

## 4. RECENT PROGRESS IN RICE INSECT RESEARCH IN PAKISTAN

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### Introduction

Rice is the staple food crop of almost the entire population in East Pakistan and about 90% rice acreage of the country is grown here. Three crops of rice, viz., Aus, Aman, and Boro, are generally grown extensively throughout the year in different seasons. It is now in an area of over 26 million acres (including multiple crops) and the crop is subject to the attack of about 27 different species of insects which cause enormous losses annually to this important crop in East Pakistan. Such losses cause a heavy toll on rice year after year. In some years such a loss in some areas has been a serious consequence. According to sources available with us the loss due to insect pests has been estimated at 12–15 per cent in general but in some years it rises upto 20% or even beyond that which is over 150 crores of rupees annually. The recent progress so far achieved on major rice insect pests research in Pakistan is briefly discussed in this paper.

#### A list of insect pests of rice so far recorded in East Pakistan.

Sl. No.	Common name	Scientific name	Family and order	Status
1)	Rice ear-cutting caterpillar	<i>Pseudaletia unipuncta</i> (H)	Noctuidae, Lepidoptera	Major
2)	Rice swarming caterpillars	<i>Spodoptera mauritia</i> (B)	—do—	—do—
3)	Rice borers	a) <i>Tryporyza incertulas</i> (W.)	Pyralidae, Lepidoptera	Major
		b) <i>Chilo polychrysa</i> (M.)	—do—	—do—
		c) <i>Sesamia inferens</i> (W.)	Noctuidae, Lepidoptera	Minor
4)	Rice hispa	<i>Hispa armigera</i> (O)	Hispidae, Coleoptera	Major
5)	Rice hoppers	a) <i>Nephotettix impicticeps</i> (I.)	Deltocephalidae, Hemiptera	—do—
		b) <i>Nepotettix apicalis</i> (M.)	—do—	—do—
		c) <i>Inazuma dorsalis</i> (M.)	—do—	—do—
		d) <i>Nilaparvata lugens</i> (S.)	Delphacidae, Hemiptera	—do—
		e) <i>Sogatella furcifera</i> (H.)	—do—	Minor
		f) <i>Tettigera spectra</i> (D.)	Tettigellidae, Hemiptera	—do—
		g) <i>Kolla mimica</i> (D.)	—do—	—do—
		h) <i>Thaia oryzivora</i> (G.)	Typhlocyidae, Hemiptera	Major
6)	Rice bug	<i>Leptocoris acuta</i> (Th.)	Coreidae, Hemiptera	—do—
7)	Rice gall midge	<i>Pachytiplosis oryzae</i> (W.-M.)	Cecidomyiidae, Diptera	—do—
8)	Rice mealy bug	<i>Geococcus oryzae</i> (K.)	Pseudococcidae, Hemiptera	—do—

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Sl. No.	Common name	Scientific name	Family and order	Status
9)	Rice leaf roller	<i>Cnaphalocrosis madinalis</i> (G.)	Pyalidae, Lepidoptera	Major
10)	Rice case worm	<i>Nymphula depunctalis</i> (G.)	Pyalidae, Lepidoptera	Miner
11)	Rice grass-hopper	a) <i>Hieroglyphus banian</i> (F.)	Acrididae, Orthoptera	—do—
		b) <i>Oxya</i> sp.	—do—	—do—
12)	Rice thrips	<i>Thrips oryzae</i> (W.)	Thripidae, Thysanoptera	—do—
13)	Rice hairy caterpillar	<i>Dasychira securis</i> (Hb.)	Lymantriidae, Lepidoptera	—do—
14)	Rice leaf beetle	<i>Leptispa pygmoea</i> (B)	Chrysomelidae, Coleoptera,	—do—
15)	Rice skipper	<i>Pelopidas agna</i> (M.)	Hesperiidae, Lepidoptera	—do—
16)	Rice butterfly	<i>Melanitisleda ismene</i> (Cram.)	Satyridae, Lepidoptera	—do—
17)	Field cricket	<i>Brachytrypes portentus</i> (L.)	Gryllidae, Orthoptera	Major

The insects noted in the list of rice pests above have been recorded causing damages to the crop in the field. Among these the first 9 pests and one species of cricket have been reckoned as major pests of rice crop in the field. Among the major pests, it is found that though most of them cause visible and appreciable damage to the crop only during the growing period in the field, some of these insects have their beginning even in the nurseries but they are generally over looked and thereby allowed to multiply and carry on their increased activities in the transplanted fields.

### Rice Ear-cutting Caterpillar,

#### *Pseudaletia unipuncta* (Haworth)

**General:** The rice ear-cutting caterpillar is the most serious pest of rice in East Pakistan. The mature caterpillars seriously damage crop by cutting off the ripened ears of Aman rice. These caterpillars appear suddenly, and losses result before the pests are detected. They disappear as suddenly as they appear.

**Host Plants:** The caterpillar feeds on a wide range of grasses. In East Pakistan it feeds on rice leaves and other succulent grasses, but serious damage has been recorded on the earned Aman rice crop only.

**Distribution:** The pest has been recorded in all southeast Asian countries and in Argentina, Hawaii, continental United States, and Canada. It is fairly common throughout East Pakistan.

**Life History:** Male longevity is three days and female, up to seven days. The incubation period is about seven to nine days. The female moths lay eggs sometimes as many as 232 throughout their lives. Observations reveal that the female moth generally prefers to oviposit her eggs in tight places which conceal her eggs.

After oviposition the female dies. The newly hatched larvae, which are dull white with a brownish head, are about 1.8 mm. long. The first two pairs of forelegs are under developed; therefore, they move with a looping motion. The hatching caterpillars, after a brief quiescent period, feed actively, causing a skeletonization of the leaves.

The looping motion and skeletonizing feeding habit are lost in the third instar- and the caterpillars are able to crawl and eat holes. The third to the sixth instars all have common habits. Caterpillars in these stages are active from dusk to dawn and feed mostly at night. During the day, they remain concealed under foliage and debris

in the field. This habit of the caterpillar of concealing itself prevents its early detection. The fifth and sixth instar larvae begin their gregarious habit and migrate for additional large amounts of food. The sixth instar alone requires 80 per cent of the total food consumed during the entire larval period. This voracious feeding habit of the caterpillars in their gregarious stage cause migration from field to field.

During this period, the half-mature ears of Aman rice generally are available. The larvae cut off the ears and seriously damage the rice crop.

The larvae of the next generation, the fifth breed, appear from early January, but they overwinter at the fifth instar before they become full fed. After hibernation the pupae and moths are subject to natural death to a great extent, so that the first-brood larval population of the next year is small.

**Natural Enemies:** A large number of parasites, predators, and pathogens of the rice ear-cutting caterpillar have been recorded in different countries. Seventeen species of Braconids, 21 of Ichneumonids, and 30 of Technids have so far been recorded as parasites of this pest. An Ichneumonid species *Barichneumon albatorius* Fabricius, has been recorded as larval parasite of the pest in East Pakistan. Nineteen species of Coleopterous insects and eight species of Hemipterous insects have been recorded as insect predators. Besides these, three species of viruses, one of bacteria, and two of fungi also have been recorded as disease pathogens of the pest. Among these, one species of virus, *Morator nudus* Wasser, has been recorded as a virus pathogen effective in inflicting heavy mortality in the rice ear-cutting caterpillar population in East Pakistan.

**Control Considerations:** Outbreaks of the rice ear-cutting caterpillar cause heavy losses in rice in East Pakistan, in spite of the availability of good chemical control.

An impending outbreak usually goes unnoticed, as the individuals remain concealed by day and do little feeding until the final instar, when they begin to feed voraciously and gregariously. If a field containing a large population of ear-cutting caterpillars remains unnoticed for several days after the major portion of the larvae have matured, application of insecticides is ineffective.

A timely warning for applying insecticide would do much to prevent damage in a locality. It is believed that a workable warning system can be developed with minimum effort once the life history and seasonal cycle of the species are known.

### Recommended Control Methods

#### (1) Cultural Control

- 1) Burn the straw and stubble of the infested field to kill the overwintering larvae. Large-scale practice of this method may lower the population of the pest in the subsequent cropping season.
- 2) After harvest, plough up the infested fields to expose the larvae to sun, as well as birds and other natural enemies.
- 3) Grasses should not be allowed to grow in or around the rice fields.
- 4) In badly affected areas, grow early maturing varieties of Aman crop which may be harvested before the gregarious phase of the pest is reached.
- 5) Grow awned varieties of Aman rice in localities infested with the pest during the previous year, since such varieties have been observed not to be infested with the pest.
- 6) If possible, the rice plot may be flooded with water which may avoid or suppress the pest attack.

#### (2) Chemical Control

Spraying with DDVP at the rate of 8 oz. or Methoxychlor at the rate of 2 lbs. or Sevin 85 SP at the rate of 1 lb. in 50 gallons of water per acre is an effective

control of the pest.

### **Rice Swarming Caterpillar, *Spodoptera mauritia* (Boisduval)**

**General:** The rice swarming caterpillar is a serious pest of rice, particularly of Aus rice. The insect generally causes serious damage on the Aus crop from June to August. Its presence on Boro in April-May and on Aman in August-October also has been recorded in some parts of East Pakistan.

**Host Plants:** The larvae of the pest defoliate the rice plants, grasses of pasture land, and other members of the grass family.

**Distribution:** The insect is distributed widely throughout the Orient and Australian regions. In East Pakistan, it is found on rice in almost all districts on the Aus crop and also on the Boro and Aman crops.

**Life History:** The adult insect is a greyish-black moth with a white blotch on its fore-wings. The male moth has immense tufts of hair on its forelegs. Generally, the eggs and young caterpillars escape notice and are detected only when they grow large and begin to eat voraciously. Caterpillars feed on leaves and shoots of rice and grasses and appear in big swarms and destroy the growing rice crop, especially the Aus crop. After finishing the crop in one field, they migrate to the next.

Small, spherical eggs are laid in blotches on rice leaves and grasses and covers them with greyish hairs. Each female moth lays 200 to 350 eggs. The eggs hatch in five to nine days, depending upon the temperature. The newly hatched caterpillars are green and often remain unnoticed in the green back-ground of the rice leaves. Under favourable conditions, their number increases considerably. The caterpillars first nibble at the surface, eating only small portion of leaves, but as they grow, they eat voraciously, devouring whole fields in a short time, and then moving to other fields. The caterpillars are nocturnal in habit. When grown, they are about 38 mm. long and become smooth and cylindrical and dark to pale green, with dull dorsal and subdorsal stripes. Their colour varies greatly. The larval period is three to four weeks. The full-grown caterpillar enters the soil and hanges into a pupa in an earthen cell. The pupa is dark brown and about 13 mm long, with two slender spines at its narrow apex. The pupal period lasts 10-14 days. Mating takes place within a day or two after which the female is ready for egg laying. The life cycle is completed in about 37 days. The insect broods on different grasses.

**Natural Enemies:** Twelve different species of parasites on this insect have so far been recorded in the Indo-Pak subcontinent. Among these *Cuphoceva varia* F., *Gonia cinerascens* Rond., and *Strumiopsis semiberbis* Bezzi (Tachinidae: Diptera); an Ichneumonid, *Cherops* species (Ichneumonidae: Hymenoptera); *Chelenus* species and *Apanteles* species (Braconidae: Hymenoptera); *Euplactrus* species (Chalcididae: Hymenoptera) have so far been recorded from East Pakistan.

### **Recommended Control Methods**

#### **(1) Cultural Control**

- 1) After harvest uproot the stubbles and burn them in the field. Then plough up the land to open the soil to the sun. This can check the pest for next infestation.
- 2) If possible, the infested field may be flooded with water which can avoid or suppress the pest.
- 3) Do not allow grasses to grow in or around the rice fields.

#### **(2) Biological Control**

- 1) Encourage insectivorous birds to feed on the insects by placing bamboo perches

or twins in the infested fields.

2) If possible allow poultry birds in the fields to feed on caterpillars.

(3) Chemical Control

Spraying with DDVP at the rate of 8 oz. or Methoxychlor at the rate of 2 lbs. or Sevin 85 SP at the rate 1 lb. in 50 gallons of water per acre is a good control of the pest.

### Rice Borers

1) *Tryporyza* (= *Schoenobius*) *incertulas* (Walker)

2) *Chilo polychrysa* (Meyer)

3) *Sesamia inferens* (Walker)

Rice borers are major problem throughout the rice growing countries of the World except the U.S.A. They seriously damage rice crops in Pakistan.

In East Pakistan, these occur in every district of rice crops and cause losses every years. The intensity of infestation is greater in the southern and eastern districts. Three species of rice borers, as mentioned above, have been recorded in East Pakistan, first two species are more abundant than the third one.

**General habits and nature of damage:** The rice borers are internal feeders and the nature of damage by all the species discussed here are more or less the same with some minor differences.

The newly hatched caterpillars bore into the growing stem, cutting through the leaf-sheath and stem wall. The larvae feed on the internal tissues of the stem. Young larvae also feed on the leaf-sheath. As a result, the continuity of the vascular tissue is broken. This affects the formation and growth of all parts, including the ear above the point of damage. The extent of feeding by larvae in the stem varies considerably; in the extreme cases only the epidermal membrane is left. The internode is littered with excreta and pieces of the broken tissues of the tiller. The extent of injury to the stem is influenced by the age of the stem which determines the degree of formation of the band of sclerenchyma underlying the the epidermis. The tissues consisting of thick walled cells will naturally be much less favourable to the larvae.

As a result of the injury by the borers, young tillers are killed. Older tillers may not be killed, but the quality of the ear heads formed on these is drastically affected. The damage done, therefore, can be considered in two stages, young and older plants. The young affected tillers extremely present in appearance usually described as a 'dead heart'. The shoot, except the lowermost two or three leaves, becomes dry, pale yellow, or straw coloured and comes off easily when pulled. Ultimately the tiller is killed.

It appears that the attack by borers at an early stage induces greater tillering. It also appeared that extent of infestation in a plant is not directly proportional to the number of eggs laid on it. The extent of damage under usual circumstances is not less than 3 per cent, and not more than 20 per cent. In the district of Khulna, where the rice crop has suffered from severe outbreaks of the pest, the damage has reached up to 20 per cent.

**Seasonal history:** There are altogether five generations of these pests passed on in rice crops and stubble during the year. The first generation on the Boro crop, the second, third and fourth generations on the Aus and Aman crops. The fifth generation on the Aman crop and stubble. The Aman crop suffers most. The generations overlap. The moth population is low up to July and gradually increases reaching a peak by the middle of October. Thereafter, the population sharply declines.

**Natural enemies:** A large number of natural enemies, including parasites predators and some unidentified pathogens, were found associated with the immature stages of different species of borers. These are as follows:—

- (a) Egg parasites of *Tryporyza incertulas* (W.)
  - a) *Tetrastichus schoenobii* Fer. (Eulophidae, Hymenoptera).
  - b) *Trichogramma* sp. (Trichogrammatidae, Hymenoptera).
- (b) Larval parasites—
  - On *Tryporyza incertulas* (W.) larvae—
    - a) *Shirakia schoenobii* Vier. (Braconidae, Hymenoptera)
    - b) *Tropobracon indica* R. (Braconidae, Hymenoptera)
    - c) *Ischnojoppa lubbeater* E. (Ichneumonidae, Hymenoptera)
    - d) *Tamelucha* sp. (Ichneumonidae, Hymenoptera)
  - On *Chilo polychrysa* (M.) larvae—
    - a) *Pocillotrapphera taeniata* M. (Platystomatidae, Diptera)
    - b) *Strumiopsis inferens* T. (Tachinidae, Diptera).

It also parasitizes *Sesamia inferus* (W.) larvae.

- (c) Pupal parasite of *Chilo polychrysa* (M.)
  - a) *Tetrastichus* sp. (Eulophidae Hymenoptera).

Crows, maynabs, fungus and two types of ants, *Monomorium latinoda* Meyer and *Tetramorium simillimum* Sum. (Formicidae, Hymenoptera) were seen to predate on the different stages of the borers. Some fungal and nematode diseases of the larvae were also recorded but the pathogens have not yet been identified.

#### Chemical control:

Any of the following methods may be applied for the control of the pest:

- 1) Application of Diazinon granule as topical application (like fertilizer) 25–30 days after transplantation @ 1.5–1.75 lbs. active material per acre and also 50–60 days after transplantation with the same rate per acre can give an excellent check of the borers.
- 2) Spraying the crop with Bidrin or Carbicron @ 12 lbs. or Diazinon or Lebaycid 50 E.C. @ 15 lbs. per acre in 50 gallons of water is a good control of the pest.

### Rice Hispa

#### *Hispa armigera* (Olivier)

The rice hispa is an important pest of rice in East Pakistan. It is a regular and common pest of Aus crop, but it also occurs on Bore and Aman crops.

**Distribution:** The pest is widely distributed in Pakistan, India, Nepal, Burma, Sumatra, Cochin China and Chikiang China. In East Pakistan, the pest is found in all parts of the province and is a serious problem particularly in the Eastern and Southern districts.

**Damage:** The pest usually attacks young rice plants. Damage is done by both adults and grubs. The beetle feeds on the green portion of the leaf leaving sometimes only the epidermal membranes. The damage is shown by characteristic white parallel streaks along the long axis of the leaf. The grubs mine into the leaf between the epidermal membrane producing irregular longitudinal white patches. Damage usually starts at the tip of the leaf and proceeds downwards. As a result the affected upper parts of the leaves ultimately wither.

The effect of the damage by this pest stunts and weakens the plant causing a lower yield. Loss from an attack by this pest has been found to vary 10 to 65 per cent some times even more. A conservative average loss estimate would be 20 per cent of the affected, and at least 150,000 to 200,000 acres of rice crop are severely affected every year.

#### Recommended Control Method

Spraying with Bidrin or Carbicron or Dimecron @ 8 oz. or Lebaycid or Diazinon 50 EC @ 1 lb. or Metasystox or Anthie 25 EC 1 lb. or Folithion or Sumithion or Ac-

couthion 50 EC @ 1 lb. or Sevin 85 SP or Imidan 50 WP @ 1 lb. in 50 gallons of water per acre is a good control of the insect.

The pest should be checked at the early stage of infestation on Aus crop and this will check the population of next generation.

### Rice Hoppers

Of the many insect species which damage the rice crop in tropical Asia, the green leafhoppers *Nephotettix* spp. and brown planthopper *Nilaparvata lugens* (Stal) are particularly significant. Light infestations of these hopper insects reduce the overall vigour of the rice crop and cause a decrease in the number of productive tillers per plant. Heavy infestations cause complete drying of the rice crop, a condition commonly known as "hopper burn".

In addition to the direct feeding damage, some leafhoppers and planthoppers are vectors of virus diseases and have almost the same overall economic significance as that of stem borers. Of these, *Nephotettix* spp. *Nilaparvata lugens*, *Inazuma dorsalis*, *Sogatella furcifera* are the important species occurring throughout Asia but the last named species has not yet been recorded in East Pakistan.

Generally, the leafhoppers feed on the leaves and upper parts of the plants whereas the planthoppers confine themselves to the basal parts. The leafhoppers and planthoppers damage the plants by sucking the sap and by plugging xylem and phloem.

In the warm and humid tropics different species of leafhoppers and planthoppers remain active in the year round and their population fluctuates according to the availability of food plants, natural enemies and environmental conditions. After the rice crop is harvested, the insects usually migrate to weeds and grasses. The abundance of *Nephotettix* spp. have been attributed to high temperature, low rainfall and abundant sunshine.

All leafhoppers and planthopper species have identical life history patterns. The females lacerate the midrib of the leaf blade or the leaf sheath to lay egg masses in the parenchymatous tissues. The number of eggs varies in different species. Most of the species undergo 4 to 5 moults and the nymphal period ranges from 2 to 3 weeks.

The following 8 different species of leafhoppers and planthoppers have so far been recorded in East Pakistan:—

Species	Family
a) <i>Nephotettix impicticeps</i> Ishihara	Deltocephalidae
b) <i>Nephotettix apicalis</i> (Motschulsky)	"
c) <i>Inazuma dorsalis</i> (Motschulsky)	"
d) <i>Nilaparvata lugens</i> (Stal)	Delphacidae
e) <i>Sogatella furcifera</i> (Horvath)	"
f) <i>Tettigella spectra</i> (Distant)	Tettigellidae
g) <i>Kolla mimica</i> Distant	"
h) <i>Thaia oryzivora</i> Ghauri	Typhlocybae

### Control

Spraying with Malathion 57 EC or Dimethoate 40 EC @ 12 oz. or Diazinon or Lebaycid or Folithion or Sumithion or Accothion 50 EC @ 1 lb. or Carbicron or Bidrin or Dimecron @ 8 oz. or Sevin 85 SP or Imidan 50 WP @ 1 lb. in 50 gallons of water per acre is a good check of the pest.

## Rice Bug

### *Leptocorisa acuta* (Thunberg)

The insect is a narrow, slender, greenish, yellow insect. This is very active and sucks the sap from the plant. It appears as a pest at a stage when the plants have flowered and the grains are in milky stage. Both adults and nymphs damage the plant by sucking up the juice from the milky grains and the sucked out empty grains appear white. When the pest is abundant, the whole crop may wither. The bug is generally found on grasses throughout the year but it appears in rice when the grains are forming. A badly infested field shows earheads with numerous sucked up grains empty and turned brown and dry.

The pest generally attacks the Aus crop but sometimes it may attack Boro and Aman crops also. The pest is generally found in the Northern districts of East Pakistan and some times also found in some Eastern districts.

**Life history:** The adult bug measures about  $\frac{3}{4}$  inch in length. The female bug lays brownish eggs in rows of 10 to 20 arranged symmetrically in one or two lines on the leaf blade. They hatch in a week and green young nymphs come out and feed by sucking the plant sap from the tender shoot and leaves. In about a fortnight the nymphs mature into adults and become winged after which they can fly and move from plant to plant and feed upon the milky grains. They increase and multiply only when there is plenty of food i.e., from July to October. They live on grasses during winter when they do not breed.

Control:

- 1) Spraying with Malathion 57 EC or Dimethoate 40 EC @ 12 oz. Diazinon or Lebaycid or Sumithion or Folithion or Accothion 50 EC @ 8 oz. or Sevin 85 SP or Imidan 50 WP @ 1 lb. in 50 gallons of water per acre is a good check of the pest.
- 2) A tiger beetle (*Cicindela sexpunctata*) sometimes feeds on this insect which gives a natural check of the pest in some area.

## Rice Gall Midge

### *Pachydiplosis oryzae* (Wood-Mason)

The rice gall midge previously was considered a minor pest of young rice crop in East Pakistan but it has become a serious pest of high yielding varieties of IRRI since 1966. The larvae of the insect cause damages to the rice plant. The shoot of the rice plant instead of growing normally is converted into a narrow, hollow, pale gall due to the attack of the insect and such gall prevents the formation of ear heads. The infestation starts from Boro and population reaches peak period during June and July on Aus and continued up to October on Aman. The primary infestation starts from seed-bed and continues secondary infestation in the transplanted plants. The extent of infestation on IR-8 was observed up to 66% and on local variety, Latisail up to 6.2%

**Life history:** The adult female fly which is about a mosquito size lays elongated, oval, opaquely eggs usually in a single row containing 20 to 40 eggs. Eggs are laid at the lower part inside the leaf sheath of the outer leaf. They hatch in about 4 to 5 days. The young tiny maggots after hatching creep into the internal leaf sheaths. On entering they lacerate the tender tissues and feed on the plant sap. Thus by feeding on tissues a hollow chamber or gall is formed in the growing shoots showing them to be onion leaf or sometimes silvery white which afterwards become dry. The larval period is about three weeks. After the larval growth the maggot turns into a pupa and the pupal period last for 5 to 6 days after which the adult fly emerge out of the pupa. The pest completes four generations during the period from April to



October.

Control:

Spraying with Dieldrin 50 WP or Methoxychlor 80 EC @ 1 lb. or Limecron or Bidrin or Carbicron @ 12 oz. or Diazinon or Lebaycid or Sumithion @ 1.5 lbs. in 50 gallons of water per acre is a good control of the insect.

### **Rice Mealy Bug**

#### ***Geococcus oryzae* Green**

The rice mealy bug is an important pest of rice in East Pakistan causing heavy losses of rice crop. An infested field shows isolated patches of stunted, sickly, scorched-looking plants. When the outer sheath of an infested stem is drawn apart, numerous bugs of all growing stages are seen attached to the stem. Mealy bugs always are found in colonies attached to the rice stem covered by the outer sheathing leaves. The damage is caused by direct sucking of the plant sap. The infested plants get stunted and turn pale yellow. A conservative average loss of Aus crop estimates about 20 per cent or more in the affected fields.

A long drought with a moderately high temperature is the important condition favouring an outbreak. The insect is active beginning April to the first part of July, and causes severe damage to the Aus crop. It is also sometimes found on the young stage of the Aman crop.

Some *Eulophid* and *Encyrtid* parasites have been recorded from this pest but their specific identities have not yet been established. Predatory ants, *Monomorium latinoda* Mayer and *Tetramorium simillimum* Sm. (Formicidae, Hymenoptera) and several species of lady beetles have been recorded predated on this insect.

Control:

Spraying with Diazinon or Lebaycid or Folithion or Accothion or Sumithion 50 EC @ 10 oz. or Malathion 57 EC or Dimethoate 40 EC @ 10 oz. or Dimecron or Bidrin or Carbicron @ 6 oz. or Metasystox or Accothion 25 EC @ 12 oz. or Sevin 85 SP or Imidan 50 WP @ 12 oz. in 50 gallons of water per acre is a good check of the pest.

### **Rice Leaf Roller**

#### ***Cnaphalocrosis medinalis* (Guence)**

The rice leaf roller is also an important pest of rice in East Pakistan. It generally occurs on Aus crop but it is also found on Aman especially in moist localities.

After hatching out of the egg the young caterpillar starts rolling the leaf with threads exuded from its mouth. The caterpillar feeds on the chlorophyll of the leaves from inside. As a result of its feeding the growth of the leaf is totally checked, the leaf is completely rolled up and appears like a stick. The infested plant presents a sickly appearance and the leaf with roll becomes dry.

The infestation in certain cases is as high as 60 per cent.

Control:

Spraying with Bidrin or Carbicron or Dimecron 100 @ 8 oz. or Diazinon or Lebaycid or Sumithion or Folithion or Accothion 50 EC 1 lb. or Sevin 85 SP or Imidan 50 WP @ 1 lb. in 50 gallons of water per acre is a good control of the pest.