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Authors

García, M. L.
Derrick, K. S.
Grau, O.

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Citrus Psorosis Associated Virus and Citrus Ringspot Virus Belongs to a New Virus Group

M. L. Garcia, K. S. Derrick, and O. Grau

ABSTRACT. The citrus psorosis associated virus (CPsAV) from Argentina and the citrus ringspot virus (CRSV) from Florida were purified and the top and bottom components of both separated. Infectivities of the individual top and bottom components on *Chenopodium quinoa* was low. Heterologous as well as homologous combinations of top and bottom components were highly infectious indicating the two viruses are closely related.

Psorosis is the most important disease affecting the citrus trees in Argentina and Uruguay. Citrus psorosis associated virus (CPsAV) causes the death of orange and grapefruit trees of Concordia, Argentina producing an important loss in the production of citrus (5). The most prominent symptoms are flecking and spots on leaves and bark scaling in field trees. CPsAV produces shock, and necrosis of young shoots, chlorotic spots and flecking in leaves on young inoculated citrus seedlings. From this material, the CPsAV was purified and partially characterized (3,4).

CRSV was described in the U.S.A. (7) and the CRSV-4 isolate was purified and characterized (1) and found to produce similar symptoms as psorosis on young seedlings. Citrus ringspot virus and CPsAV share some local-lesion hosts as *Chenopodium quinoa*, *Nicotiana megalosiphon* and *Gomphrena globosa* (3,6), although the infectivity detected on *C. quinoa* per gram of citrus tissue is higher with CRSV than with CPsAV. From these viruses, top and bottom components, which are short and long flexuous particles, respectively, can be separated by ultracentrifugation. The only protein that is detected in both components seems to be the coat protein (1,4). The genomic material of these viruses is composed of at least two RNA species (2,3). We report herein the genomic compatibility relationship between CRSV-4 and CPsAV-90-1-1.

The starting materials were local lesions obtained from *C. quinoa* inocu-

lated with extracts from young shoots infected with CPsAV 90-1-1 (3) and CRSV-4. The purification procedures and preparations of top and bottom components were as described by Garcia et al. (5) and Derrick *et al.* (1).

Top and bottom fractions were obtained from local lesions produced by CRSV or by CPsAV on *C. quinoa*. CRSV extract was diluted 20 times to match the infectivity of CPsAV. The infectivity of one volume of each individual component (CRSV-top, CRSV-bottom, CPsAV-top, and CPsAV-bottom component) and all the possible binary mixtures of half volume of each component were inoculated on five leaves of *C. quinoa* and the local lesions counted.

Table 1 shows that no infectivity is associated with the top component of either virus indicating that they were completely free from the bottom components. The bottom component of CRSV was also well-purified but this was not the case of CPsAV which had some infectivity. When homologous mixtures were tested, significant increases of infectivity were obtained as expected from previous experiments. The mixture of top component of CPsAV and bottom component of CRSV gave 100-fold increase in infectivity. This value is almost the same as that obtained when the CRSV homologous mixture was tested. The partial purification of CPsAV causes the lower activation of infectivity when the mixture of CPsAV bottom either with CRSV-top or CPsAV-bottom were inoculated; however, in both cases, the number of

TABLE 1
INEFFECTIVITY ON *CHENOPODIUM QUINOA* OF INDIVIDUAL FRACTIONS OF CRSV
AND CPsAV AND THE MIXTURES

	top-CRSV	bottom-CRSV	top-CPsAV	bottom-CPsAV
top-CRSV	1 ^z	207	2	113
bottom-CRSV		4	236	56
top-CPsAV			0	154
bottom-CPsAV				70

^zNumber of lesions on five *C. quinoa* leaves.

lesions increased 100%. These results of compatibility between CRSV and CPsAV components suggest that both genomes share enough information to produce local lesions on *C. quinoa* when infected with the mixture of both viruses. CRSV and CPsAV share several other characteristics: similar symptoms on citrus trees, local hosts, multipartite genomes; they contain RNA and a protein of 48 and 50 kDa and they cross-react with specific antibodies. These results indicate the close relationship between the isolates. However, there are some differences such as the initial titer of infectivity in citrus tissue and the difference of 2

kDa in the MW of the coat proteins supporting the idea that these viruses are different strains of the same virus or different viruses of the same group. On the other hand, all characteristics described here do not seem to belong to any already defined group of plant viruses, but more studies are necessary to confirm this hypothesis.

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