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¹⁴C INTAKE OF NILAPARVATA LUGENS (STÅL) (HOM., DELPHACIDAE) OF DIFFERENT SEXES AND WING-FORMS FROM ¹⁴C- LABELLED RICE SEEDLINGS

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The difference between the male and female, and the macropterous and brachypterous forms of *N. lugens*, a serious insect pest on rice, has been mainly discussed in the morphological (Hasegawa 1955; Kisimoto 1957; Mochida 1970), bionomical (Kisimoto 1957; Suenaga 1963; Mochida 1964ab, 1970), anatomical, and histological aspects (Mochida 1970). However, the difference in the amount of plant-sap ingested by the males and females of the two wing-forms has not yet been studied despite the economic importance of the delphacid. The present paper deals with the amount of ¹⁴C ingested by *N. lugens* of different sexes, wing-forms, and developmental stages.

Methods

Seven days' seedlings of the paddy rice variety 'Toyotama' were photosynthesized in ¹⁴CO₂ (100 ml chamber, 1% CO₂, ¹⁴C 10 µCi or 3000 ml chamber, 1% CO₂, ¹⁴C 1000 µCi). Adults or 5th-instar nymphs were kept on the ¹⁴C-labelled seedlings for 24 hours. After feeding, the insects were immersed in a scintillation solution, Toluene — PPO (2, 5-diphenyloxazole) — POPOP (1, 4-bis-2-(5-phenyloxazolyl)-benzene), and the ¹⁴C in the insects was measured by a Tri-Carb liquid scintillation counter (Packard, model 2002). The ¹⁴C in the seedlings used was assayed in a scintillation solution, PPO (4 g)-POPOP (0.1 g)-Naphthalen (75 g) in Toluene:Dioxane:Ethylcellosolve (1:1:1 v/v), after they were homogenized. All the insects were reared at about 27°C.

Results and discussion

A group of 12 adults, 3 for each sex and wing-form, was reared on one ¹⁴C-labelled seedling (about 8.3×10⁵ cpm) for 24 hours, and the amount of ¹⁴C of the insects was measured. The amount of ¹⁴C of 5th-instar nymphs was also measured from a group of nine 5th-instar nymphs and nine macropterous males kept together on another ¹⁴C-labelled seedling for 24 hours.

The means and relative values for the amount of ¹⁴C ingested are given in Table 1. In the ability for the ¹⁴C intake males were smaller than females, and macropterous adults of each sex were smaller than brachypterous ones. The ¹⁴C intake of 5th-instar nymphs was about 2 to 6 times as large as that of adults.

Table 1. ^{14}C intake by different sexes and wing-forms from ^{14}C -rice seedlings at about 27°C for 24 hours.

Sex & wing-form	No. individuals measured	^{14}C ingested (cpm)			Mean	Rel. value for mean
		min.	med.	max.		
Males*						
Macropterous	3	53	230	319	200.7	1.00
Brachypterous	3	225	330	527	360.7	1.80
Females**						
Macropterous	3	237	606	644	495.7	2.47
Brachypterous	3	126	204	1261	530.3	2.64
5th-instar nymphs	9	101	779	3290	1205.3	6.01

* 10 days old unmated. ** 7 days old mated, laying eggs.

All the three macropterous 7 days old females shown in Table 1 were in the ovipositional period. The amount of ^{14}C ingested by six macropterous 0 to 2 days old females in the preovipositional period was measured for comparison. The mean of ^{14}C ingested was 496.0 cpm with a range of 244 to 935 cpm, and the relative value of ^{14}C intake was 2.47 when the mean of ^{14}C ingested by macropterous males was unity. Both measurements for the females in the preovipositional and ovipositional periods resulted in the same relative value, 2.47.

The amounts of ^{14}C ingested by the adults of both sexes and both wing-forms were closely correlated to the fresh and dried body weights ($r=+0.858$ and $+0.906$, respectively), and water content within the body (-0.987), as shown in Table 2.

Table 2. Relations between the amount of ^{14}C ingested and the body weight.

Sex & wing-form	Rel. value for mean amount of ^{14}C ingested A	Fresh body weight (mg) /insect B	Dried body weight (mg) /insect C	Water content (mg)/insect (%)	
				D	E
10 days old males					
Macropterous	1.00	1.300	0.375	0.925	71.2
Brachypterous	1.80	1.325	0.475	0.850	64.2
7 days old females					
Macropterous	2.47	2.100	1.000	1.100	52.4
Brachypterous	2.64	2.850	1.400	1.450	50.9
5th-instar nymphs	6.01	1.240	0.380	0.860	69.4
Correlation coefficients between A and B, C, D, and E, excluding 5th-instar nymphs	—	+0.858	+0.906	+0.748	-0.987*

* Significant at 5% level, d.f.=2.

Nuorteva (1960, 1962, 1965) indicated that the damage caused by *Javesella pellucida* (Fabricius) (Delphacidae) to oats is more serious by female than by male adults. He (1960) also implied that the egg-formation in the ovaries of *J. pellucida* may be associated with the salivary secretion and the severity of the damage to oats. Yamamoto & Suenaga (1957) showed that the ^{32}P intake of adults from ^{32}P -labelled rice seedlings is about 30% of that of 3rd- to 5th-instar nymphs in *Sogatella furcifera* (Horváth) (Delphacidae). In the present investigation *N. lugens* adults in the preovipositional period were shown not to be different in the amount of ^{14}C ingested from those in the ovipositional period. The

amounts of ^{14}C ingested by *N. lugens* of different sexes, wing-forms, and developmental stages are probably associated with the degree of damages to rice plants. Fifth-instar nymphs showed the largest amount of ^{14}C -ingestion despite their lighter body weights. Nymphs at late stages are considered to be more serious to rice plants than adults. This agrees with the results obtained in *S. furcifera* by Yamamoto & Suenaga (1957).

Summary

1. As an indicator of the activity of plant-sap ingestion, ^{14}C intake of adults and nymphs from ^{14}C -labelled rice seedlings was examined in *Nilaparvata lugens*.
2. Relative values for ^{14}C intake of macropterous and brachypterous males and females, and 5th-instar nymphs were 1.00, 1.80, 2.47, 2.64, and 6.01, respectively.
3. There was no quantitative difference in ^{14}C ingested by macropterous females between the preovipositional and ovipositional periods.
4. The degree of ^{14}C ingestion was closely correlated to the body weight and water content of adults. Fifth-instar nymphs ingested the largest amount of ^{14}C despite their lighter body weights.

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