5. RECENT PROGRESS IN RICE INSECT RESEARCH IN VIETNAM

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Introduction

Rice is the main food crop is S. Vietnam. Of the country's 3 million hectares of cultivated area, about 2,520,000 ha are under rice cultivation in 1970–1971. Yields of local varieties are low, averaging 2 tons per hectare. In 1964 S. Vietnam was still capable of exporting 48,651 tons of rice, but since 1965 when the security conditions in the countryside became worse and worse, the majority of the farmers have left their lands to either move to the cities or join the Armed Forces of the Republic of Vietnam. S. Vietnam, therefore, has had to import rice to meet domestic requirements. In 1967 alone, she had to import 765,090 tons of polished rice, the highest amount to be imported by any country in the world (Anonymous, 1970).

With the view toward making the country self-sufficient in rice production, since 1967 S. Vietnam has begun growing high-yielding varieties such as IR-8 and IR-5 which were released by the International Rice Research Institute in the Philippines. Under optimum conditions they may give up to 8 tons per ha. The total acreage under IR variety cultivation amounts to 750,000 ha in 1971.

From 1971 to 1975 within the framework of the Five-Year Rural Economic Development Plan which was launched by the Government in 1970, IR-20 and IR-22 varieties will replace IR-8 and IR-5.

Besides recommending the use of improved rice varieties the Plan also advocates the following practices for increasing rice production: (a) rational use of fertilizers, (b) improved cultural techniques and (c) control of insect pests and diseases.

Control of pests and diseases is thus recognized as one of the factors which will bring about an increase in rice yield.

Research on insect pests was carried out by the "Institut des Recherches Agronomiques de l'Indochine" long before World War II. Research activities were hampered from 1939 to 1954, and most of the data collected was either lost or transferred to France or Cambodia.

Entomological work was greatly encouraged by the Government with the creation of the Plant Protection Service in the Ministry of Agriculture in 1962. However, with so few technicians (for a country of 172,102 sq. km., S. Vietnam has only 5 college-trained Entomologists and out of these only one actually works on the control of insect pests of all crops), not much has been accomplished especially in the field of ecology and physiology. A lack of qualified entomologists is one of the most serious problems S. Vietnam has to encounter now and in the near future.

There are now about 31 known species of insect pests (anonymous, 1964). They are:

Order Lepidoptera
Pyralidae
Tryporyza incertulas

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T. innotata
Chilo suppressalis
Cnaphalocrosis medinalis
Nymphula depunctalis
Noctuidae
Sesamia inferens
Spodoptera mauritia
S. litura
Pseudaletia unipuncta
Hesperidae
Parnara guttata
Nymphalidae
Melanitis ismene
Order Orthoptera
Acridiae
Patanga succincta
Oxya velox
Gryllotalphidae
Gryllotalpha africana
Order Thysanoptera
Thripidae
Thrips oryzae
Order Coleoptera
Hispidae
Hispa armigera
Curculionidae
Echinocnemus sp.
Order Diptera
Cecidomiidae
Pachydiplosis oryzae
Order Homoptera
Cicadellidae
Nephotettix apicalis
N. impicticeps
Inazuma dorsalis
Delphacidae
Sogatella furcifera
Nilaparvata lugens
Nisia atrovenosa
Order Hemiptera
Coreidae
Leptocorisa acuta
Clethus punctiger
Pentatomidae
Nezara viridula
Scotinophara coartata
S. obscura
Menida bengalensis
Lagynotomus elongatus

Distribution of Major Species of Rice Insects

Of the total 31 species that we know so far, rice stem borers, planthoppers, leafhoppers, rice leaf folders and gall midge cause extensive damage throughout S. Vietnam.

(1) Rice stem borers

Three species of rice stem borers are widespread. They are: yellow rice borer *Tryporyza incertulas,* striped stem borer *Chilo suppressalis* and pink borer *Sesamia inferens*. Another species of borer, which was identified by Professor F. Y. Yen (Yen, 1967) of National Taiwan University as the white rice borer *T. innotata,* is known to have occurred only in Phong-Dinh, An-Giang, Bien-Hoa and Gia-Dinh Provinces. *T. incertulas* and *C. suppressalis* are the most important pests while *S. inferns* and *T. innotata* are less serious.

According to a study made at LongDinh Rice Experiment Station in DinhTuong Province (Delta Region) in 1963–64 (Quyen, 1964) by the Plant Protection Service entomologist, *T. incertulas* had 4 generations a year and *C. suppressalis* 6. The former occurred in great numbers from November to December when the water level in the paddies was low, 10–15 cm, and the average monthly rainfall was from 100 to 150 mm; the latter, on the contrary, occurred abundantly from August to October when the average monthly rainfall was from 150 to 230 mm. *C. suppressalis* is, therefore, more serious on the wet season crop and *T. incertulas* on the dry one. There has not been any such study of stem borers in the northern most provinces; however, we do know that *C. suppressalis* is more serious than *T. incertulas* in that region, especially during the 3rd lunar month crop when the weather is usually cold.

Damage caused by stem borers to local varieties had been serious before, and losses of up to 30–40% sometimes had occurred. But since the introduction of the new varieties IR-20 and IR-22, stem borer incidence has become less and less severe.

(2) Rice leafhoppers and planthoppers

Rice green leafhoppers *Nephotettix apicalis and N. impicticeps*: the zigzag leafhopper *Inazuma dorsalis,* the brown planthopper *Nilaparvata lugens*; and the white-back planthopper *Sogatella furcifera* are the five most important species. A sixth species, *Nisia atrovenosa,* has been found only in the green-house at the Plant Protection Service in Saigon.

From 1962 to 1965 *N. apicalis* and *N. impicticeps* caused the most damage to the rice plants throughout S. Vietnam, but since 1965, due to unknown reasons, they have become less and less serious. *N. lugens* and *S. furcifera,* on the other hand, have become more and more abundant every year. *I. dorsalis* has been found sporadically in Gia-Dinh, Bienhoa and Phongdinh provinces and is of minor status.

A study of the ecology of the white-back planthopper, *S. furcifera,* in the green-house in Saigon in 1968 (Ngoan 1968) was jointly carried out by the Plant Protection Service entomologist and the entomologist of the Chinese Agricultural Technical Group to Vietnam. According to the report, *S. furcifera* has up to 16 generations a year ranging from 17.5 to 37.2 days each. Females begin to lay eggs 3 or 4 days after couplation, and eggs are laid in the tissues of the leaf sheath in masses of 5 to 20 eggs each. Each female is capable of laying up to 300 eggs. The incubation period ranges from 5 to 10 days and the nymphal stage lasts from 9.6 to 14.0 days.

N. lugens and *S. furcifera* usually attack the rice plants during tillering, differential, booting and heading stages causing loss of vegetation, reduction of tillers, leaf withering, empty rice panicles and in severe cases, hopperburn. A study made in 1970 at LongDinh Rice Experiment Station during the wet season crop (Ngoan, 1970) showed that from the 14th to the 82nd day after transplanting, the total numbers of planthoppers (white-back and brown) per 15 hills increased from 10 to 5450. The percentage of *S. furcifera* decreased from 90.1% at the beginning of the season to 1.1% 20 days before harvest, and that of *N. lugens* increased from 9.9% to 98.9% during the same period (Table 1). Hopperburn was, therefore, caused mostly by *N. lugens*.

Table 1. Hopper population and composition at Long Dinh.

Date	Days after transplanting	Hopper population (15 hills)	Composition (%)	
			S. furcifera	N. lugens
July 17, 1970	14	10	90. 1	9. 9
31, 1970	28	33	87. 8	12. 2
Aug. 12, 1970	40	49	55. 1	49. 9
26, 1970	54	353	4. 3	95. 7
Sept. 23, 1970	82	5350	1. 1	98. 9

In Cailay (Ngoan, 1970 b), also in DingTuong Province, almost the same information was found during the first season crop in 1970 (Table 2).

Table 2. Hopper population and composition in Cailay.

Date	Days after transplanting	Hopper population (15 hills)	Composition (%)	
			S. furcifera	N. lugens
June 10, 1970	28	76	94. 73	5. 26
24, 1970	42	141	99. 28	0. 70
July 6, 1970	56	121	77. 68	22. 31
22, 1970	70	560	49. 02	50. 98
Aug. 7, 1970	96	4922	22. 31	77. 69
28, 1970	115	5561	1. 30	98. 70

Before 1967, planthoppers and leafhoppers did occur and cause damage to local varieties but not to the same extent as they do today. There are many reasons for this: (a) high nitrogen application rates for newly introduced varieties; (b) high humidity during the wet season; (c) close spacing; (d) great number of tillers per hill; (e) little air movement bewteen hills. When these favorable conditions arise hopper population increases rapidly and hopperburn often occurs.

Planthopper damage seems to be the main limiting factor in rice production as far as insect pests are concerned.

(3) Rice leaf folders and rice gall midge

With the introduction of new rice varieties new problems also arise. To local varieties, the rice leaf folder *Cnaphalocrosis medinalis* and the rice gall midge *Pachydiplosis oryzae* only cause damage sporadically but they cause great losses to IR-varieties. In some instances, they completely wipe out thousands of hectares. Worse yet, their histories and their seasonal occurance have not been throughly understood.

Chemical Control of Major Insect Pests of Rice

Control studies have been carried out against rice stem borers, planthoppers and leafhoppers at LonDinh Rice Experiment Station and HiepHoa Improved Village. A number of insecticides have been tested but only Endrin, Sevin, Malathion, DDT, Diazinon, gamma BHC have been recommended to the farmers (anonymous, 1965).

(1) Rice stem borer control

In 1963 Endrin (0.06%), Sumithion (0.07%), E. I. 43064 (0.04%) and Dieldrin (0.10%) were tested at LongDinh Rice Experiment Station (Quyen 1964). Only Endrin applied at 3-week intervals proved to be effective (Table 3).

Table 3. Effectiveness of insecticides against *Tryporyza incertulas*.

Insecticides	% Control				Mean %	Yield kg/ha
	Rap. I	II	III	IV		
Endrin	56.42	58.90	57.21	34.55	51.77	4,185
Sumithion	31.17	34.93	51.86	63.64	45.40	3,785
EI. 43064	46.03	69.70	21.22	33.34	42.57	3,405
Dieldrin	22.73	76.86	10.13	44.00	38.43	3,345
Check	—	—	—	—	—	3,155

In 1967 granular systemic insecticides were introduced into S. Vietnam and tested at HiepHoa Improved Village in BienHoa Province (Ngoan, 1969). Sevidol, Diazinon and gamma BHC at 2 kg/ha were applied to the water surface. A randomized complete block design with 4 replications was used. Each plot was 50 sq. m. During the experiment the water level in the field was kept at 10–15 cm. Results (Table 4) indicated that Diazinon-treated plots gave the highest yield, followed by Sevidol plots.

Table 4. Effectiveness of insecticides against *Chilo suppressalis*.

Intici̇cides	Dosage	Dead heart		White head		Yeild (kg/ha)	Index
		%	angle	%	angle		
Gamma BHC	2 kg/ha	0.16	1.87	2.80	9.61	4,100	120.0
Sevidol	—	0.11	1.37	3.70	10.09	4,860	150.0
Diazinon	—	0.08	1.32	3.50	10.67	5,050	156.0
Check	0	0.70	4.67	4.90	12.36	3,230	100.0

Another test was carried out at LongDinh Rice Experiment Station (Ngoan, 1970) during the wet season crop of 1970 to determine the effectiveness of 9 insecticides against the rice stem borer. Granular insecticides were applied to the water surface on

Table 5. Timing of application.

Insecticides	Days after transplanting and dosage				
	14	35	42	56	77
Endrin EC	1 liter	1		1	1
Endrin G	2 kg		3		
Unden	2		3		
Terracur	2		3		
Diazinon	2		3		
Gamma BHC	2		3		
Thimet	2		3		
Sandoz 6626	2		3		
Cyolane	2		3		
Check	0		0		

the 14th and 42nd days after transplanting while Endrin was applied 4 times at 3-week intervals (Table 5). Results showed that during the first half of the season, Endrin and Diazinon proved to be effective. During the second half there were no significant differences between the treated plots and the check because there was an interval of more than one month between the last application and the observation date (82 days after transplanting). Endrin, on the other hand, was applied for the last time on the 77th day, but was washed off by heavy rain (Table 6).

Table 6. Effect of insecticides on borer damage at Long Dinh.

Insecticides	Dead hearts (angle)	White heads (angle)	Yield (kg/8 sq.m)
Endrin EC	5.96	11.55	2.842
Endrin G	12.04	7.05	2.525
Unden	7.54	6.79	3.235
Terracur	10.58	5.71	2.920
Diazinon	5.65	9.32	2.598
Gamma BGC	9.69	6.78	3.295
Thimet	10.96	8.62	2.575
Sandoz 6626	15.52	4.52	2.890
Cyolane	10.11	12.10	1.925
Check	11.44	10.91	2.195
l.s.d. 5%	5.45	5.48	0.487
1%	7.36	7.40	0.635

Data collected from the ecological plot (plot not treated with insecticides) showed that the borer population started to increase from the 28th day after transplanting and was the highest on the 82nd day (Table 7).

Two applications of granular insecticides, therefore, appear to be needed. The 1st application takes place on the 28th day, and the 2nd on the 56th day. For Endrin EC, there should be about 4 applications at 3-week intervals.

Table 7. **Borer population in ecological plot.**

Date	Days after transplanting	% Damage
July 17, 1970	14	0
31, 1970	28	0.81
Aug. 12, 1970	40	1.09
26, 1970	54	4.22
Sept. 27, 1970	82	4.50

Granular systemic insecticides have proved to be effective and convenient. Farmers like them very much because they no longer have to purchase expensive spraying machaines.

(2) Leafhopper and planthopper control

Malathion, DDT and Sevin had been recommended to the farmers for control of leafhoppers and planthoppers. Since 1967 gamm BHC, Diazinon and Sevidol have also been added to the list.

Ngoan (1970) found out that among 9 insecticides tested against planthoppers, Unden, applied 2 times at 28 day intervals, proved to be the best. Gamma BHC, Diazinon and Thimet also gave good control. Cyolane was the least effective (Table 8).

Table 8. **Planthopper population (88 days after transplanting).**

Insecticide	Replication			Total	Mean
	I	II	III		
Endrin EC	570	508	285	1363	454
Endrin G	750	320	403	1473	491
Unden	54	23	15	92	30
Terracur	411	337	512	1260	420
Diazinon	391	195	145	731	243
Gamma BHC	286	154	210	650	216
Thimit	225	205	335	765	255
Sandoz 6626	520	396	165	1081	360
Cyolane	685	745	1110	2540	846
Check	460	625	407	1492	497
l.s.d. 5%					230
1%					311

Unfortunately, Unden and Thimet are not available on the market in S. Vietnam for the time being.

(3) Rice leaf folder and gall midge control

Work on rice leaf folder and gall midge control has not been carried out. At present Endrin (0.06%) and Diazinon (2 kg/ha) are recommended. To better cope with a future cutbreak of these pests studies should be made on their life histories, seasonal occurrence, and control methods.

Future Projects

One of the most urgent problems S. Vietnam has to solve now is to train more entomologists. Lack of qualified technicians is the main reason why rice insect research has not been carried out more extensively.

With the cooperation of the Korean Agricultural Technical Group to Vietnam, physiological and ecological studies of rice stem borers will be made when the wet season crop starts this year. Newer insecticides such as Ambithion, Furadan and MIPC will also be tested along with Unden, Terracur, gamma BHC, Thimet, and Diazinon against rice stem borers, planthoppers, the rice leaf folder and the gall midge.

Since security conditions have improved lately, light traps will be set up again this year at 10 pilot sites chosen from 10 provinces, known to have been seriously damaged by rice stem borers, to gather data for future use in forecasting the occurrence of these pests. In order to obtain accurate light-trap data cadres from different provinces have just finished a short course on rice insect identification in Saigon. Before 1965, light traps were set up throughout S. Vietnam, but when the countryside became unsafe for cadres to operate light traps, this program was interrupted.

A survey of the natural enemies of insect pests of rice should be made, and biological control methods should be evaluated.

Discussion

Soenardi, Indonesia: The white rice borer is also found in Vietnam. Can you give me some information on the followings: 1) What is the average altitude of the area where that insect is found? 2) What is the annual rainfall and how is the distribution? 3) How many rice crops are grown annually in that area? 4) What crops are grown in that area? 5) How is the crop rotation?

Answer: 1) The white rice borer is found in Giadinh, BienHoa, An-Giang and Phong Dinh Provinces which are found at an altitude of less than 100 m. 2) I'm sorry I don't remember the exact figure but it's usually high. 3) Two crops are annually grown in those areas. 4) Only rice is grown. 5) There is no rotation.

K. Kiritani, Japan: Does actually *S. furcifera* can repeat as many as 16 generations a year under natural conditions as reported by a Chinese scientist.

Answer: The study of life history of *S. furcifera* was carried out in the greenhouse. I doubt very much if they could produce so many generations a year under natural conditions.

R. Kisimoto, Japan: I suppose that population growth of the plant hoppers is caused by the immigrants soon after transplantation. 1) Where do these immigrants come from? 2) Is there any other host plant other than the rice plant? 3) Do you have outbreaks of a large scale, and if any, how is the scale?

Answer: 1) We have no data concerning the migration of plant hoppers. 2) Rice is the only crop grown in the region. 3) Yes, we do have. Thousands of hectares have been destroyed every year.

M. D. Pathak, IRRI: Regarding the statement on page 137—sixth paragrah, is this based on the light trap or actual field plot sampling?

Answer: It was based on the field plot sampling,

M. D. Pathak, IRRI: I understand that IR 20 is performing very well in Vietnam. Do you have any data on insect infestation on this variety?

Answer: IR 20 is seriously damaged by plant hoppers, especially, a brown plant hopper *Nilaparvata lugens,* but not by stem borers.

N. Kimura, Japan: Have you any rice insect pest on floating rice, in case you have floating rice in your country.

Answer: We could not find out the rice stem borer on floating rice, but we can see rice leaf hoppers on it.

T. Hidaka, Japan: What is the percentage caused by the rice gall midge in Vietnam at the present time?

Answer: Usually the percentage of the damage is from 30–40% on IR varieties.

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