INCIDENCE AND SOME ECOLOGICAL ASPECTS OF COWPEA SEVERE MOSAIC VIRUS IN TWO CROPPING SYSTEMS IN COSTA RICA[1] /

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Compendio

La incidencia del virus del mosaico severo del frijol de costa (cowpea severe mosaic virus) es similar tanto en el cultivo individual de esta especie como en su asociación con maíz. En ambos sistemas de cultivo se registró una correlación positiva entre el número de plantas infectadas y la población de crisomélidos vectores. Además, el número de insectos viruliferos colectados en el campo resultó proporcional a la incidencia del virus. Sin embargo, la cantidad de precipitación pluvial resultó negativamente correlacionada con el número de plantas infectadas. La leguminosa silvestre, Vigna vexillata *fue la única fuente natural de inóculo identificada de la que el virus fue transmitido fácilmente al frijol de costa por* Cerotoma ruficornis rogersi.

Introduction

Cowpea severe mosaic virus (CPSMV) (1) was first described in Costa Rica by González *et al* (3) in 1975. It is transmitted by several species of beetles including: *Cerotoma ruficornis rogersi, C. atrosfasciata, Diabrotica balteata, D. adelpha, Epilachna varivestis* and *Gynandrobrotica variabilis* (5). Despite that CPSMV is very common in the tropics (1), little is known about the epidemiology and ecology of this disease. The CPSMV is economically important since yield reductions of nearly 90% have been recorded (6). In a recent study, González (4) reported significant differences between the incidence of CPSMV in a monoculture of cowpea and the incidence in an association of crops (cowpea-maize).

The present work was conducted to study the incidence of CPSMV in two cowpea cropping systems (monocultures vs. association with maize) and its relation to rainfall and population of *C. ruficornis rogersi* and *D. balteata*.

Material and methods

Two plots of 17 x 17 m located in the experimental field of CATIE in Turrialba, were used. Plot A was planted with cowpea cv. V-5 Moh as a monocrop while Plot B was planted with cowpea in association with maize cv. Tuxpeño crema P.B.C.-7; in this plot the rows of corn were alternated with rows of cowpea cv. V-5 Moh. After emergence, cowpea plants were examined every 4 days for CPSMV symptoms, which were corroborated in the laboratory by serological tests using the Outcherlony double diffusion technique.

Also, every 4 days randomized samples of beetle populations were taken. Thirty *C. ruficornis rogersi* and 30 *D. balteata* were collected weekly from the plots, and tested in the greenhouse for infectivity on

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individual healthy cowpea plants of the same cultivar. Diurnal rainfall was recorded daily. Over 10 different species of wild legumes found near the experimental plots showing viral symptoms and beetle damage were tested for CPSMV by serology and beetle transmission.

Results

The rate of increase of CPSMV in both cropping systems approximates a sigmoid curve (Figure 1).

No statistical difference (p 0.05) was found between the incidence of CPSMV in monoculture and diculture (Figure 1, Table 1) even though the total beetle population was higher in the monoculture than in the diculture. Positive correlations (+0.8975, +0.8670) were found between the number of infected plants and the population of the two main species of beetle vectors in both cropping sytems (Figure 2). A negative correlation (-0.3174) was obtained between the rainfall and the number of infected plants (Figure 3). In general, the number of viruliferous beetles collected in the field was proportional to the incidence of CPSMV. This was true for both beetle species (Table 2).

Vigna vexillata was the only legume infected with CPSMV from which the virus was successfully transmitted to cowpea by *C. ruficornis rogersii*.

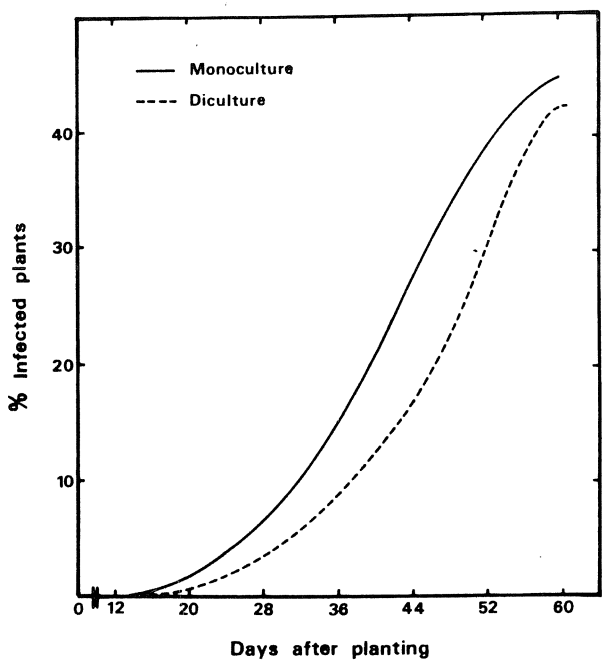

Fig. 1 Incidence and rate of increase of CPSMV infections in cowpea monocultures and cowpea-corn dicultures.

Table 1. Incidence of CPSMV in two crop systems: monoculture (cowpea) and diculture (cowpea + corn).

Cropping System	No. of plants infected /Total No. of plants	Incidence (%)
Monoculture	$1609/_{3817}$	42.15
Diculture	$599/_{1340}$	44.70

Discussion

In our experimental fields the combination corn-cowpea had no effect on the incidence of CPSMV. A lower virus incidence in the diculture and higher in the monoculture was observed by González (4) in previous studies in the same location but using different cowpea cultivars. The total virus incidence and populations of beetle vectors was much higher in our experiments, and this probably accounted for the lack of effect of the polyculture. The population of *C. ruficornis rogersii* and *D. balteata* was an important

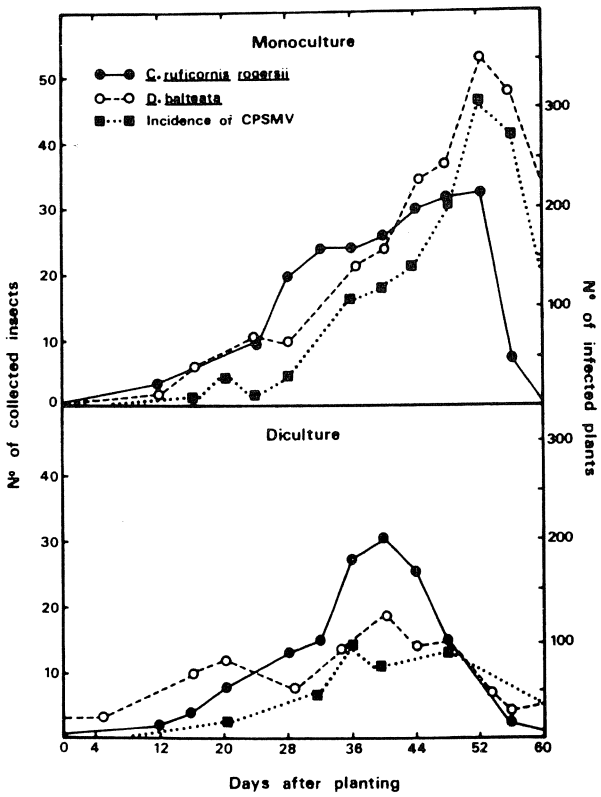

Fig. 2 Correlation of number of CPSMV infected plants in cowpea monocultures and cowpea-corn dicultures with populations of the two main species of beetle vectors.

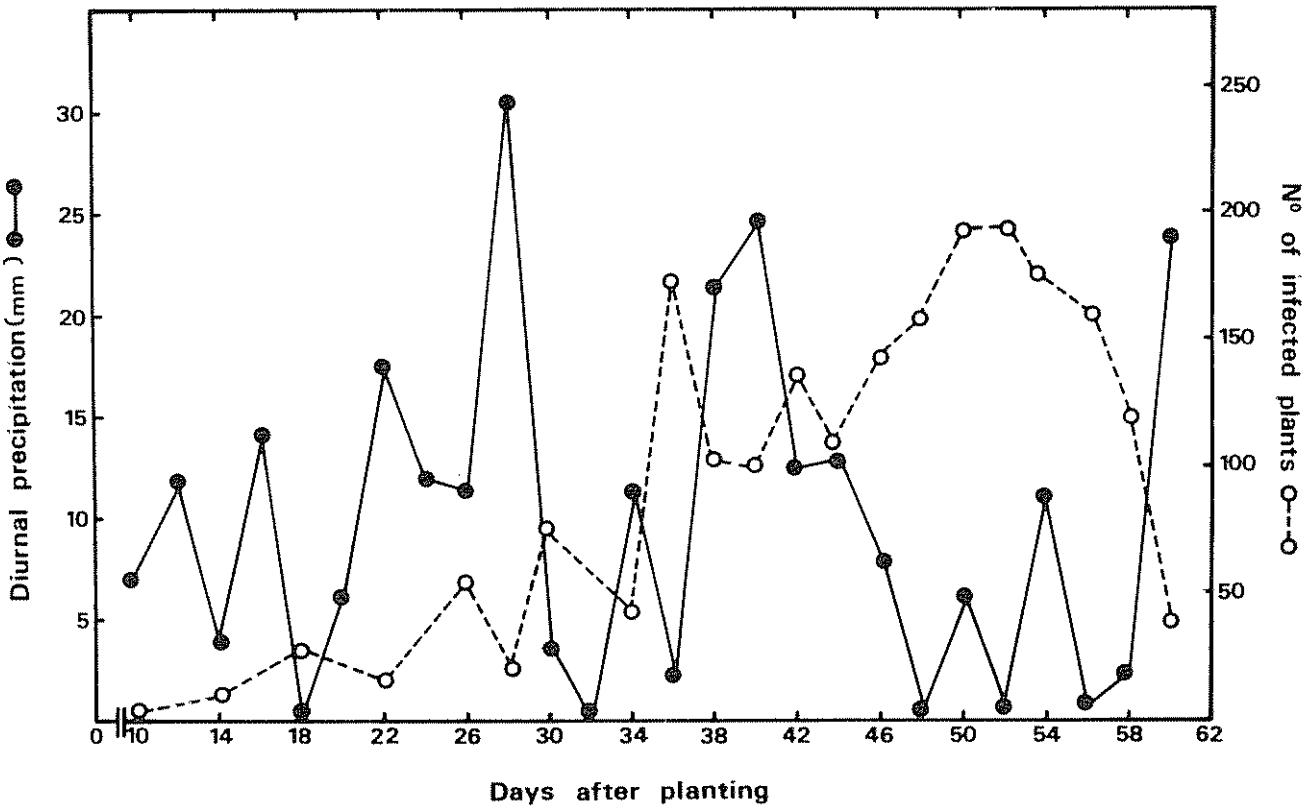

Fig 3 Correlation of diurnal rainfall and number of CPSMV infected cowpea plants.

factor determining the relative incidence of the disease. When the population was high, the incidence of CPSMV increased. This was corroborated by the association between the increase in the number of viruliferous beetles and the increase in incidence.

Rainfall during the day played an important role in the dissemination of CPSMV by the vectors. The rate of increase of the disease was low during rainy periods. The reason for this was the decrease in activity of the beetles during rainy days and the increased activity during dry days. It is important to point out that the beetle population did not change during rainy days, but its activity was reduced.

Vigna vexillata, a wild legume abundant in the field, is probably an important source of primary inoculum of CPSMV. It is present throughout the year and it is a good host for both *C. ruficornis rogersi* and the virus.

The high population of vectors, the presence of weeds infected with CPSMV, and the lack of resistant cultivars appear to be the main reasons for the high incidence of CPSMV in Costa Rica.

Table 2. Relation between the number of cowpea plants infected with CPSMV in the field and the number of viruliferous beetles.

Weeks after planting	Number of infected plants[a]	*Viruliferous beetles*[b]	
		C. ruficornis rogersi	*D. balteata*
3	75	0/30	0/30
4	239	0/30	0/30
5	603	6/30	2/30
6	1287	8/30	4/30
7	2208	11/30	1/30

a Total number of infected plants in both cropping systems.
b Number of viruliferous beetles/number of beetles tested.

Abstract

The incidence of cowpea severe mosaic virus is similar in a monoculture of cowpea and in its association with maize. Both cropping systems registered a positive correlation between the number of infected plants and the population of crisomelid vectors. Furthermore, the number of viruliferous insects collected in the field was proportional to the incidence of the virus. A negative correlation, however, was obtained between the rainfall and the number of infected plants. *Vigna vexillata*, a wild legume, was the only natural source of inoculum identified, from which the virus was easily transmitted to cowpea by *Cerotoma ruficornis rogersi*.

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