Variation of *Thrips tabaci* in colour and size

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Abstract: Adult colour and body size in two colour strains of *Thrips tabaci* were observed under different temperatures. Thrips were reared from hatch to adult emergence at low temperature (15 °C) or high temperature (25 °C) and long photoperiod (L16: D8). Temperature during the pupal stage determined darkness of adult body colour. In both strains, adult body colour darkened under lower temperature, even when the larval stage was raised under high temperature. Colour darkness of adults at every temperature condition was significantly different between the two strains, and the dark strain individuals were bigger than pale strain individuals. Adult body size was determined by the temperature during the larval stage, being bigger under low temperature than high temperature. Nucleotide substitution in the two strains was detected on cytochrome oxidase subunit 1 (CO1) of mitochondrial DNA and internal transcribed spacer 2 (ITS2) of ribosomal DNA.

Introduction

It is well known that thrips body colour changes depending on season. Sakimura (1937) stated that there were more than three different types of *Thrips tabaci* in Japan, but there is no data on the cause of this variation in colour and size. Intraspecific variation in *T. tabaci* in Japan might be expected to be small because of thelytokous reproduction, but the variation among different populations has not previously been examined. In this study, we assess whether colour and body size of *T. tabaci* are determined genetically or environmentally.

Materials and method

Two strains of *T. tabaci* were collected from a field population on radish at Rokunohe, Aomori, in northern Japan in September 2000. Both strains of *T. tabaci* tested were produced asexually, resulting in an all-female sample, i.e. thelytokous reproduction. Thrips were reared on germinated broad bean seeds using Murai's method (REF??), and cultures were kept in a thermostatic cabinet set (SANYO Co. MIR-151) of 20 +1°C and 16L: 8D photoperiod. Thrips were reared under the combination of low temperature (15°C) and high temperature (25°C) in larval and pupal stage. Body colour on head, thorax and abdomen was measured by grey scale of Photoshop® 3days after adult emergence. Body size was measured on head width and body length by a digital microscope (VH-7000, Keyence Ltd., Osaka) at the same time.

DNA sequencing was conducted on five individuals of both strains. Preparations for DNA sequencing followed conventional methods (REF??).

Results and discussion

Body colour of adults reared under different temperatures was evaluated using Photoshop software (Table 1). Adult body darkness was determined by temperature during the pupal stage. In both strains, adult body colour darkened when pupae were reared under lower temperature, even though the larval stage was raised under high temperature. Colour darkness of adults at every temperature condition was significantly different between the two strains, and the dark strain was bigger than the pale strain.

Body sizes measured by a digital microscope are shown in Table 2. Body size of adult was determined by the temperature during larval stage and became bigger under low temperature than high temperature. There was a significant difference on body size between two strains.

Nucleotide substitution of two strains was detected on Cytochrome Oxidase subunit 1 (CO1) of mitochondrial DNA and Internal Transcribed spacer 2 (ITS2) of ribosomal DNA. CO1 consisted of 574 base pairs and ITS2 of 521 base pairs in both strains. Only one nucleotide in CO1 and two nucleotides in IS2 were different between the two strains.

		Colour index (percentage of black on grey scale)		
Strain	**Treatment***	**Eye**	**Thorax**	**Abdomen**
A	HH	81.8±1.5	72.2±3.3	79.9±5.3
	HL	86.1±1.3	86.0±2.0	91.2±2.1
	LH	84.0±0.8	76.4±1.7	81.3±3.0
	LL	84.6±1.0	84.0±1.8	90.2±3.1
AL	HH	79.1±1.5	62.0±2.6	64.8±1.8
	HL	82.4±1.5	78.8±2.9	84.0±3.3
	LH	77.4±1.4	61.9±1.5	64.9±2.6
	LL	81.7±1.2	75.5±2.4	83.3±3.1

*: H; 25° C, L; 15° C, larval stage-pupal stage

Table 1. Colour darkness of two strains of *Thrips tabaci*

		Body size in micro meter	
Strain	**Treatment**	**Length**	**Width**
A	HH	1043.2±38.2	139.6±2.2
	HL	1000.3±32.8	140.6±3.1
	LH	1021.6±75.1	144.0±2.7
	LL	1136.4±38.8	148.8±3.8
AL	HH	934.4±43.4	122.8±4.3
	HL	869.2±43.2	114.0±3.8
	LH	1033.9±59.5	122.5±3.5
	LL	965.1±83.3	125.3±3.0

Table 2. Body size of two strains on *Thrips tabaci*

Although the number of different nucleotide was a few in both CO1 and ITS2, genetic difference was detected between these two strains of *T. tabaci*. It is not confirmed whether this difference is associated with colour and size. Variation on colour and size may be due to genetic factor.

Loomans (1997) stated that the thrips parasitoid, *Ceranisus menes*, differed in the number of parasitized offspring on dark and pale strains of *T. tabaci*, being more efficient in parasitizing the dark than the pale strain. This difference might be due to body size. Sakimura (1962, 1969) discussed the colour forms of *Frankliniella occidentalis* and *F. schultzei* in relation to transmission of tomato spotted spot virus. Despite their small size, thrips have complex relationships to their environment. Variation in colour and size is affected by environmental as well as genetic factors, and may be associated with relationships between thrips, their host plants, their natural enemies, and Tospovirus transmission.

References

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