

CELLS AND CHROMOSOMES OF THE SWEET POTATO WEEVIL, *CYLAS FORMICARIUS* (FABR.) (COLEOPTERA: CURCULIONIDAE) SAMPLED FROM LAGUNA AND ILOCOS NORTE¹

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ABSTRACT

Lacto-aceto-orcein preparations of Carnoy-fixed testicular tissues of newly emerged males of *Cylas formicarius* Fab. revealed variations in cells and chromosomes of local populations infesting sweet potato in Los Baños, Laguna and Batac, Ilocos Norte. Meiotic index of weevils from Los Baños ranged from 40 to 65%, those from Batac exhibited 30 to 52%. Relative lengths of labile autosomes and sex chromosomes at pachytene and diakinesis were different in the two local populations. Frequency of telomere joints was higher (32%) in Batac weevils than Los Baños weevils (12%).

Key words: Sweet potato weevil, *Cylas formicarius*, cells, chromosomes

INTRODUCTION

Sweet potato (*Ipomoea batatas* Lam.) is an important root crop in the Philippines and other tropical countries. It ranks seventh among the world's food crops. Its production is usually hampered by over 270 insect and mite pest species (Talekar, 1987). A major destructive pest of *I. batatas* is the sweet potato weevil, *Cylas formicarius* Fab. It renders a reduction in yield by as much as 60-100% in the absence of adequate control measure (Lavani, 1987). Several studies have been made and more studies are currently being conducted on the management of *C. formicarius*.

In the Philippines, *C. formicarius* exhibited varying effects and responses on the sweet potato. Such variation may be due to the differential resistance of host varieties against the insect pest or the genetic variation between and among populations of *C. formicarius*.

One way by which the genetic differentiation of insect pest population can be assessed is through cytological-cytogenetic investigations. Thus, the objective of the study. This paper, therefore, presents and compares the cells and chromosomes of populations of *C. formicarius* sampled from the Institute of Plant Breeding, Los Baños, Laguna and from the International Potato Center (CIP), Batac, Ilocos, Norte.

Sweet potato cultivars infested with *C. formicarius* from two locations, Institute of Plant Breeding (IPB), U.P. Los Baños, Laguna and International Potato Center, Batac, Ilocos Norte, were placed in screened containers. *C. formicarius* were allowed to multiply and served as stock cultures.

Newly-emerged male insects were fixed in freshly prepared Carnoy's fixative for 24 hours. Then, they were transferred to 70% ethyl alcohol. Testes of males were removed and macerated on a clean slide with a drop of lacto-aceto-orcein and covered with a cover glass. The prepared slide was heated on an alcohol lamp. Pressure was applied to flatten the cells. Slides were permanently mounted in Canada balsam after passing them through series of alcohol with increasing concentrations.

Cells and chromosomes of *C. formicarius* were observed and photographed under the oil immersion objective lens of the microscope.

RESULTS AND DISCUSSION

Lacto-aceto-orcein squash preparations of Carnoy-fixed testes of newly-emerged *C. formicarius* males revealed the details of its reproductive cytology.

In both populations of *C. formicarius* sampled from Batac and Los Baños, the most abundant reproductive cells encountered were the spermatogonia. They constituted 45% and 50%, respectively, of the gametic cells of male *C. formicarius*. These cells were oval and measured 25-30 μ long and 20-22 μ wide. The distinct nuclei were also oval and measured 12-15 μ in length and 8-10 μ in width. Within the nuclei were darkly stained 1.0-1.5 μ chromatin granules mostly attached to the laminal linings of inner membrane of the nucleus. The mononucleolus measured 2 μ in diameter.

Prior to meiotic divisions, the nuclei of gametic cells of *C. formicarius* exhibited gradual changes in size. So far, seven nuclear forms (Fig. 1) were observed from both populations of the weevil. Such nuclear differentiation exhibited increases in chromatin granules and nucleoplasmic area.

The dimensions of these forms are shown in Table 1.

In both populations, the most abundant nuclei (45-65%) were forms II, IV, and V whereas the rest of the nuclear forms occurred in almost equal numbers. Nuclear forms VI and VII constituted the leptoneuma or primary spermatocytes that signalled the onset of cell division.

The meiotic indices of newly emerged males of *C. formicarius* sampled from two localities, Batac and Los Baños, differed from each other. The meiotic index of male weevils from Batac ranged from 30% to 52% whereas those from Los Baños exhibited 40% to 65% indices. The Batac populations had more non-dividing cells than those from Los Baños. This observation indicated that the reproductive potential of the Los Baños weevils is relatively higher than that of the Batac weevils.

The primary spermatocytes of *C. formicarius* consisted of about 30% of the reproductive cells. They underwent the different stages of meiosis. At pachytene (Fig. 2), lengths of autosomes I, IV, V, VII, and X and sex chromosomes differed in the two populations. Table 2 shows the relative lengths of chromosomes of *C. formicarius* from Batac and Los Baños.

Table 1 Dimensions of the seven different nuclear forms of *C. formicarius* from Los Baños and Batac.

Nuclear forms	Dimensions (mm)	
	Length	width
I	.010	.007
II	.015	.012
III	.020	.016
IV	.025	.017
V	.025	.022
VI	.032	.025
VII	.042	.035

Table 2. Relative lengths of pachytene chromosomes of *C. formicarius* sampled from Batac and Los Baños.

Chromosome Homologues	Populations of <i>C. formicarius</i>	
	Batac	Los Baños
I	0.109	0.113
II	0.108	0.108
III	0.107	0.107
IV	0.085	0.087
V	0.087	0.092
VI	0.092	0.092
VII	0.086	0.086
VIII	0.087	0.087
IX	0.062	0.062
X	0.060	0.062
Sex-chromosome	0.30	0.028

At diakinesis (Fig. 3), the chromosomes condensed to 10 bivalent autosomes and univalent sex chromosome. Thus, the karyotypic formula for male *C. formicarius* is $2n=21$ (10 IIA + XO) yielding heterogametes (10 IA + X) and (10 IA). *C. formicarius* possessed homomorphic autosomes or symmetrical karyotype. Autosomes appeared as dumbbells scattered along the cytoplasmic area. Table 3 shows the dimensions of diakinetiic autosomes and sex chromosomes.

Table 3. Lengths of diakinetiic chromosomes of *C. formicarius* sampled from Batac and Los Baños.

Bivalent	Populations of <i>C. formicarius</i>	
	Batac	Los Baños
I	3.88	4.67
II	3.83	3.83
III	3.62	3.67
IV	2.95	3.50
V	2.88	3.25
VI	3.00	3.00
VII	2.90	2.92
VIII	2.75	2.75
IX	2.50	2.50
X	2.35	2.33
Univalent Sex Chromosome	1.30	1.33

The X-chromosome was easily distinguishable due to its heteropycnotic appearance, smallness in dimension, and lagging behavior during autosomal disjunction.

The condensed diakinetiic chromosomes of the Los Baños populations of *C. formicarius* were relatively longer than those from Batac. The same autosomes and the sex chromosome which exhibited differences at pachytene also differed during diakinesis. Such chromosome components of the genome of *C. formicarius* are considered labile and hereby suggested to be the ones undergoing variations in local populations of *C. formicarius*. Whether this type and amount of genetic variation is ample to resort to incipient speciation in *C. formicarius* is the supposed objective of the reciprocal genetic crossing that should be conducted between these two local populations.

At diakinesis, two forms of autosomal arrangements were observed. The most common form, which occurred at about 65-70% of the diakinetiic cells, exhibited the standard distribution of the bivalents wherein they were com-

pletely isolated from each other and scattered all over the nucleoplasmic area (Fig. 3A). The other form of diakinesis, showed telomere attachments usually between the labile autosomes IV and V resorting to formation of elongated bivalents measuring 5.82-6.80u (Fig. 3B). Populations of *C. formicarius* from Batac had higher frequencies of bivalent telomere joints (32%) than the populations from Los Baños (12%). The exact mechanism of chromosome joinings at the telomeres of labile autosomes of *C. formicarius* is unknown yet. In many insect species telomere adhesions are considered as speciation mechanism. Chromosomal isolation plays a primary role in the speciation of some groups of organisms (White, 1968). Karyotypic differentiation of populations represents the first stage of species divergence. The primary chromosomal differences provide the necessary isolating barrier which permits genetic differentiation of populations, and the subsequent acquisition of full reproductive isolation.

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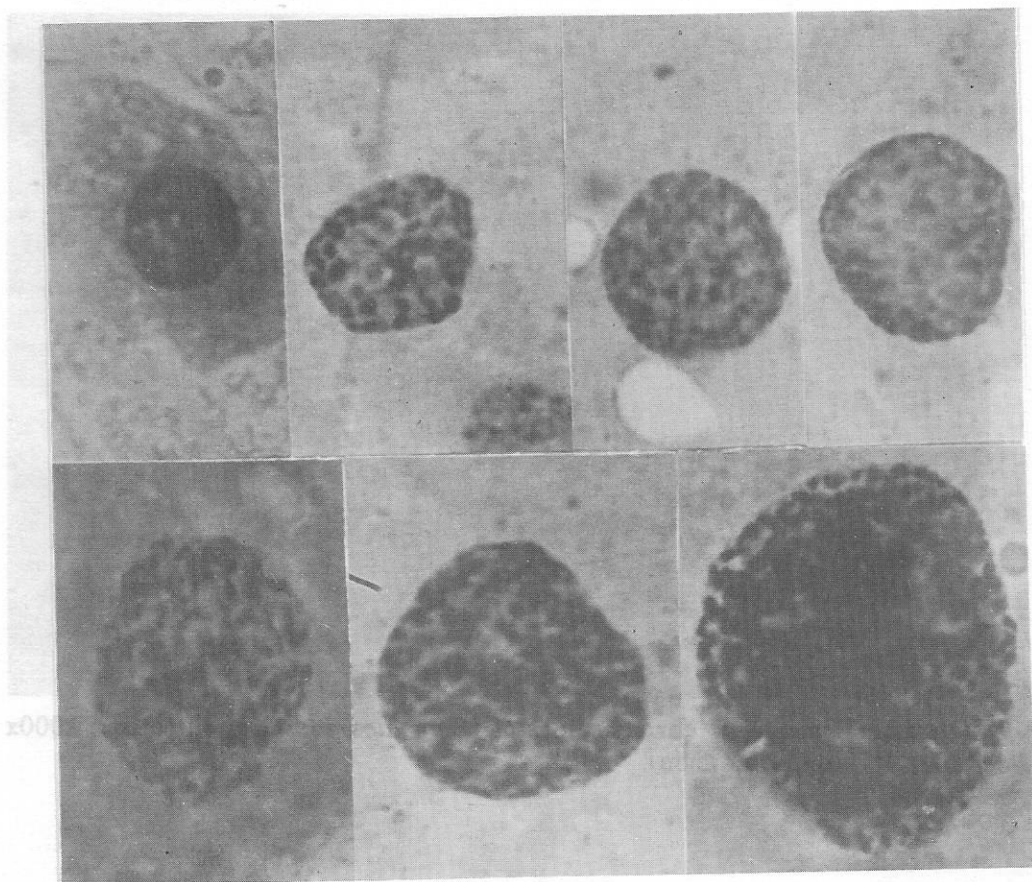


Figure 1. Different nuclear forms of *C. formicarius*. Magnification, 1000x (oil immersion).

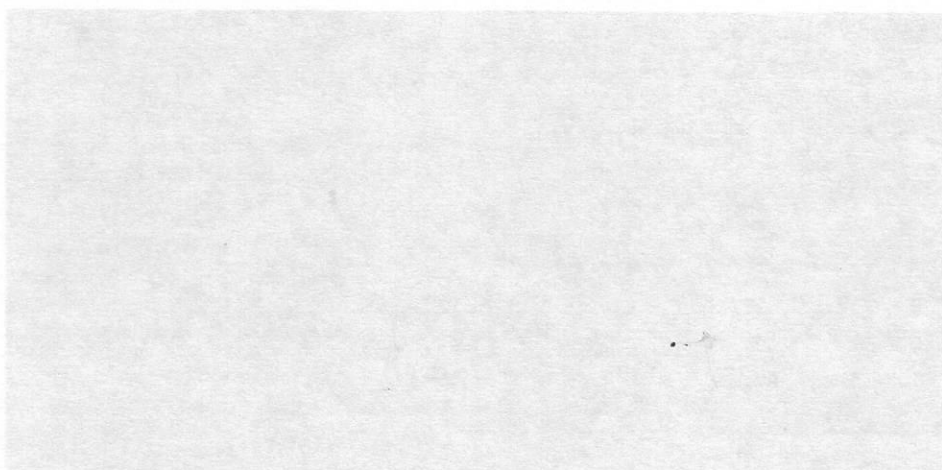


Figure 2. Diskinesis of *C. formicarius*. a. Normal diskinesis. b. Telomere joint of IV and V autosomes.

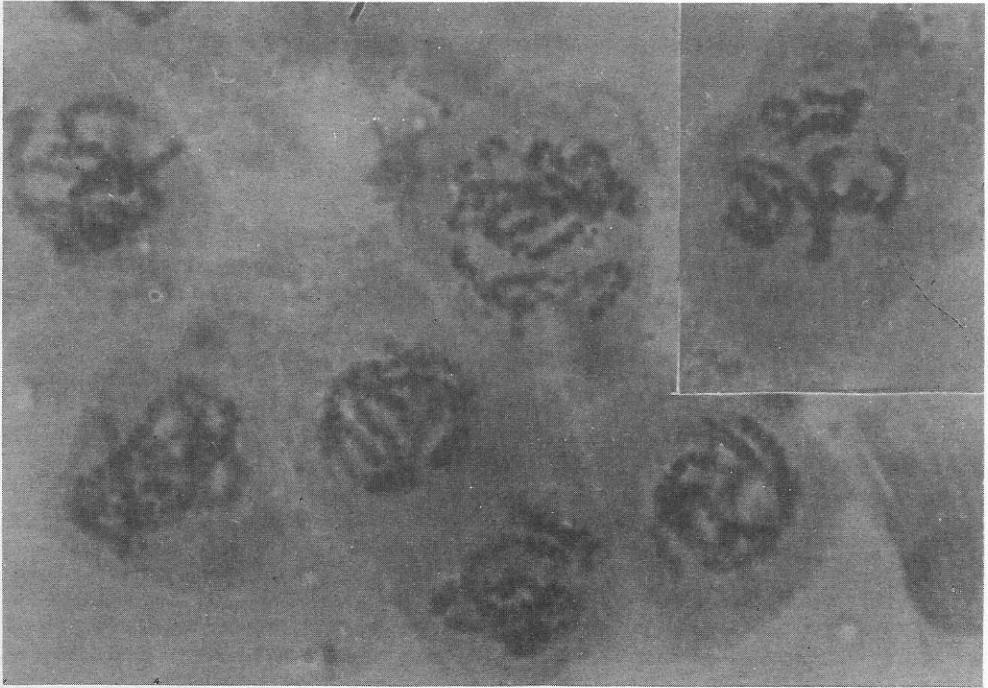


Figure 2. Pachytene chromosomes of *C. formicarius*. Magnification, 1000x (oil immersion).

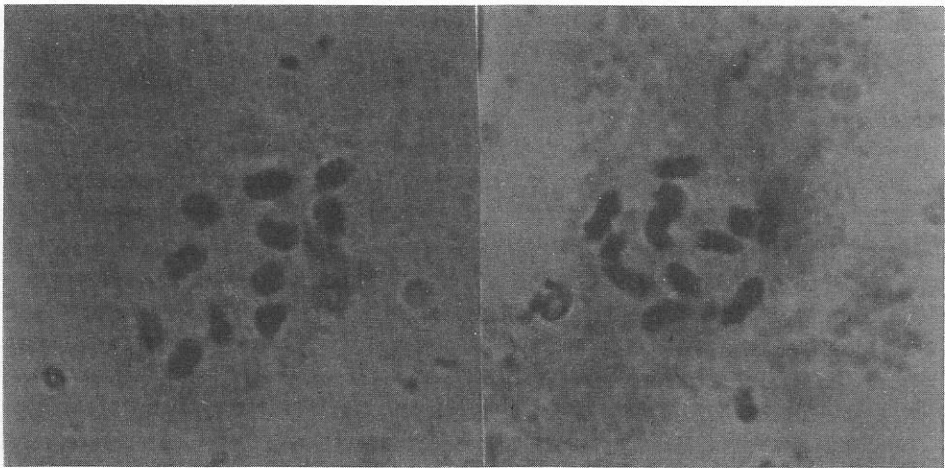


Figure 3. Diakinesis of *C. formicarius* a. Normal diakinesis, b. Telomere joint of IV and V autosomes.