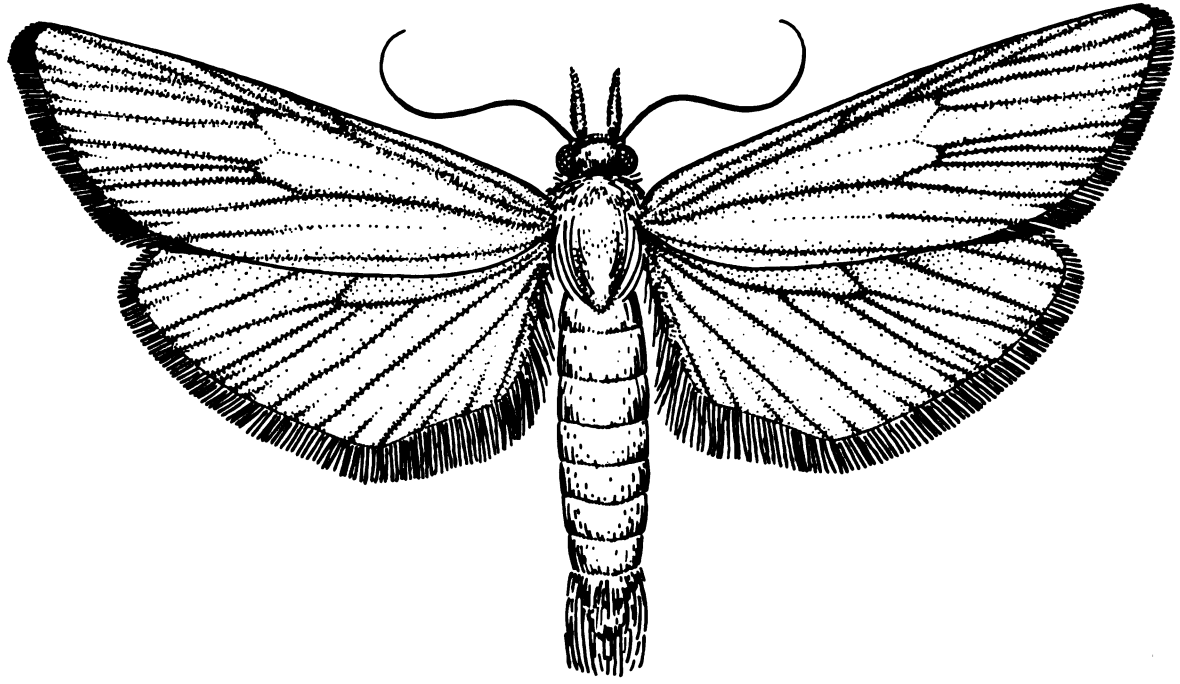
Takano 1934

Takahashi 1939

Resistant Varieties:

Takano and Ijima 1935

Thuljaram Rao 1941



Scirpophaga auriflua Zeller
(Original)

156. White sugar cane borer, Scirpophaga auriflua Zeller, has a wing spread of about 2.8 to 3.0 centimeters for the male and 2.4 to 5.0 for the female. Both sexes are pure white, their abdomen yellowish dorsally, but the anal tuft of the female is orange brown, or bright red as in var. intacta Snellen. A mature caterpillar is creamy white, head and thoracic plate yellow, and attains a length of 2.5 to 4.5 centimeters.

Distribution: It occurs widely over the Oriental Region, including China, India, Ceylon, Malaya, East Indies, and Philippines. However, its occurrence in China has been recorded only in Kwangtung, Formosa, Liukiu, Chekiang, and Kiangsu.

Affected: Sugar cane.

Nature of Losses: It is one of the more important pests of sugar cane in China, India, and the East Indies as well. Like the two aforementioned species, it destroys canes by boring through the leaf-sheaths, and the affected plants average some fifteen inches shorter than healthy ones. Heavy outbreaks were reported in Formosa during the years 1920 to 1923, and again in Kwangtung in 1936. In one instance, some 66 per cent of the plants suffered from the inroads of this borer.

Life History: Four or five generations are produced in Kwangtung, Formosa, and Liukiu, and possibly three or four in areas farther north. The winter is passed in the larval stage followed by pupation the next spring, though all stages are present the year round in southern Formosa. Eggs are deposited

on the underside of the leaves in clusters, hatching in about seven days. Larval life occupies some thirty days. Pupation commences at the upper ends of the tunnels and concludes in about seven days.

Control Measures: Recommendations for the sugar cane Eucosma are generally suggested for the control of this insect. The egg parasite Phanurus beneficiens is a powerful destroyer, killing up to 70 per cent of the first generation. Proper measures should be taken to encourage such a natural agent to check the growing pressure of the host population. Efforts should also be made to select resistant varieties of cane.

Natural Enemies:

Egg stage:

Phanurus beneficiens Zehntner (Hym. Scelionidae)

Larval stage:

Stenobracon maculata Matsumura (Hym. Braconidae)

Stenobracon trifasciatus Szepligeti (Hym. Braconidae)

Elasmus sp. (Hym. Chalcididae)

Cremastus biguttulus Mumakata (Hym. Ichneumonidae)

Mesostenus longicornis Ishida (Hym. Ichneumonidae)

A fungus

Pupal stage:

Xanthopimpla stemmator Thunberg (Hym. Chalcididae)

References

General Notes:

Chan 1936

Yashiro 1940

Biology and Control:

Ishida and Moritsugu 1926

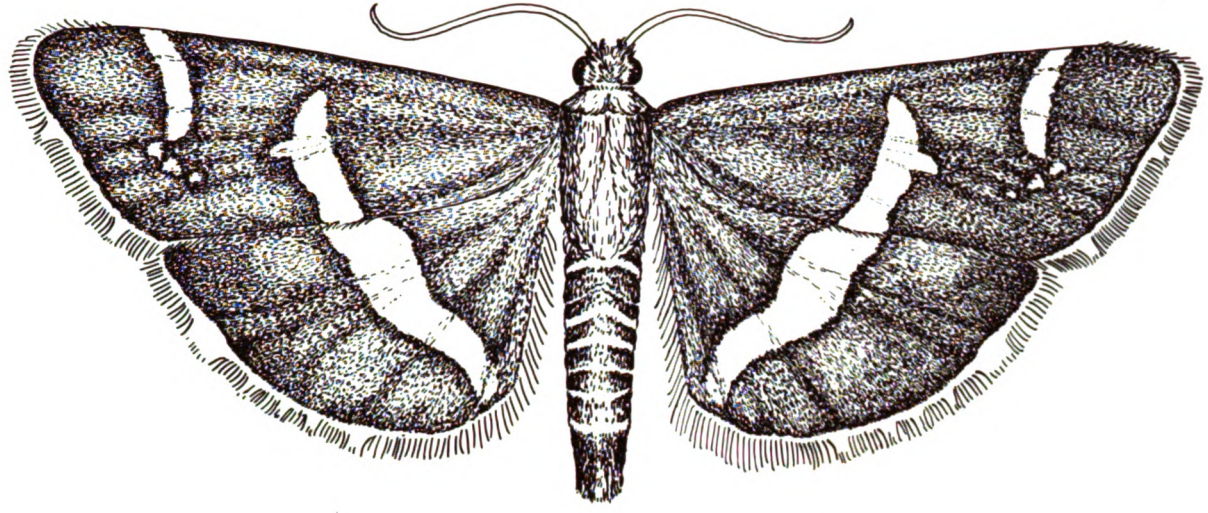
Moritsugu 1931

Parasites:

Ishida 1927

Sonan 1929

Takano 1934



Zinckenia fascialis Cramer
(Original)

157. Sugar beet moth, Zinckenia fascialis Cramer, has a wing spread from 1.8 to 2.5 centimeters. It is a chocolate brown moth, the forewing of which is marked with two white bands with three white spots adjacent to the end of one band on the outer border. The hind wing has a white transverse band running across its center, and the edge of each of the abdominal segments has a small white band. Young caterpillars are greenish, becoming reddish at maturity, at which time they measure approximately 2.0 centimeters.

Distribution: Presumably it is found all over China including her island possessions, but records have thus far confirmed its occurrence only in Kwangtung, Hainan, Formosa, Liukiu, Szechwan, Chekiang, Shantung, Kiangsu, and Jehol. It is also reported from Korea, Japan, India, Indo-China, East Indies, Australia, Polynesia, Hawaii, Africa, and America.

Affected: Beet, mangel, chard, corn, millet, Amaranthus.

Nature of Losses: It is more or less a general feeder, but it prefers beet and chard. A considerable amount of damage is inflicted on sugar beet plantations in Shantung, and also to an important degree in Korea and Japan. During the larval stage, it attacks the underside of the foliage and later skeletonizes the entire leaf, leaving only the veins. Infested leaves may be partially rolled.

Life History: Kwangtung and Formosa in the south possibly have four or five generations annually, whereas Shantung is credited with two or three. Hibernation takes place in the

pupal form underground, followed by the emergence of the adults in spring in the south, and in summer in the north. Eggs are deposited singly on the under surface of the leaves along the veins, some 300 having been laid by a female in one season. During the growing season, the egg stage covers about seven days, larval 7 to 21, and pupal 7 to 14. A life cycle may be completed in from 20 to 40 days.

Control Measures: Destroying the over-wintering stage is of great importance in control and may be accomplished by winter plowing. During the active larval period, spraying or dusting of arsenicals, pyrethrum, pa tou, or Celastrus angulatus preparations are recommended.

References

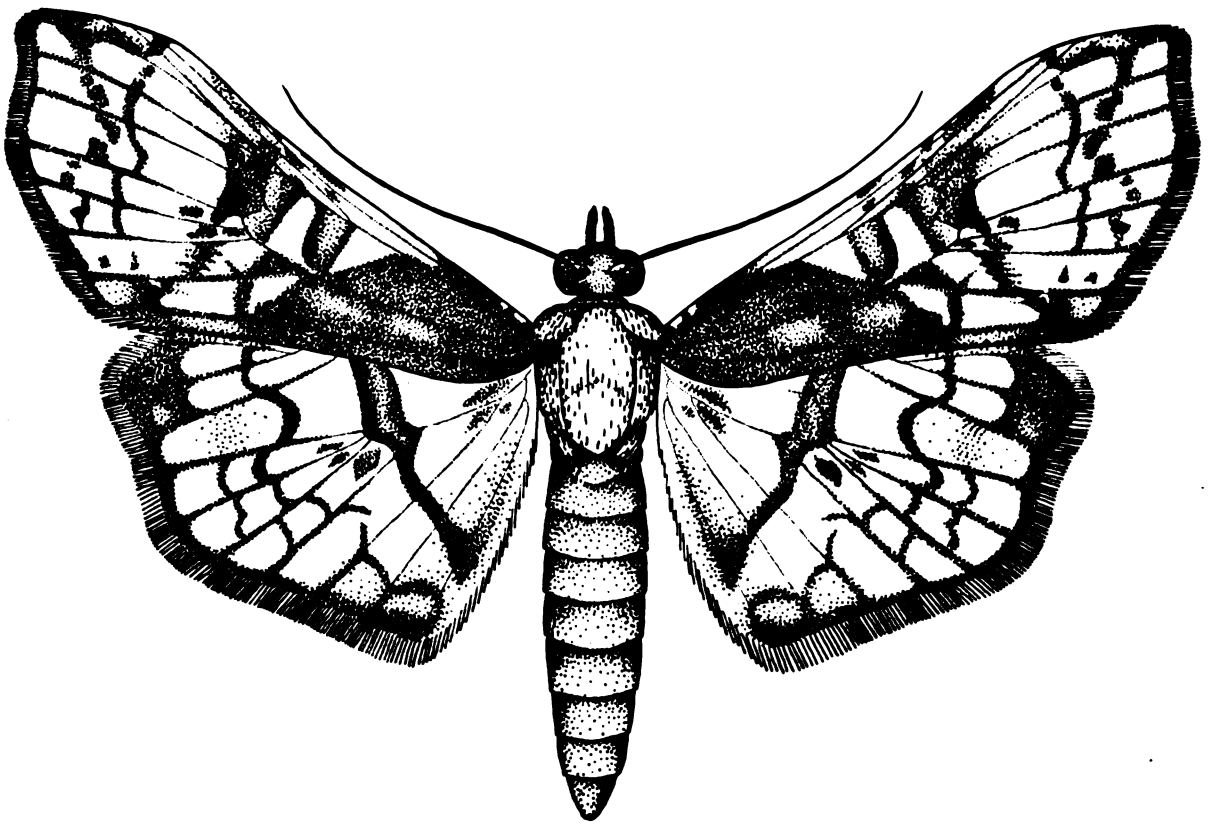
Biology and Control:

Anonymous 1938

Kuwayama, Kuribayashi and Oshima 1925

Eguchi 1926

Woo and Tsui 1937



Omphisa anatomosalis Guenee
(Original)

158. Sweet potato stem borer, Omphisa anatomosalis Guenee, has a wing spread of 2.5 to 3.7 centimeters. There are irregular brown wavy lines on the wings, the front one of which is basally suffused by a large brown blotch extending over the greater part of the cell whereas the hind wing has a dark transverse bar or double line at the end of the cell, and also has its apical angle darkened. A mature caterpillar is purplish-yellow, head reddish-brown, thoracic plate dark, body spotted, and measures from 2.5 to 3.0 centimeters.

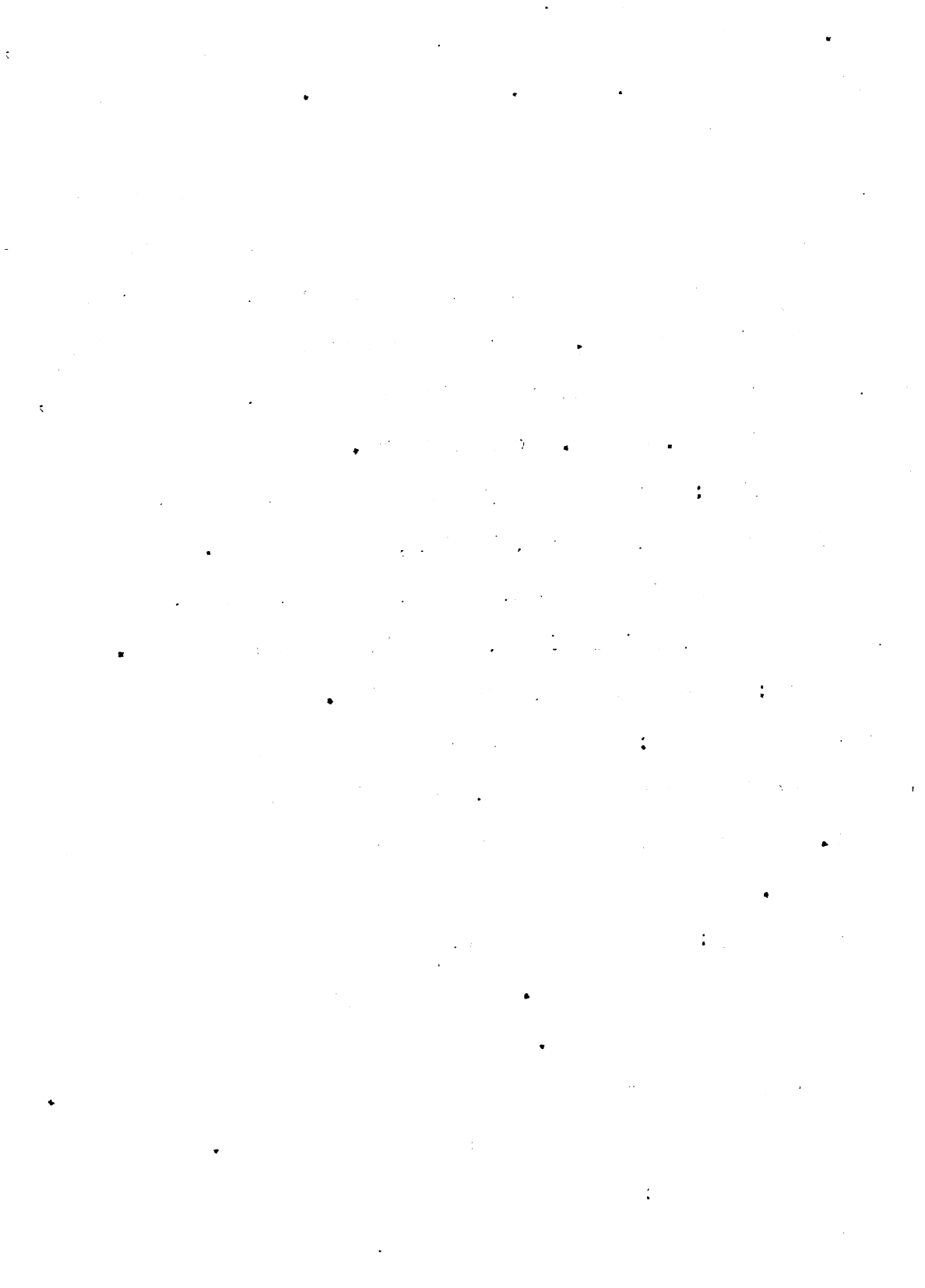
Distribution: It is widely found in South China, being reported in Kwangtung, Hainan, Fukien, and Formosa. The same species is reported from Japan, India, Ceylon, Burma, Indo-China, East Indies, Philippines, Hawaii, and West Indies.

Affected: Sweet potato, other allies.

Nature of Losses: Destruction is caused by the tunnelling of the larvae in stems and roots, retarding the development of the plant. In badly infested plants the economic value of the roots is lost.

Life History: Little is known concerning the biology and habits of this borer in China. Eggs are deposited singly on the leaves and leaf petioles. Upon hatching, caterpillars bore into the stem, then into the roots through petioles and nodes. Pupation occurs inside the burrows where they feed.

Control Measures: Control is largely effected by the elimination of the over-wintering stage, which possibly takes place either as larva or pupa in roots that have been harvested

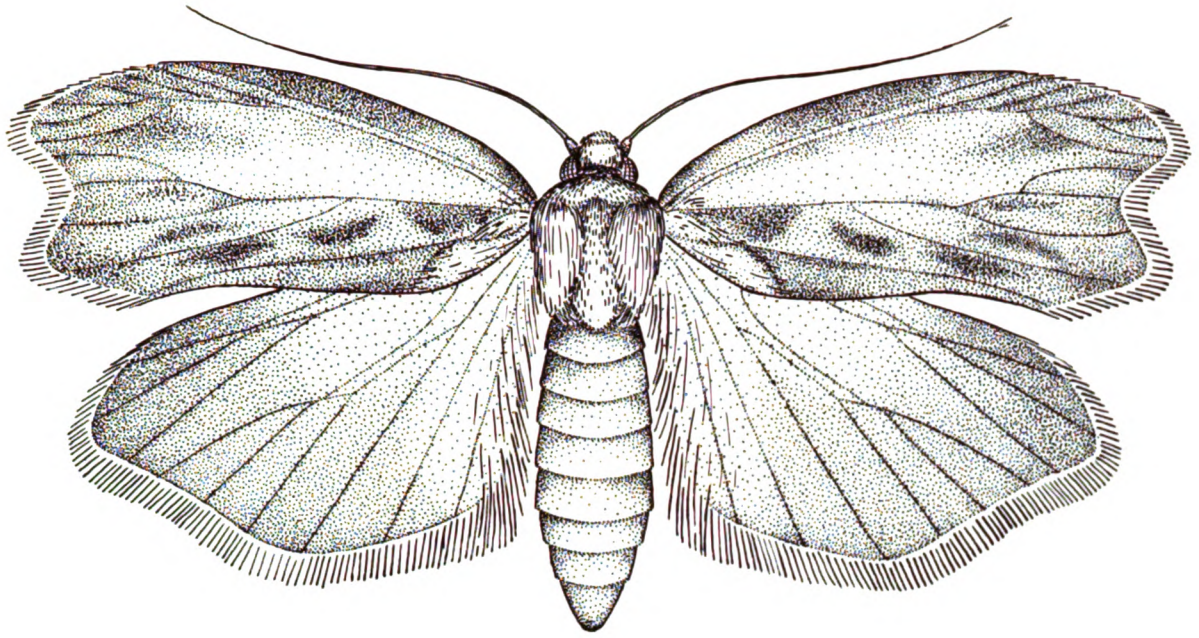


and stored or those left over in the fields. It is suggested that the roots left over the winter in open fields be dug up as soon as new runners appear. Some reduction of the infestation may be obtained by keeping the stored tubers under screens to prevent the moths from escaping during the spring season. Crop rotation is also a useful aid to control.

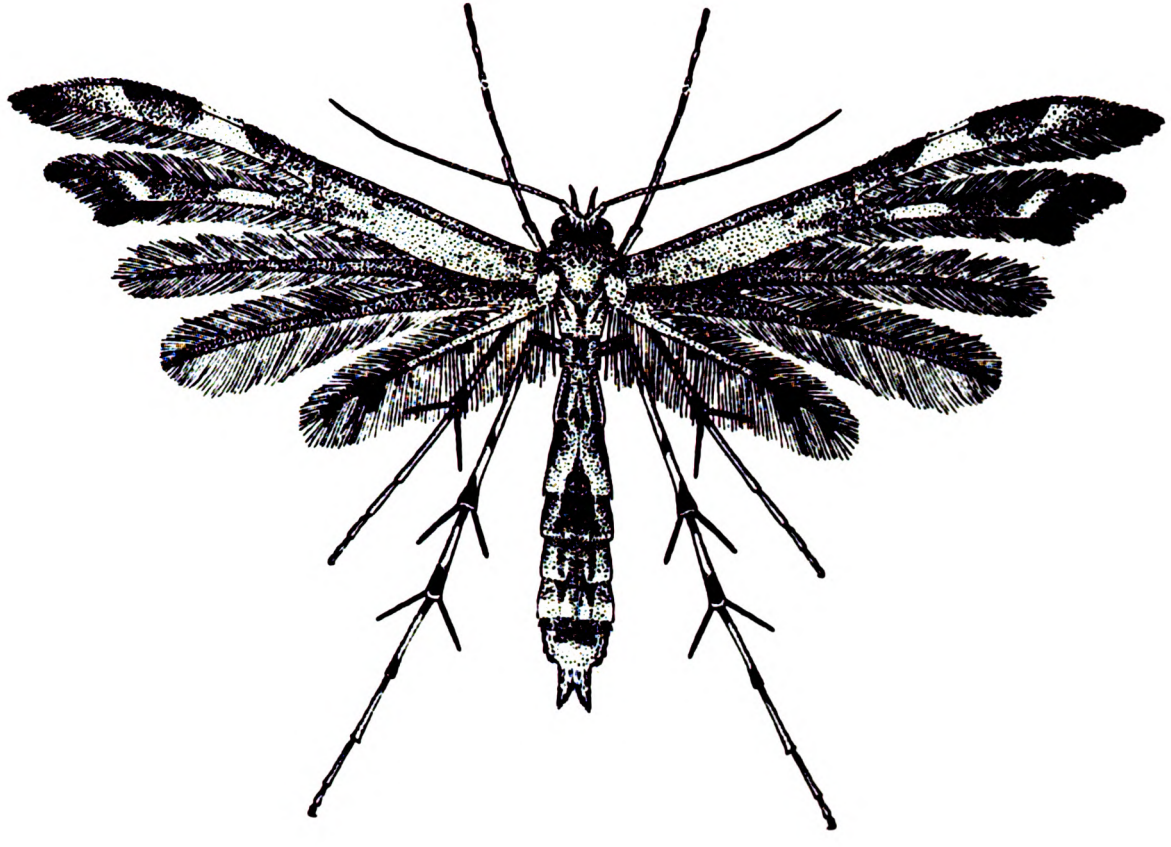
Reference

General Note:

Shiraki 1917



Galleria mellonella Linne
(Original)



Sphenaches caffer Zeller
(Modified Esaki, et al)

159. Wax moth, Galleria mellonella Linne, has a wing expanse of 2.0 to 4.0 centimeters. The basic color of the moth is a greasy, greyish-brown. The forewing is dark brown shaded with black blotches and irregular dashes along the costal and anal areas; while the hind wing is light brown, darkening towards the margin. An obvious sexual characteristic of the male consists in a deep arch at the outer margin of the front wing. A fully grown larva is dirty grey, head reddish brown with a V-shaped mark on the top, thoracic plate brown, and measures about 2.0 to 2.5 centimeters.

Distribution: It is found possibly all over China except in regions of high altitude. However, present records show it only in Kwangtung, Chekiang, Kiangsu, Hopeh, and Manchuria. Its occurrence has also been reported from Japan, India, Ceylon, East Indies, Australia, New Zealand, Hawaii, Asia Minor, Europe, Africa, West Indies, and America.

Affected: Beeswax, skins, and the allied material.

Nature of Losses: It is a primary pest of beeswax, feeding on wax and pollen in the bee hives. Attack is often made on colonies that have been previously weakened by other agents such as disease, starvation, mechanical damage, poor queens, or predators. Some damage is done in the hives where it destroys combs. Appreciable differences of resistance have been observed among various races of bees. Paddock (1926) stated that the indica bee is ravaged in China as well as in India and East Indies, but the italica bee is more or less free from the pest

due to its vigorousness. Infested hives are more prone to produce the phenomenon of swarming which is not a desirable feature of commercial beekeeping.

Life History: No information is available in China regarding the biology of this insect, but there are probably at least two or three generations a year. Under artificial conditions, a generation may be completed in about five or six weeks, and perhaps eight or ten in open fields. A female is capable of laying some 500 to over 1,800 eggs which are deposited on the combs or in cracks of the beehives that are exposed from outside. Upon hatching, the caterpillars bore their way through honey combs, and pupate around the rims of the hives at maturity. The larval stage usually covers eight instars, sometimes more, the number varying according to environmental conditions.[1]

Control Measures: Preventive measures are of great importance in controlling the wax moth in fields. Close attention should be given to checking the beehives and the health conditions of the bees so as to eliminate all factors contributing to the association of the pest.[2] Infested combs must be promptly removed and fumigated with carbon disulphide before transferring or storing. A smaller entrance to the beehive reduces the infestation to some degree.

References

General Note:

Paddock 1926

Biology:

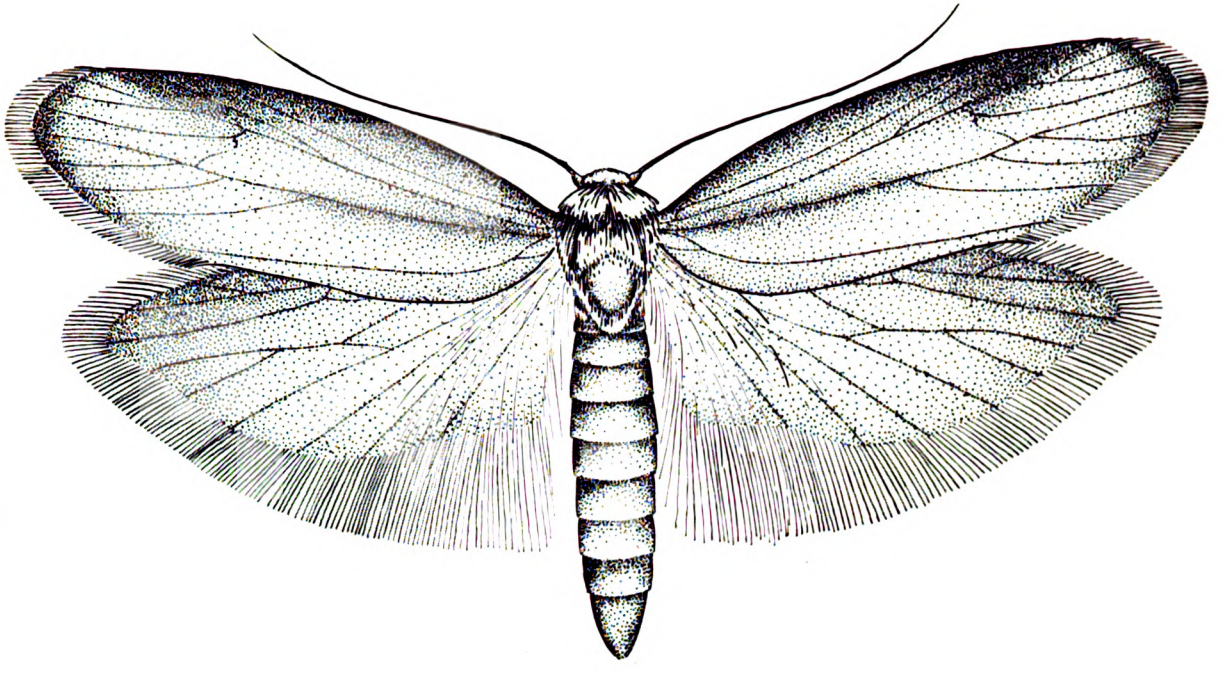
Borchert	1933, 1935
Vohringer	1934

Biology and Control:

Paddock	1918, 1933

Control:

Paddock	1928



Achroia grisella Fabricius
(Original)

160. Lesser wax moth, Achroia grisella Fabricius, has a wing expansion of 1.8 to 2.0 centimeters. It is uniformly greyish brown, the front wing is slightly darker along the lower edge of the cell and costal area, and the head is yellow. A fully grown larva is creamy white, head yellowish brown, thoracic plate dull yellow, and measures about 1.5 to 1.8 centimeters.

Distribution: The geographical range of this insect in China is assumed to be similar to that of the preceding one, but is only recorded in Kwangtung, Formosa, and Kiangsu. The same species is also reported from Korea, Japan, India, Australia, Europe, North America.

Affected: Beeswax, stored grains, dried fruits.

Nature of Losses: The general nature of losses is identical with that of the wax moth. However, destruction is less severe.

Life History: Similar to that of wax moth.

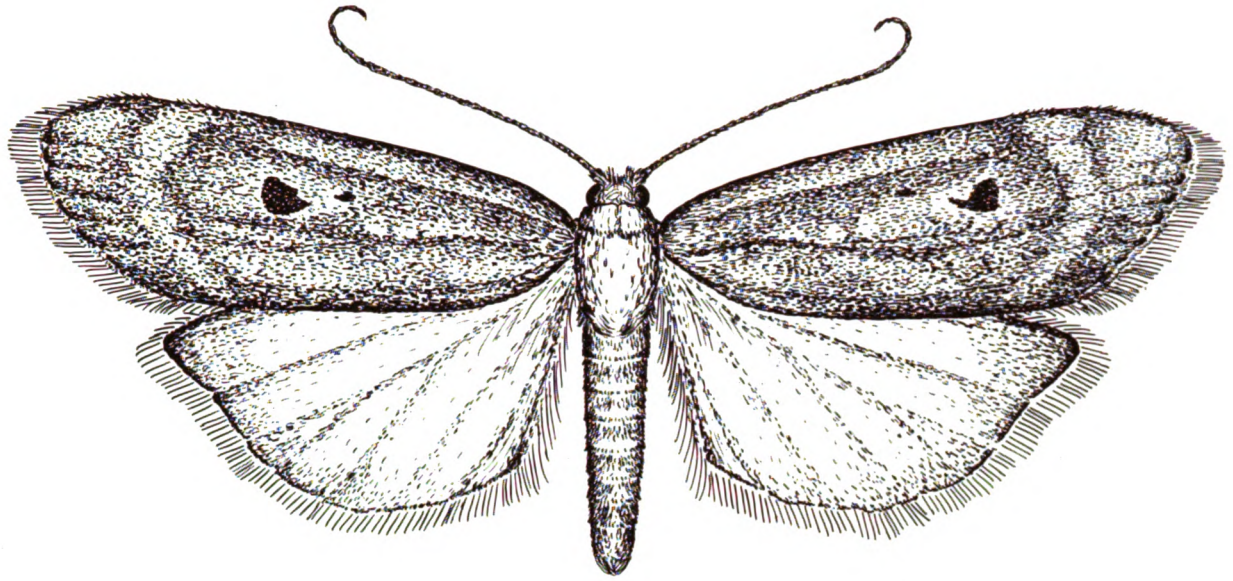
Control Measures: Same recommendations as for wax moth.

References

Biology:

Shiraki 1913

Hayes 1936



Paralipsa gularis Zeller
(Original)

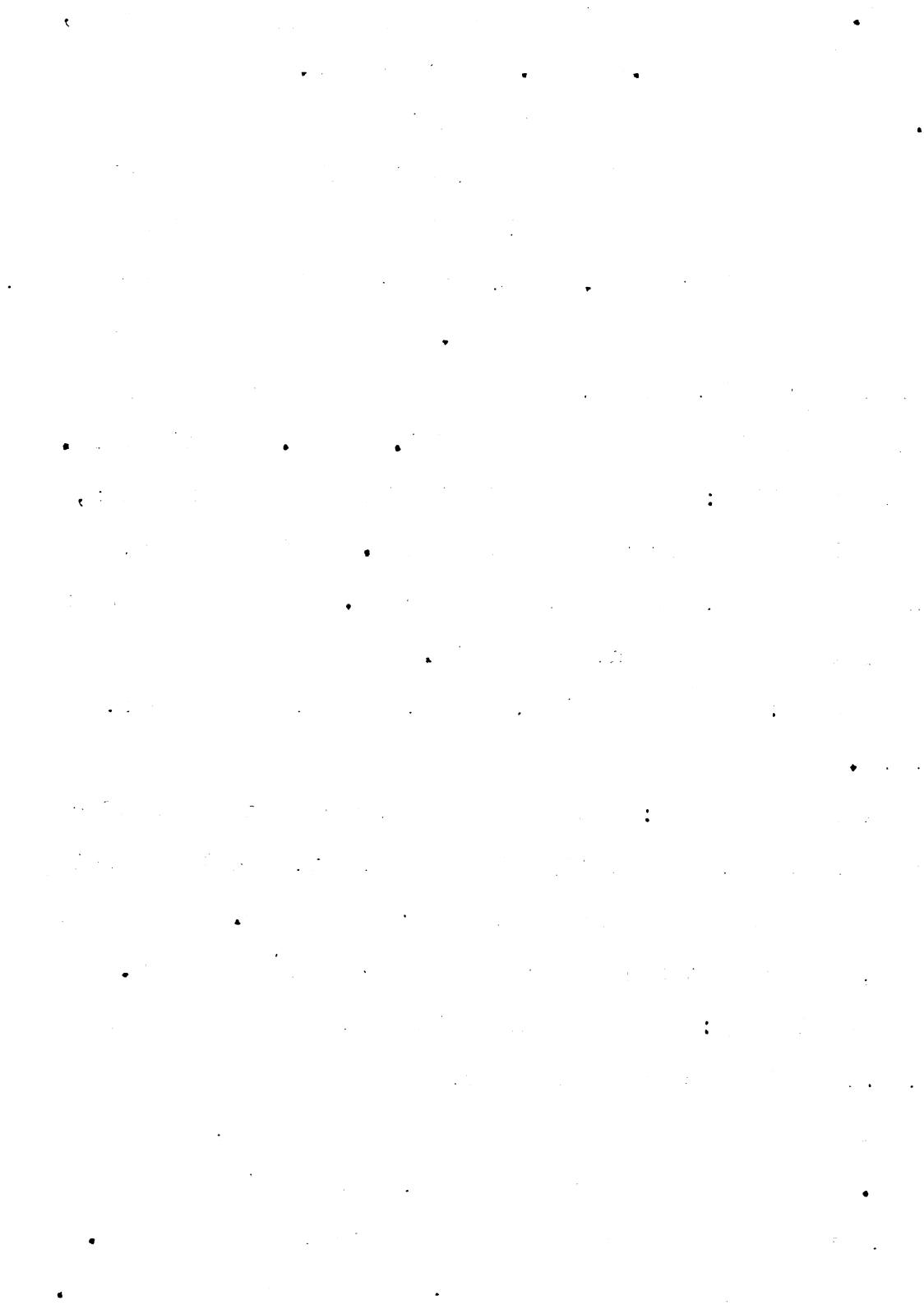
161. One dotted grain moth, Paralipsa gularis Zeller, has a wing spread of 2.5 to 3.0 centimeters. It is brownish-grey. The front wing of the female is dark with a prominent black spot at the end of the cell, while that of the male has a zigzag light brown mark on the cell and a small black dot located by its distal end. Both of their hind wings are paler, but darker toward the outer border. The fully mature caterpillar is yellowish green, head and thoracic plate greyish brown; and attains a measurement of 1.8 to 2.1 centimeters.

Distribution: Presumably it is found all over China, although it has been actually recorded only in Formosa, Szechwan, Kiangsi, Chekiang, and Kiangsu. It is also known to occur in Korea, Japan, and India.

Affected: Stored grains, flour, seeds, old papers, clothing.

Nature of Losses: It is one of the common pests of stored cereals in China, especially rice and wheat, one larva being capable of destroying more than 20 or 30 grains. In unheated storage, it is most injurious during the summer season.

Life History: Usually there is only one generation a year, which winters as mature larvae in cocoons suspended from posts or the ceiling of the storage room in long, felt-like strands. Pupation follows in spring, giving rise between April and June to adults which lay eggs for the new generation. The second generation adults appear between July and September.



The egg-laying capacity of the female varies from 200 to 500 eggs. Newly hatched larvae feed on decaying insects and eggs of their own kind, but later attack cereals in clumps. They undergo eight instars to acquire maturity. During the active season, the egg stage takes 3 to 12 days, larval 50 to 60, and pupal 25 to 35.

Control Measures: In addition to those measures recommended for the rice weevil, efforts should be made to eliminate the hibernating stage before the emergence of adults in the spring. If such a step is accomplished effectively, it would not be difficult to check the insect.

References

General Notes:

Anonymous 1938

Yang 1934

Wood and Hsu 1935

Biology:

Matsumura 1932

Occasional Pests

	Name	Distribution	Affected
162.	Acrobasis indigenella Zeller	2	Apple, pear, plum, peach, cherry, Prunus domestica
163.	Aglossa dimidiata Haworth	2,3	Rice, flour
164.	Ancylolomia chrysographella Kollar	1	Rice
165.	Cirrhochrista brizoalis Walker	1	Fig, mulberry
166.	Crambus obliterans Walker	(?)	Rice
167.	Critonia sp.	1	Sugar-cane
168.	Crocidolomia binotalis Zeller	1	Turnip, orchid
169.	Crocidophora evenoralis Walker	1,2	Bamboo
170.	Diatraea auricilia Dudgeon	1	Rice
171.	Dichocrocis nelusalis Walker	1	Chestnuts
172.	Ephestia cautella Walker	1,2	Stored grains, nuts
173.	Ephestia elutella Hübner	2	Stored grains, flour, nuts, tobacco
174.	Ephestia figulilella Gregson	2	Stored grains, flour, nuts.

	Name	Distribution	Affected
175.	Ephestia kuehniella Zeller	2	Stored grains, nuts
176.	Etiella zinkenella Treitschke	(?)	Soybean
177.	Eurhodepe pirivorella Motschulsky	3	Pear
178.	Eurrhypara urticata Linnaeus	2,3	Mint, Urtica Thunbergiana
179.	Euzophera sp.	3	Pear
180.	Evergestis extimalis Scopoli	3,5	Turnip, rape, Illicium anisatum
181.	Glyphodes indica Saunders	1,2	Cucumber, cotton, sunflower
182.	Glyphodes midas Butler	1	Mulberry
183.	Glyphodes nigropunctalis Bremer	1,3	Sterculia platanifolia
184.	Glyphodes perspectalis Walker	1,2	Buxus sempervirens
185.	Glyphodes pryeri Butler	1,2	Mulberry
186.	Hellula undalis Fabricius	1,2,3,5	Cruciferious plants
187.	Herculia glaucinalis Linnaeus	1,3	Fruits, seeds, fat, cheese, animal products
188.	Hypsipyla formosanus Shiriki	1	Cotton

	Name	Distribution	Affected
189.	Lamoria anella Schiffermüller	1	Woolen products, zoological specimens, animal skins
190.	Lamprosema indicata Fabricius	1,2	Soybean, beans
191.	Leucinodes orbonalis Guenée	1,2	Egg plant
192.	Maruca testulalis Geyer	1,2,3	Beans
193.	Nephopteryx bicolorella Leech	2	Juniperus chinensis
194.	Nephopteryx rubrizonella Ragonor	3	Peaz, apple
195.	Nephopteryx semirubella Scopoli	1	Astragalus sinicus
196.	Nymphula depunctalis Guenée	1	Rice
197.	Nymphula fluctuosalis Zeller	1	Rice
198.	Nymphula interruptalis Pryer	1,2,3	Nymphaea
199.	Nymphula vitalis Bremer	1,3	Rice
200.	Omphisa plagialis Wileman	1,2,3,5	Catalpa Kaempferi
201.	Paralipsa Modesta Butler	2	Stored grains and plant products

	Name	Distribution	Affected
202.	Phycita abietella Schiffermüller	3	Pine, juniper, allied plants
203.	Phycita infusella Meyrick	1	Cotton
204.	Piletocera sodalis Leech	1	Gardenia florida
205.	Pionea forficalis Linnaeus	1	Radish, cruciferous plants
206.	Plodia interpunctella Hübner	1,2,3	Beans, bean cake dried fruits, milk powder, flour, zoological specimens
207.	Polyctaenodes palealis Schiffermüller	2,3	Mustard, Illicium anusatum
208.	Pyralis farinalis Linnaeus	1,2,3	Fruits, seeds, bean cake, fat, cheese, animal products, zoological specimens
209.	Pyralis pictalis Curtis	1,2,3	Stored grains
210.	Pyrausta damoalis Walker	1,2	Ramie, Boehmeria nivea
211.	Pyrausta machoeralis Walker	1	Teak

	Name	Distribution	Affected
212.	Pyrausta nubilalis Hübner	1,2,3	Millet, corn, bean beet, cotton Cananbis sativa, chrysanthemum, Polygonum tinctovum
213.	Pyrausta phoenicealis Hübner	1	Mint
214.	Sacada fasciata Butler	(?)	Oak
215.	Sacada inordinata Walker	1,3	Oak
216.	Sylepta balleata Fabricius	1,2	Loquat
217.	Sylepta luctuosalis Guenée	1,2,3,5	Grape
218.	Sylepta ruralis Scopoli	1,3	Soybean
219.	Zinckenia perspectalis Hübner	1	Beet, allied plants

FAMILY PTEROPHORIDAE

This small family is comprised of possibly less than 1,000 species of small insects in the world's fauna, of which perhaps about 100 are expected to be inhabitants of China, although only a few have been recorded. Most of the adults are characterized by the strikingly fissured wings, the front pair being cleft into two parts and the hind pair into three. Their larvae are leaf rollers and stem borers, and include several minor pests of economic plants.

Occasional Pests

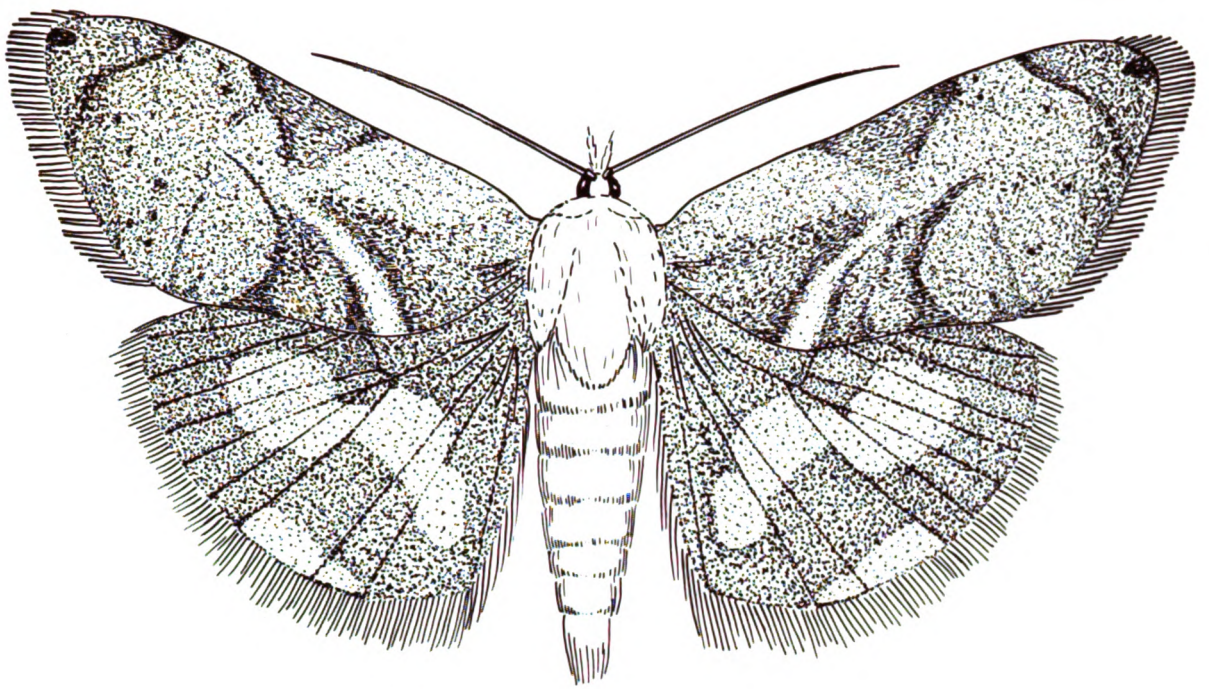
	Name	Distribution	Affected
220.	Alucita niveodactyla Pagenstecher	1	Sweet potatoes
221.	Nippoptilia vitis Sasaki	1	Grapevine
222.	Ochyrotica concursa Walsingham	1	Sweet potato
223.	Sphenarches caffer Zeller	1	Kidney bean, peach, Mucuna capitata

FAMILY HYBLAEIDAE

Hyblaeidae was formerly incorporated in the Noctuidae, but now stands as a separate family which is represented in the old world by a single genus composed of several species of medium-size moths. Of these, three are reported in China, two of which are of economic significance, destroying plant foliage.

Occasional Pests

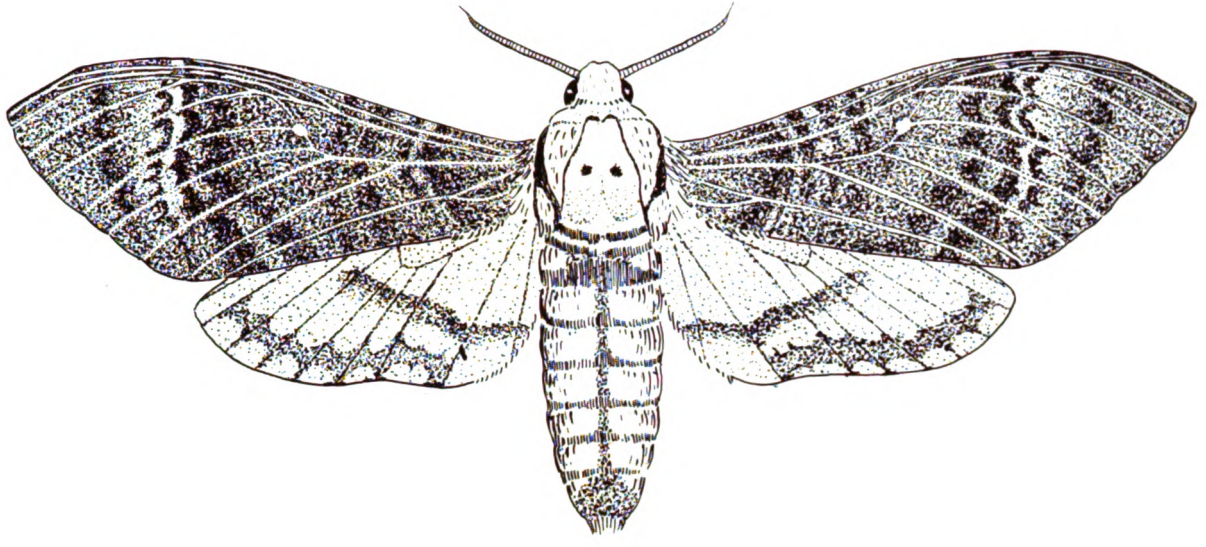
	Name	Distribution	Affected
224.	Hyblaea firmamentum Guenée	1	Callicarpa inacraphylla
225.	Hyblaea puera Cramer	1,2,3	Teak



Hyblaea puera Cramer
(Original)

FAMILY SPHINGIDAE

This family of world-wide distribution comprises about 800 species, and is highly developed in the tropics. The majority of its members are large, heavily built moths whose habits may be either diurnal or nocturnal. Their caterpillars are generally provided with a short horny tail near the rear end and are exclusively defoliators. They seldom occur in large numbers, and therefore are pests of minor importance. Approximately 150 species are credited to the Chinese fauna, and nearly 40 altogether have been considered injurious.



Acherontia styx Westwood
(original)

226. Death's head moth, Acherontia styx Westwood, has a wing spread of 9.0 to 12.0 centimeters. The moth is so named by the presence of a facial mark on the thorax. It is somewhat powdery and furry; and the front wing, with the exception of the lower half of the base, is black shaded with bluish-white and yellow scales, and has an orange dot located at the end of the cell. The hind wing is orange-yellow with two blackish bands, and the body is also orange-yellow marked with black bands. There are three types of larvae: green with double slanting bands of blue and yellow; yellow with the same markings; and brown marked with dark brown stripes. When mature, they measure from 10.0 to 12.0 centimeters.

Distribution: It is probably found all over China, but it is recorded only in Formosa, Liukiu, South China, Kiangsu, and Hopeh. Its occurrence has also been reported from Korea, Japan, India, Ceylon, East Indies, and the Philippines.

Affected: Sesame, pea, Irish potato, eggplant.

Nature of Losses: It is a general pest of Irish potato, eggplant, and sesame, injuring foliage alone.

Life History: One or two generations are produced annually in China; in Formosa two are reported, but areas farther north may have only one. In the two-brooded regions, the adults of the overwintering generation appear in spring, and they fly again in late summer; but those of the single-brooded one emerge between late spring and early summer. Eggs are laid individually on leaves.

Control Measures: Winter plowing will be of assistance in keeping down the pest population. Since the larvae are very large, it would not be difficult to destroy them by hand picking. If insecticides should be needed, arsenicals are desirable material.

References

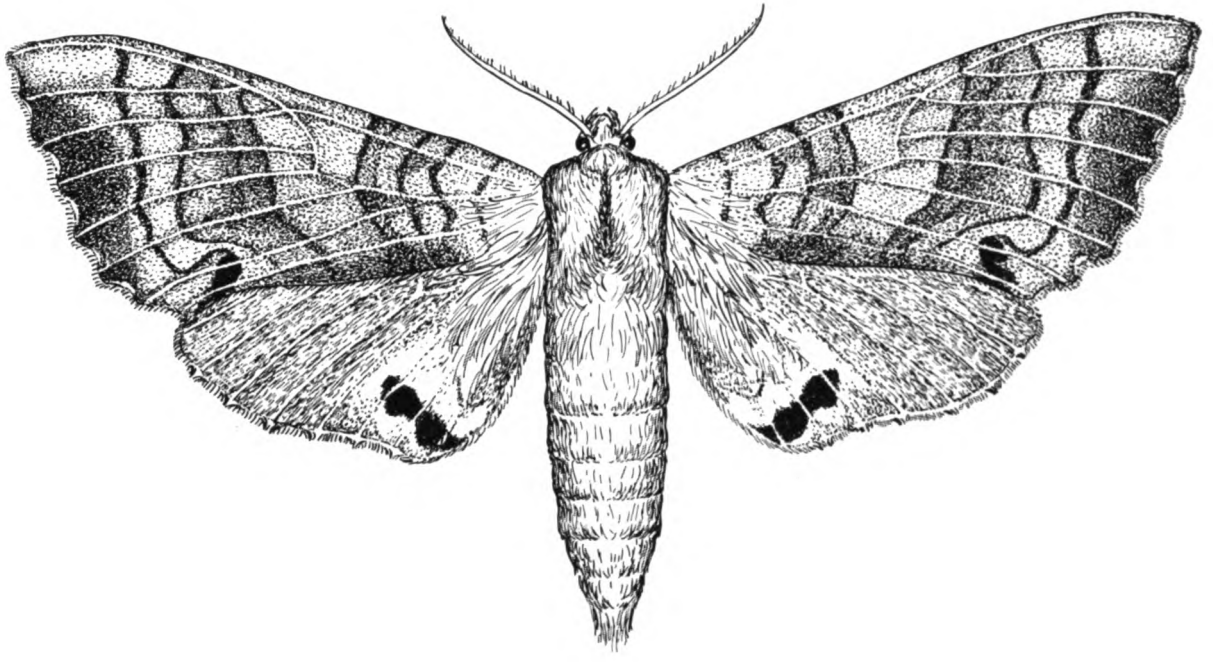
General notes:

Shiraki 1913

Matsumura 1932

Control:

Morgan 1923



Marumba gaschkewitschi Bremer & Grey
(Original)

227. Peach hawk moth, Marumba gaschkewitschi Bremer & Grey, has a wing spread of 8.0 to 12.0 centimeters. It is a greyish-brown insect characterized by the presence of a dark spot near the inner angle of the front wing, and by an obvious mark at the inner angle of the reddish hind wing. Also there is a dark line running through the middle of the prothorax. The caterpillar is rough-skinned, green with yellowish white stripes, legs reddish, and measures about 7.0 or 8.0 centimeters.

Distribution: It is widely distributed in China, being known to occur in Kwangtung, Yunnan, Szechwan, Chekiang, Hopeh, Shantung, Manchuria, and Tibet. The same species is reported from Japan, Siberia, and Himalayas.

Affected: Peach, cherry, jujube.

Nature of Losses: The larvae attack the foliage of the hosts causing damage, but not to a serious extent.

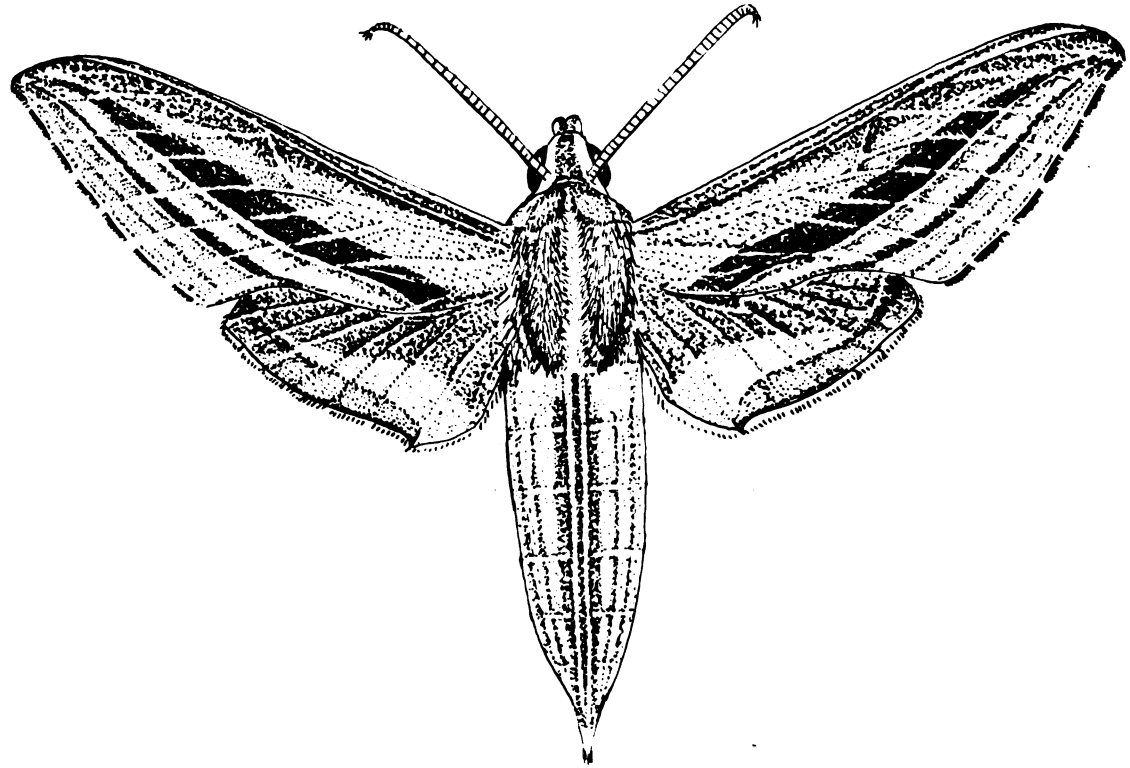
Life History: Possibly identical with that of the foregoing species.

Control Measures: Same recommendations as for the death's head moth.

Reference

General note:

Matsumura 1932



Theretra oldenlandiae Fabricius
(Original)

228. Taro hawk moths, Theretra silhetensis Walker, T. oldenlandiae Fabricius, T. nessus Drury, have a wing spread of 7.0 to 10.0 centimeters. The first two have a similar appearance, and are smaller in size than the third; however, the second one differs from the first by having brown color in the center of the white line on the body and also a lateral coppery abdominal stripe. The last species is unlike the other two species in the position of the dark brown areas and in the abdominal white line. The larva of the first species is either light brown or green, broadly striped with lighter and darker shades, has the seven eye-spots small, alike, and black centered; that of the second is mottled with light and dark grey with some pale yellow; the first two eye-spots are symmetrical with black and blue centers, while the other five have the lower half of the center red; that of the last species is green or pale brown, shaded and blotched with white, the first ocillus inconspicuous and pale-centered, the second very small and the rest absent. A fully-grown larva measures approximately from 9.0 to 12.0 centimeters.

Distribution: In China, the geographical range of these insects probably has been confined more or less to the south, although some have been recorded as far north as Manchuria. Their occurrence has also been reported from Japan, India, Ceylon, Burma, East Indies, Philippines, and Australia.

Affected: Taro, sweet potato, Irish potato, beans, cruciferous plants.

Nature of Losses: They exclusively attack leaves of the plants, at times causing some mild damage.

Life History: There are one to three generations a year, wintering in the pupal stage. Eggs are deposited on foliage and the larvae undergo five instars of development before maturity.

Control Measures: The same recommendations as for the death's head moth are suggested for the present species.

References

Taxonomy:

Rothschild & Jordan 1903

Bell & Scott 1937

General note:

Shiraki 1917

Matsumura 1932

Occasional Pests

	Name	Distribution	Affected
229.	Acherontia lachesis Fabricius	3	Sesame
230.	Acosmeryx naga Moore	1	Grape
231.	Amorpha amurensis Staudinger	3,4	Balsam poplar
232.	Ampelophaga rubiginosa Bremer & Grey	1,3,4	Grape
233.	Calambulyx tatarinovi Bremer & Grey	3	Zelkowa acuminata
234.	Celerio lineata Fabricius	(?)	Grape, cotton
235.	Clanis bilineata Walker	1,3	Soybean, Mucuna adans, Pueraria
236.	Dolbinia inexacta Walker	3	Fraxinus bungeana
237.	Herse convolvuli Linné	1,2	Sweet potato, allied plants
238.	Hippotion celerio Linné	1	Taro, cotton?
239.	Hippotion echeclus Boisduval	1	Seseme
240.	Kentrochrysalis streckeri Stauding	3,4	Ligustrum ibota
241.	Leucophlebia lineata Westwood	1	Sugar-cane, allied plants

	Name	Distribution	Affected
242.	Macroglossum stellatarum Linné	1, 2	Beans
243.	Marumba sperchius Ménétriés	1,3	Loquat, chestnut, oak, Pasania cuspidata
244.	Meganoton analis Felder	1,2,4	Sassafras
245.	Mimas tiliae Linné	3	Alder, elm, oak, Corchoropsis orenata
246.	Oxyambulyx sericeipennis Butler	(?)	Oak, Elaeocarpus chinensis, Juglans regia
247.	Oxyambulyx liturata Butler	1	Canarium album, Castanopsis spach.
248.	Oxyambulyx ochracea Butler	1	Poupartia fordii
249.	Oxyambulyx subocellata Felder	1	Canarium album
250.	Parum colligata Walker	1,3,5	Oak
251.	Psilogramma menephron Cramer	1,2,4	Sassafras tsumu, tung tree, Ligustrum ibota
252.	Rhagastis olivacea Moore	1	Grapes
253.	Rhagastis albomarginata Rothschild	1,2	Grapes
254.	Rhyncholaba acteus Cramer	1	Taro

	Name	Distribution	Affected
255.	Sataspes infernalis Westwood	1?	Albizzia lebbek
256.	Smerinthus planus Walker	1	Apple, cherry, flowering cherry, balsam poplar, willow
257.	Theretra alecto Linné	1?	Grapes
258.	Theretra clotho Drury	1	Hibiscus mutabilis
259.	Theretra jabponica Orza	1,2,3	Sweet potato, grape