Chromosomal Polymorphism in Sweet Potato Weevil, *Cylas formicarius*

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The sweet potato weevil, *Cylas formicarius* (*sens. lat.*) occurs throughout the tropical and subtropical regions of the world where it infests sweet potato, *Ipomoea batatas*, both in the field and in storage. It presumably entered the United States from the West Indies, with the first case reported in the vicinity of New Orleans in 1875 (Edmond 1971). This insect has now spread throughout the eastern half of Texas, the southern one-third of Louisiana, the coastal counties of Mississippi, Alabama, and Florida and certain areas in the lower coastal plain in South Carolina. Because of its concealed feeding habit, it is difficult to control this pest with conventional insecticide application. As part of a project to develop genetic control methods against this pest, a cytogenetic study of the sweet potato weevil was carried out at the University of Guam in 1979-1980.

Materials and methods

The insects used in this study were obtained from laboratory colonies maintained at the Asian Vegetable Research and Development Center (Taiwan) (AVRDC), Louisiana State University (Baton Rouge) (LSU), the University of Hawaii (Honolulu), and from infested sweet potato on Guam and Tinian. These five cultures were maintained individually in one-gallon glass jars with sweet potato at 28°C. Pupae were collected by manually breaking open the potatoes. Chromosome preparations were made using the technique of Hung *et al.* (1972). At least 20 well spread cells from either ovaries or testes were studied in each pupa. Chromosome photographs were taken with a Wild M20-EB Phase Microscope using Fuji Minicopy film.

Results and discussion

Manna and Lahiri (1972) and Sharma *et al.* (1980) reported $10AA+Xy_p$ as the chromosome number and sex determining mechanism in *C. formicarius* Fab. from India. According to Smith and Virkki (1978), the same karyotype is found in the Puerto Rican strain, *C. f. elegantulus* (Summers). This chromosome constitution was also found in most of the materials studied (Fig. 1). However, at

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Figs. 1-2. Chromosome constitution in sweet potato weevil. 1, Xy_p association in male from Hawaii. 2, XY and Xyy_p association in the testes of one male from Louisiana. (Arrows indicating sex chromosomes). Scale=10 microns.

least 3 sex chromosome systems were found in these materials, i.e., 10AA+XX for females in all cultures with the males showing either 10AA+XY or 10AA+Xyy_p or 10AA+XY_p. In some cases, two sex chromosome systems were found in the same male (Fig. 2 and Table 1). Therefore, most males from the LSU culture were 10AA+XY and a few individuals exhibited both XY and Xyy_p karyotypes. The culture from Hawaii had only Xy_p males. Those from Guam, Tinian and Taiwan were mostly Xy_p, but some were Xyy_p and a few had both the Xyy_p and Xy_p karyotypes in the same individual.

Table 1. Frequency of sex chromosome constitution in males from 3 localities

	XY	XY+Xyy _p	Xyy _p	Xyy _p +Xy _p	Xy _p
LSU	15	3	0	0	0
Hawaii	0	0	0	0	97
AVRDC	0	0	1	6	18

The Xyy_p sex determining mechanism has also been reported in the following 4 species of curculionids: *Scepticus insularis* Roelofs (Takenouchi 1969b), *Deporaus pacatoides* Voss (Takenouchi 1969c), *Diocalandra* sp. (Takenouchi 1969d), and *Deporaus unicolor* Roelofs (Takenouchi 1970). Takenouchi also reported chromosomal polymorphism in the weevils *Phyllobius longicornis* Roelofs (Takenouchi 1969a), *Baris ezoana* Kono (Takenouchi 1971), *Telephae kono*i Morimoto (Takenouchi 1972b), and *Catapionus gracilicornis* Roelofs (Takenouchi 1976). Intra-individual chromosomal variation has been reported in the weevils *Sitona* sp. (Takenouchi 1972a) and *Okikuruminus roelofsi* Harold (Takenouchi 1973). However, in most of these cases only the autosomes were involved. The results reported here represent the first case of male sex chromosome polymorphism among populations and within the germ line of the same individual curculionid beetle.

Although taxonomists refer to the Old World sweet potato weevil as *C. formicarius* and New World populations as *C. f. elegantulus*, there are no distinct morphological differences between my samples from Louisiana and those from Asia, even in the male genitalia (Horace R. Burke, personal communication). However, preliminary isozyme studies also show that the Louisiana culture is different from the other cultures in at least two enzyme systems (Hung, unpublished data). This and the fact that the Louisiana culture is the only one with an XY system indicates the possibility of reproductive incompatibility between New World and Old World sweet potato weevils. Unfortunately, cross-breeding information is not available for assessing this biological character.

Summary

Karyotype and sex-determining system of *Cylas formicarius* from Louisiana were determined as 10AA+XX in females, and 10AA+XY in most males with a few individuals exhibited both XY and Xyy_p karyotypes. The culture from Hawaii had only Xy_p males, those from Guam, Tinian and Taiwan were mostly Xy_p, al-

though some were Xyy_p and a few had both the Xyy_p and Xy_p karyotypes in the same individual.

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