

**Effect of Volatile Substances from Safflower
on Germination of Teliospores of
*Puccinia carthami***

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ABSTRACT

Exposure of teliospores of *Puccinia carthami* to volatile substances from safflower resulted in an increase in germination over that of nonexposed spores. Highest percentage germination (more than 90% of spore population) was achieved when spores were exposed to volatile substances from safflower seedlings. Among several non-host plant species, only volatile substances from sunflower seedlings were effective in stimulating germination. Phytopathology 63:795

Germination of teliospores of *Puccinia carthami* Cda. in nature and in infested autoclaved soil is evident by development of rust on hypocotyls and cotyledons of safflower (*Carthamus tinctorius* L.) seedlings after emergence (1, 2). When teliospores from naturally infected plants are incubated in water or on an agar medium, only a low percentage germinate (1, 2). On the other hand, a high percentage of spores germinate on a medium supplemented with host-plant materials (1).

Observations on germinated spores in relation to their proximity to leaf and stem fragments of safflower suggested that volatile substances from safflower stimulated germination of spores as effectively as plant materials incorporated in agar medium. Assays were designed to determine whether germination of teliospores is affected by volatile substances from safflower and some non-host plants.

Teliospores shed from rust-laden safflower leaves collected in plastic bags were separated from leaf debris with screen sieves, then suspended and washed in sterile tap water for 1 min in a blender. After three successive centrifugations and resuspensions in sterile tap water, the spores were dried as previously described (1) and stored at 12 C.

Effect of volatiles on germination was determined in chambers made from plastic petri dishes. Spores were dispersed on water agar (pH 7.0) in a dish which was inverted over another dish containing seedlings or autoclaved plant parts on agar. Openings were cut through the dish lids to allow diffusion of volatile substances into the upper dish. Seedlings (six/chamber) ranged in age from germinating seeds (24 hr) to those 7 days of age. Prior to germination, seeds were surface sterilized 3-5 min in 10% sodium hypochlorite solution, thoroughly rinsed in sterile water, and air-dried. Exposure of spores to volatile substances in all germination assays began on the first day of incubation. Chambers were not sealed but

TABLE 1. Effect of volatile substances from safflower on germination of teliospores of *Puccinia carthami*

Source of volatiles ^a	% Germination in 7 days
Seedlings	96
Moistened stems	60
Dry stems	31
Moistened leaves	20
Dry leaves	12
None	4

^aDry stems and leaves not on agar.

were enclosed in plastic bags during incubation at 24 C for 7 days under 25 ft-c light for 10 hr daily. In some assays, spores were incubated at 3-degree temperature intervals from 12 to 27 C. Two hundred spores were scored in each of three dishes/assay. Germination data represent total spores germinated from one or both cells by production of a four-celled promycelium.

Germination of teliospores not exposed to volatile substances from plant parts was regularly less than 10%. Data (Table 1) show that germination of teliospores is induced in the presence of volatile substances from safflower. Germination was stimulated from 12 to 27 C over seedlings, with more than 90% of the spores germinating at 15 to 24 C in 7 days. A lower percentage of spores germinated when the exposure period was less than 7 days. Germination was not induced when the exposure period was less than 2 days.

Rate of germination and total percentage germination among spores incubated over six seedlings were similar to that among spores incubated over twelve seedlings. A slower rate of germination over single seedlings and a subsequent total germination that was only 8% less than that over six or twelve seedlings, implies that spore germination is stimulated by volatile substances at low concentrations.

When spores were exposed at 12 to 27 C to volatile substances from non-host seedlings of wheat, corn, pea, cotton, sorghum, and bean, germination was similar to that of non-exposed spores. Volatile substances from non-host sunflower seedlings induced 35 to 46% germination at 18, 21, and 24 C.

These studies suggest that volatile substances from safflower seedlings or debris near teliospores in the soil may induce them to germinate if the environment is otherwise favorable.

LITERATURE CITED

1. KLISIEWICZ, J. M. 1972. Effect of host plant materials and temperature on germination of teliospores of *Puccinia carthami*. *Phytopathology* 62:436-438.
2. SCHUSTER, M. L. 1956. Investigations of the foot and root phase of safflower rust. *Phytopathology* 46:591-595.