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LEAF AND PLANT HOPPERS OF RICE

B. C. Misra and P. Israel¹

Leaf hoppers and plant hoppers which were considered as of minor importance in India have now become serious pests and assumed a major role. In addition to the direct injury caused by them by sucking the cell sap and injecting toxins into the plant, they may pose a threat as carriers of virus diseases.

In this paper, the life histories of eight species of injurious leaf hoppers and plant hoppers present at Central Rice Research Institute are briefly presented.

The cages used for different purposes are given below. For mass breeding, glass square cages of 63 × 32 × 34 cm height and round glass chimneys of 60 × 15 cm were used. For studying the fecundity of a single female and development, ordinary chimneys of lamps of 22 cm height were used.

LEAF HOPPERS

(1) *Nephotettix apicalis* Motschulsky :

This is a green leaf hopper having two black patches in the forewing of the males extending upto the black distal portion of the forewing (Fig. 1). In case of the females only some of them have these patches. These are distinguished mainly from the *Nephotettix impicticeps* externally by having a submarginal black band. There are other differences in the shape of the body, colouration and in the aedeagus.

The leaves of the attacked plants show yellowing uniformly from the tip to the mid half of the leaf. There is no appreciable reduction in the tillering, height and width of the leaves. The young seedlings rarely die due to their attack when there is average population. There is sooty mould in the attacked plants.

This leaf hopper is reported to be responsible for transmitting four virus diseases of rice, namely, transitory yellowing (Chin *et al* 1965), yellow dwarf, dwarf and Tungro (Nasu, 1964).

These leaf hoppers lay the eggs exclusively in the leaf sheaths and they prefer young seedlings for their oviposition. They make a vertical incision by their ovipositors in the leaf sheath and deposit the eggs in a row across the incision. The ovipositing place is not clearly seen to the outside except slight bulging in the ovipositing area. The eggs with egg caps are fully hidden in the leaf sheath.

One female can lay upto 360 eggs with 44 egg masses and each egg mass contains 1.20 eggs. Freshly laid eggs are transparent which later turn brownish with reddish eye spots.

Eggs hatch within 6-7 days during September when the maximum temperature is 32.7°C and the minimum 25.3°C and the R. H. 83-85%. There are 5 instars be-

¹ Research Scholar and Entomologist respectively, Central Rice Research Institute, Cuttack-6, Orissa, India.

fore it becomes adult. The 1st, 2nd, 3rd, 4th, and 5th instars take 4, 2, 3, 3 and 5 days respectively. The total period from egg to adult is 23 days. Females can live upto two months.

(2) *Nephotettix impicticeps* Ishihara (*N. bipunctatus* Fab) :

This is a greenish leaf hopper with two black spots in the forewing of males. Females may or may not have the black spots. Unlike *N. apicalis*, these spots do not have an extension upto the black distal portions of the forewing (Fig. 8).

The leaves of the attacked plants show yellowing with the drying up of the tips. The yellowing in the first stage of attack is not continuous throughout the leaf. It starts here and there to the margins and also it proceeds from the tip. In the later stage, the whole leaf becomes yellow. There is reduction in the height of tillers. The younger seedlings die completely but the older plants recover. There is sooty mould in the attacked plants.

It is reported to be responsible for transmitting rice yellow dwarf, rice stunt diseases (Nasu, 1964).

It lays eggs in the leaf sheaths in the same manner as *N. apicalis*. One female can lay upto 420 eggs during its life. There may be as many as 37 egg masses and the number of eggs in each egg mass varies from two to 27. Freshly laid eggs are transparent, become brownish when they grow older and reddish eye spots are visible just before hatching.

The eggs hatch within 6-7 days during August when the maximum temperature is 32.4°C and minimum 26.0°C and the R. H. 85-86%. The freshly hatched nymphs moult

5 times before they become adults. The 1st, 2nd, 3rd, 4th and 5th instars take 4, 2, 3, 3 and 5 days respectively. The total period from egg to adult is 24 days. Females can live upto two months.

(3) *Inazuma dorsalis* Motschulsky :

This is a brownish white leaf hopper with sculptures in the forewings (Fig. 3).

In the leaves attacked by this leaf hopper the leaf tip dries and both the margins of the leaf show orange colouration. In the later stage, the whole leaf becomes orange and the leaf curls up from the margins. These symptoms are first seen in older leaves and gradually the younger leaves also show similar symptoms. Width of the leaves is reduced and sooty mould develops. The young seedlings die outright when the leaf hopper attacks. In the later stage of the crop, the attacked plants do not die.

This leaf hopper is reported to be responsible for rice dwarf disease and orange leaf disease (Nasu, 1964).

The female lays one to two eggs at a time, rarely in masses of 3 or 4 eggs. No external symptom is seen when eggs are freshly laid but when the eggs grow older, a faint brownish spot develops around the site of oviposition. The peculiarity in egg laying of this leaf hopper is that the eggs are scattered here and there mostly lying along the inside tissue of the leaf sheath. They even lay just above or below the juncture of the sheath.

One female lays upto 90 eggs during its life time. There may be as many as 44 egg masses. Freshly, laid eggs are clear and become brownish when they grow older and eye spots are seen before hatching.

The eggs take 6 days for hatching during the months of August when the maximum and minimum temperatures 32.4°C and 26.8°C respectively and R. H. 85-86%. There are 5 instars before the nymph becomes an adult. The 1st, 2nd, 3rd, 4th and 5th instars take 3, 2, 2, 2 and 3 days respectively. The total period from egg to adult is about 18 days. The adult female lives for about 55 days.

(4) *Cicadella spectra* Distant :

This is commonly called the white jassid and this is the biggest among all the leaf and plant hoppers under study. The veins on the forewing are distinctly seen and it can walk even for some distance. The body colour is greyish white (Fig. 5).

The tip of the attacked leaf dries up and orange colouration starts below the dried tip towards the base. Then the whole leaf becomes orange colour and then curls up. Here the colouration starts from the margin and tip and then proceeds towards the middle and then to the base. Appreciable reduction in the height of the plant is noticed.

So far no virus diseases have been reported to be transmitted by this leaf hopper.

The female lays eggs inside the leaf sheaths by making an incision by the ovipositors.

The female can lay upto 164 eggs during the life time. They can lay as many as 17 egg masses, the maximum number of egg in an egg mass is 17 and the minimum is 5.

The eggs hatch in 6-7 days during the month of September. There are 5 instars

before it becomes adult. The 1st, 2nd, 3rd, 4th and 5th instars take 4, 3, 3, 3 and 5 days respectively. The females can live up to 30-35 days.

(5) *Kolla mimica* Distant :

This is a green pigmented leaf hopper and looks like the white jassid and slightly smaller in size. This can be differentiated by the 5 black spotted vertex and by the green vertex and pronotum (Fig. 7).

The symptoms of attack are same as noted for *C. spectra* but here the orange colouration starts generally from the tip towards the base along the midrib and the whole leaf becomes orange.

So far, no virus diseases have been reported to be transmitted by this leaf hopper.

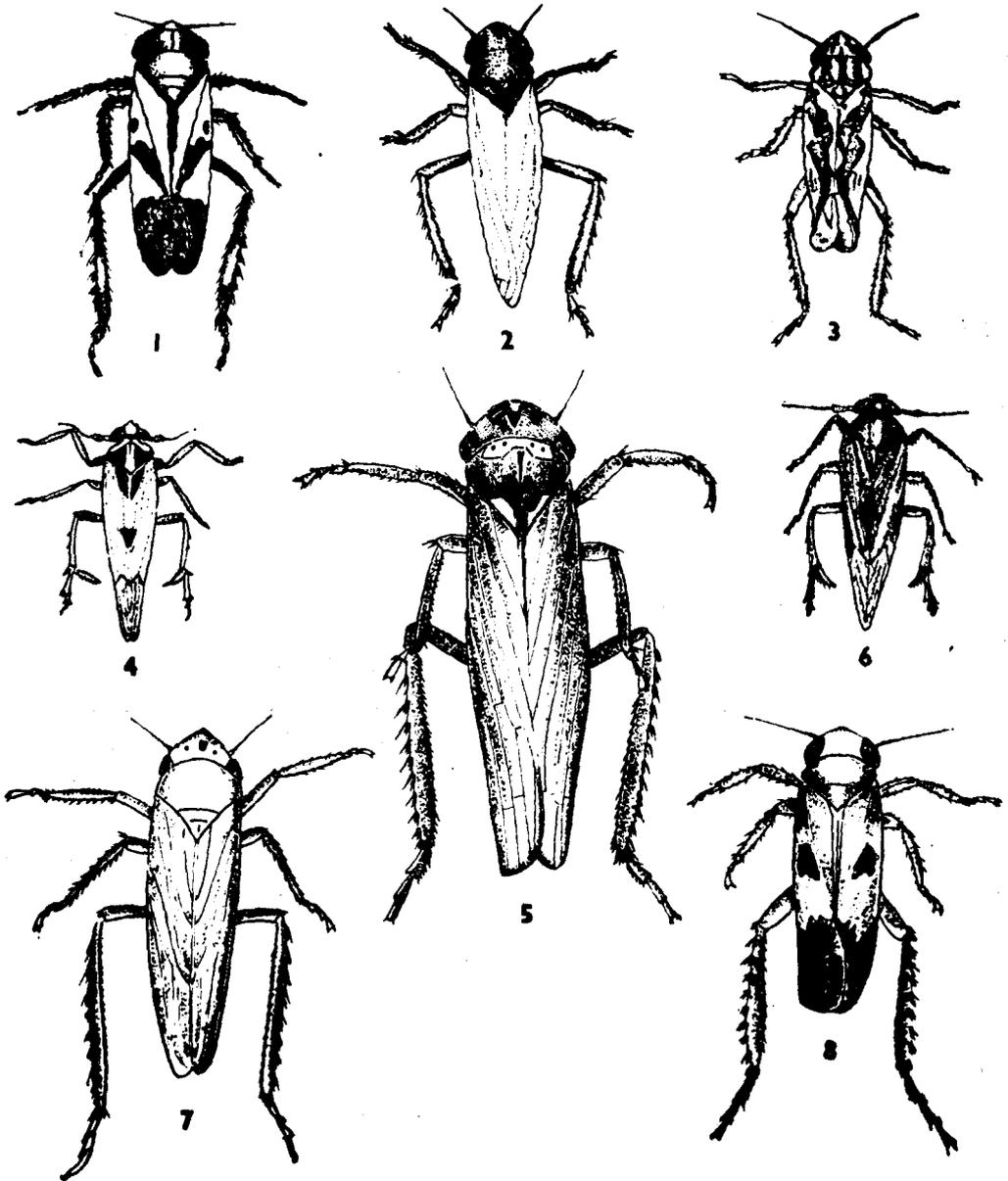
The female can lay upto 286 eggs in as many as 29 egg masses with 3-18 eggs in each mass. Invariably the female covers the oviposition area by a whitish gelatinous substance.

The eggs take 8-9 days for hatching during August-September. There are 5 instars before the nymph becomes an adult. The 1st, 2nd, 3rd, 4th and 5th instars take 6-7, 4, 4, 4 and 6 days respectively. The total period from egg to adult takes 34 days. Females live for 45 days.

(6) *Typhlocyba maculifrens* Motsch :

This is a blue leaf hopper. This is very small (smallest among all under study) with vertex and pronotum yellow. The forewings are blue and there is a big black patch in the middle of the vertex (Fig. 2). This leaf hopper is a new record on rice.

The leaves attacked by this leaf hopper show characteristic whitish wavy lines



Figs. 1-8. Male specimens of leaf and plant hoppers :

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| (1) <i>Nephotettix apicalis</i> Motsch | (2) <i>Typhlocyba maculifrons</i> Motsch |
| (3) <i>Inazuma dorsalis</i> (Motsch) | (4) <i>Sogatella furcifera</i> (Horv.) |
| (5) <i>Cicadella spectra</i> Dist. | (6) <i>Nilaparvata lugens</i> (Stål) |
| (7) <i>Kolla mimica</i> Dist. | (8) <i>Nephotettix impicticeps</i> Ish. |

on the leaf blades. Later on the leaf starts drying up. The leaf sheaths are also attacked in severe cases. They attack mostly seedlings in the seed bed as a result of which high mortality of seedlings occurs.

No virus is reported to be transmitted by this leaf hopper.

The eggs are laid singly or in batches of 2,3 or 4 in the leaf sheath or adjacent areas of midrib (commonly on the upper midrib of leaf blade). A single female can lay upto 64 eggs. Freshly laid eggs are clear but become brown when they grow older. Red eye spots are seen before hatching.

The eggs take 10-11 days to hatch during the month of February when the maximum temperature is 31.6°C and the minimum 16.0°C, the R. H. is 61-62%. There are 5 instars before it becomes an adult. The 1st, 2nd, 3rd, 4th and 5th instars take 3, 3, 3, 2 and 2-3 days respectively. The total period from egg to adult takes about 23-25 days. The adult female lives for 45-50 days.

PLANT HOPPERS

(1) *Nilaparvata lugens* Stål :

This is commonly called the brown plant hopper. This plant hopper is brown to brownish black in colour (Fig. 6).

Leaves attacked by this plant hopper become yellow, dry up and the whole plant dies after a few days. In the later stage of attack, the plants become stunted, there is sickly appearance in the plants with huge number of cast skins floating in the water and also adhering to the plants. There is also sooty mould development in the plants. The leaf sheath becomes dirty brown in colour.

This plant hopper has been reported to be the vector of grassy stunt disease (Rivera *et al* 1966).

The female lays eggs mostly in clusters in the leaf sheaths and in the fleshy basal portions of the midrib of the leaf. The eggs laid are so closely packed that counting of eggs in case of plant hoppers is more difficult than leaf hoppers.

One female can lay upto 681 eggs during its life time in as many as 158 egg masses with one to 16 eggs in each egg mass. The egg caps in the mass are tightly held to the surrounding tissue when freshly laid but become gradually loose when the eggs get older.

The eggs take 12 days to hatch during the month of December when the maximum temperature is 27.1°C and minimum is 13.5°C and R. H. being 90-91%. There are 5 instars before the nymph becomes an adult. The 1st, 2nd, 3rd, 4th and 5th instars take 3, 4, 10, 8, 5 days respectively. The total period from egg to adult takes 42 days.

(2) *Sogatella furcifera* Horvath :

This is a white-back plant hopper (Fig. 4).

The attacked plants show greenish yellow colouration in the leaves. The attack by these plant hoppers on young seedlings will result in the death of the seedlings. In the grown up plants, the attack results in production of sickly yellow leaves with huge number of white cast skins of the nymphs in the plant as well as in the surrounding water. There is also sooty mould development in the plants.

The female lays eggs in the leaf sheath and in the midrib of leaves. The ovipositional site is characterised by black

streaks. One female can lay upto 758 eggs in as many as 112 egg masses with one to 24 eggs in each egg mass.

The eggs hatch in 6 days during September when the maximum temperature is 32.7°C and the minimum is 25.3°C, the R. H. being 83-85%. There are five instars before it turns into adult. The 1st, 2nd, 3rd, 4th and 5th instars take 4, 2, 5, 4 and 2-3 days respectively. The total period from egg to adult is about 23-24 days. The females live for about two months.

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