

Differential Alterations of Glutathione S-Transferase Enzyme Activities in Three Sorghum Varieties Following Viral Infection

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Activities of the enzyme glutathione S-transferase were determined in leaves of sorghum varieties of differential susceptibility to infection with sugarcane mosaic virus. Inoculation with the virus resulted in significant induction of the enzyme in the leaves of the immune host, while hitherto unpublished dramatic reductions were detected in the leaves of the systemic host sorghum varieties.

Glutathione and isoenzymes of glutathione S-transferase (GST, E. C. 2.5.1.18.) play important roles in plant response to environmental, chemical and biotic stress effects (Smith *et al.*, 1990; Mauch and Dudler, 1993). Thus, significant elevations of GST activities were observed in plants exposed to heavy metals (Kömives *et al.* 1994), glyphosate (Uotila *et al.* 1995), and to the peroxidizing herbicide (Sandmann and Böger, 1990) acifluorfen (Gullner *et al.* 1991). Moreover, one of the genes activated in winter wheat plants following infection by the non-pathogen fungus *Erysiphe graminis* f. sp. *hordei* encoded a GST isoenzyme (Dudler *et al.*, 1991). Different GST isoenzymes were induced in wheat by xenobiotics and by the above fungal infection (Mauch and Dudler, 1993). In this paper we present the first investigation of effects of virus infections on plant GST activities.

Three sorghum varieties (obtained from Dr. L. Bányai, Agrobotanical Institute, Tápiószele, Hungary) of different susceptibility to infection by the MB strain of sugarcane mosaic *Potyvirus* (SCMV-MB; Gáborjányi *et al.*, 1992) were used as model

plants: 1) an immune host (*Sorghum bicolor* L., var. GKC-84), 2) a systemic one (*Sorghum sudanense* L., var. Akklimat), in which spread of the virus is not limited by resistance mechanisms, and 3) a systemic one of intermediate susceptibility that displays necrotic symptoms following infection (*Sorghum bicolor* L., var. Róna-2). The virus was maintained on sweet corn. Inocula were prepared from leaf tissue homogenized in 0.1 M phosphate buffer (pH 7.2) in 1:10 w/v ratio. Celite was used as abrasivum during mechanical inoculation of the sorghum plants at the age of 28 days. Mock-inoculated (buffer-rubbed) and intact plants served as controls. GST enzyme activities were determined spectrophotometrically at 340 nm using

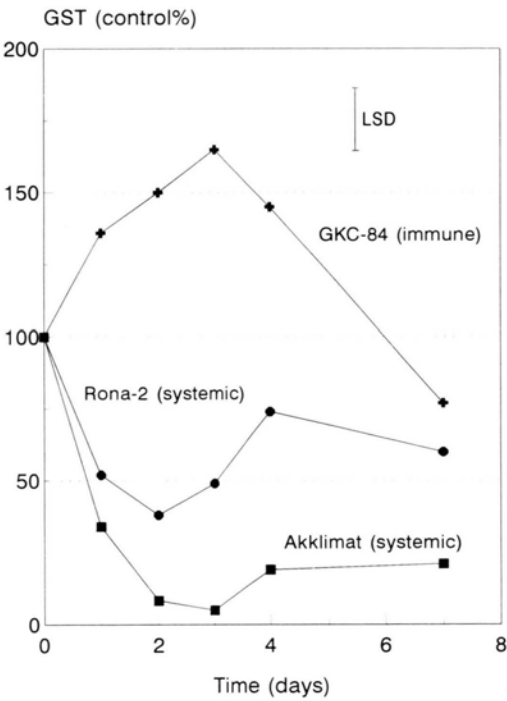


Fig. 1. Changes in glutathione S-transferase enzyme activities in leaves of immune (GKC-84), susceptible (Akklimat) and moderately susceptible (Róna-2) sorghum varieties after inoculation with the MB strain of sugarcane mosaic virus. Data are percentages of values found in the buffer treated controls. GST activities in control plants were 0.54 ± 0.06 , 0.65 ± 0.06 , and $0.43 \pm 0.04 \mu\text{mol conjugate g FW}^{-1} \text{ min}^{-1}$ in the GKC-84, Róna-2 and Akklimat varieties, respectively ($n = 4$). Means of three replicate experiments and the least significant difference (LSD) are shown ($P = 5\%$).

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1-chloro-2,4-dinitrobenzene as substrate (Uotila *et al.*, 1995).

The GST activities in the buffer-treated leaves did not differ significantly from those found in intact plants. However, SCMV-MB infection strongly influenced GST activities in the leaves of each sorghum variety, and the changes in the enzyme activity were remarkably different in the three types of host-virus interaction. In accord with previous findings on abiotic stress effects, inoculation of the immune sorghum variety resulted in GST induction, reaching a maximum after 72 h of treatment (Fig. 1). However, in leaves of the susceptible, systemically infected Akklimat variety a dramatic, hitherto not observed decrease in GST levels was determined (Fig. 1). The GST activity was strongly reduced already 24 hrs after inoculation and after 48 hrs it fell below 10% of the control, and remained under the control level during the 7-day experimental period (Fig. 1). The GST activity also decreased in the moderately suscepti-

ble Róna-2 variety following SCMV-MB inoculation, but to a lesser extent than in the susceptible Akklimat.

GST inductions in stressed plants are regulated at the transcription level (Mauch and Dudler, 1993). We believe, that this applies also to the induced GST activity in the virus infected immune sorghum variety. The observed reductions in GST activities in the systemically infected plants may be under transcriptional control, as well. However, other mechanisms leading to a repression of GST protein synthesis, or to elevated GST turnover should also be considered.

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