Discharge of Ascospores of *Eutypa armeniacae* in New York

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ABSTRACT

PEARSON, R. C. 1980. Discharge of ascospores of *Eutypa armeniacae* in New York. Plant Disease 64:171-174.

Discharge of ascospores of *Eutypa armeniacae* from perithecia on Concord grape stumps in Geneva, New York, usually began less than 3 hr after rainfall started, continued throughout the rainy period, and ceased after rainfall ended and stromata dried. Water from snowmelt also stimulated ascospore discharge. Ascospores were released during each period of rainfall throughout the year, but the highest counts occurred in winter and spring and the lowest in summer. This finding is significant because winter and early spring are when grapes are pruned in New York. Ascospore counts from grape stumps collected from the field and stored on a laboratory bench showed a seasonal periodicity similar to those from spore trapping in the field.

Additional key words: epidemiology, *Eutypa* dieback, *Vitis labruscana*

Eutypa armeniacae Hansf. & Carter, a vascular pathogen of apricot (*Prunus armeniaca*) (1), has been associated with dying arms of grapevine in Australia (4), California (11), Greece (6), and New York (7,13) for several years. However, proof that *E. armeniacae* is the incitant of the disease causing dying arms of European grape (*Vitis vinifera*), named *Eutypa* dieback (formerly dead arm), has been provided only recently (10).

Because *E. armeniacae* is a vascular pathogen that commonly enters pruning wounds (3), knowledge of inoculm availability during the time of pruning, as well as environmental conditions necessary for ascospore discharge, is important. Studies on ascospore discharge from apricot wood in South Australia revealed continuous discharge throughout the year, with lowest counts in winter (9). Similar work in California revealed highest numbers of ascospores in early autumn (12). Based on these studies and duration of pruning wound susceptibility (2,12), pruning apricot trees in winter in South Australia (8) and in summer in California (12) has been suggested. Because of climatic and host differences, ascospore discharge from grapevine under New York conditions was studied.

MATERIALS AND METHODS

Weathered, dead stumps of Concord grapevines (*V. labruscana*) bearing perithecia of *E. armeniacae* were collected from a vineyard in Penn Yan, New York, in November 1977. The stumps, 12–24 cm

This research was partially supported by the New York State Grape Production Research Fund.

Accepted for publication 10 October 1979.

00191-2917/80/000033$03.00/0

long and 4–6 cm in diameter, were secured to the ground in an upright position, similar to that on the vineyard floor, by placement in 5-cm diameter wire mesh screen. The stumps were arranged in a ring around a Burkard 7-day recording volumetric spore trap (Burkard Manufacturing Co., Ltd., Rickmansworth Herts, England). The trap orifice was 45 cm above ground. Distance from stumps to spore trap ranged from 18 to 60 cm. The spore trap was located at an official Climatological Reference Station (No. 3031840) at Geneva, New York. The trap, operating on alternating current, functioned continuously from November 1977 through July 1979. The Melinex tapes on the spore trap drum were coated with a thin layer of vacuum pump oil (Precision Scientific Co., Chicago, IL), which served as an adhesive. Temperature and humidity (RH) were recorded continuously with a 7-day recording hygrothermograph at 1.3 m above ground level in a standard weather shelter. Amount and duration of rainfall were recorded continuously by a tipping bucket rain gauge.

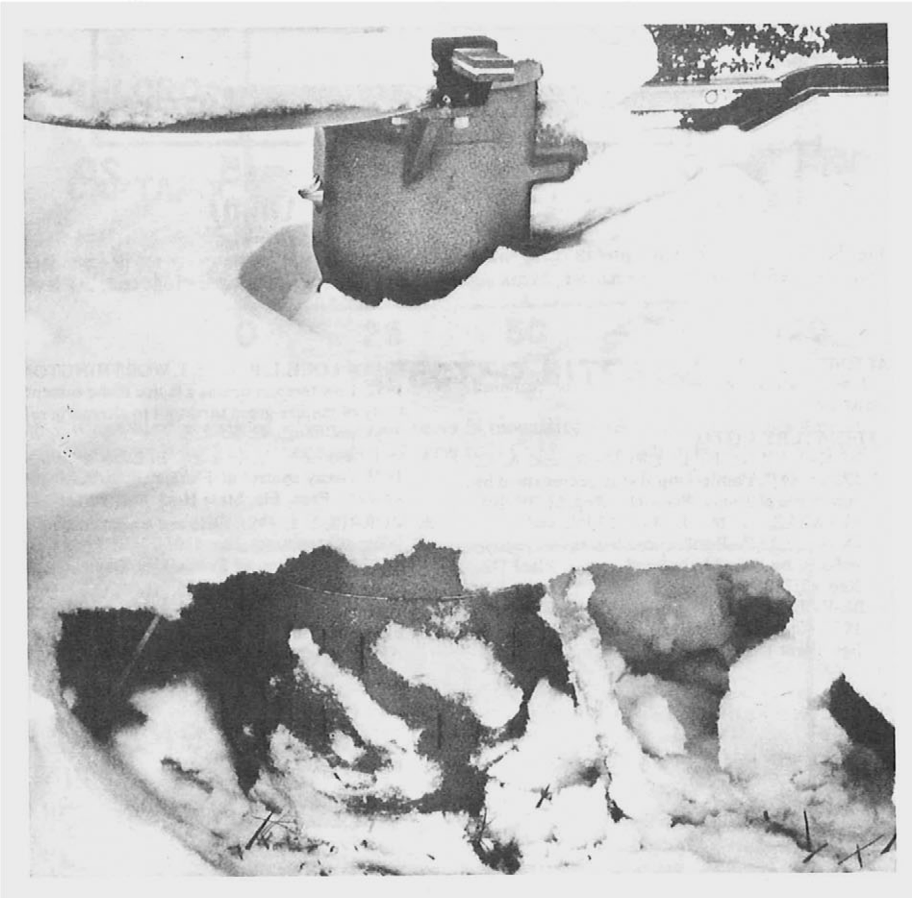

Fig. 1. Snowmelt caused by heat from the pump motor at the base of a Burkard spore trap created an igloo effect. Snow has been removed from the base of the trap to show the cavity.

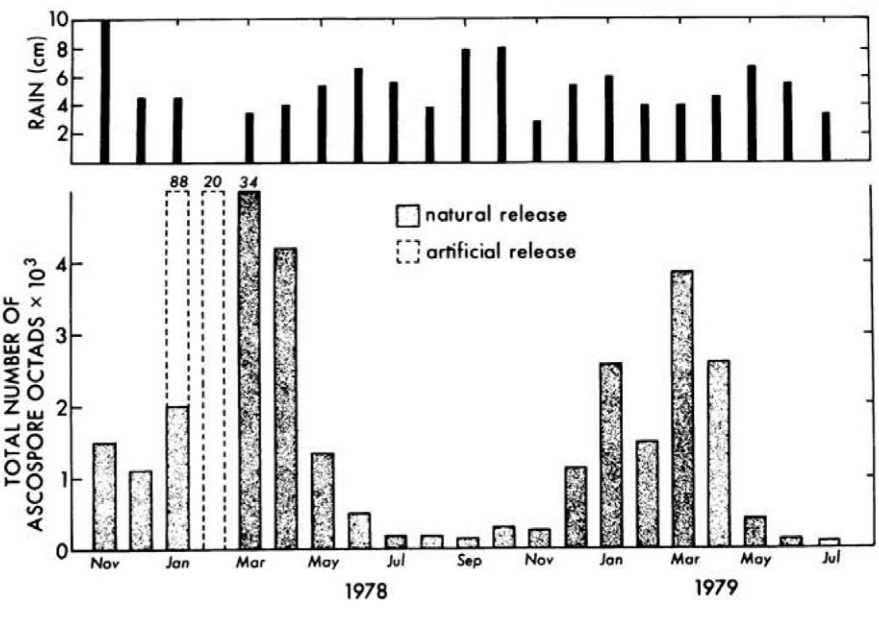

Fig. 2. Monthly totals of rainfall and airborne ascospore octads of *Eutypa armeniacae* detected from November 1977 through July 1979 at Geneva, New York. Artificial release was caused by heat from the spore trap motor melting snow that covered some of the grapevine stumps and the spore trap.

Ascospores of *E. armeniacae* were identified at 400× by their size, shape, and presence in octads (1) and by their failure to stain in lactophenol-cotton blue (9). Groups of ascospores numbering five to eight were counted as one octad, and all counts were reported as number of octads. Although Carter (1) indicated ascospores were common in air only during or soon after rain, we examined spore trap tapes for all hours to detect discharge triggered by snowmelt.

Snow was removed from the base of the spore trap and from the tops of the grape stumps during winter, and grass was cut around the spore trap and grape stumps during spring and summer.

Some of the grapevine stumps collected in November 1977 were held on a bench in the laboratory through July 1979. They were exposed to overhead fluorescent lights for about 9 hr a day at 20–24 C and at 50–65% RH in summer and 15% in winter. At monthly intervals, the same subsample of stumps was soaked in distilled water for 1 hr and placed in a spore discharge tower (5) attached to a vacuum pump for another hour. Ascospores that discharged into the tower were directed into a deep well slide containing 400 μl of distilled water. The number of ascospores captured in the well was counted on a hemocytometer.

RESULTS

Ascospore release triggered by rainfall usually began less than 3 hr after rainfall started, continued throughout the rainy period, and ceased after rainfall ended and stromata dried.

Ascospore discharge triggered by snowmelt was first observed on 20 January 1978 under artificial conditions that developed when a heavy snowfall and blowing snow buried the spore trap. The vacuum pump at the base of the trap continued to operate, and heat from the motor melted the snow. This created an igloo effect that enclosed the trap orifice and several grape stumps. A similar situation was observed during a later snowfall, although the snow line was below the trap orifice (Fig. 1). Ascospores were released from the wet stumps within this chamber and were captured in great numbers by the trap for 108 hr. Snowstorms in January and February 1978 caused artificial release of great numbers of ascospores in the same manner (Fig. 2). The capture of ascospores under these artificially wet conditions indicated that large numbers of ascospores were mature and ready for discharge at this time of the year. This suggested the likelihood of ascospore release being triggered by natural snowmelt. Ascospore discharge during March 1978, in the absence of rainfall but in the presence of melting snow, confirmed this hypothesis (Fig. 3).

Ascospores of *E. armeniacae* were trapped during periods of rainfall or snowmelt from November 1977 through July 1979 (Fig. 2). Most ascospores were trapped during January, February, March, and April. Ascospore discharge declined greatly during the summer months.

Discharge of ascospores from grapevine stumps stored in the laboratory showed seasonal patterns during 1978 and 1979 similar to those from spore trapping under field conditions (Fig. 4). Laboratory conditions of temperature and lighting were fairly constant, but humidity fluctuated greatly from winter to summer and resulted in variations of actual vapor pressure that were similar to those measured under field conditions (Fig. 4).

DISCUSSION

Seasonal periodicity of ascospore discharge by *E. armeniacae* under New York conditions differs from that reported from South Australia and California. In South Australia, where seasonal rainfall (about 25% in each of the four seasons) is similar to that in New York, most ascospores were released in spring, with lesser numbers in summer and autumn and fewest in winter (9). In New York, however, most ascospores were released in winter and spring. Under California conditions in which absence of summer rains precluded discharge of ascospores, they were released in autumn, with amounts decreasing through winter and spring (12). Release of ascospores triggered by snowmelt could contribute significantly to the total inoculum potential.

Release of ascospores, whether triggered by rainfall or snowmelt, from infected grape stumps during winter and spring is especially significant under New York conditions, since this is the time when most grapes are pruned. Unlike South Australia and California, where a shift in time of pruning apricot trees has been suggested, it would be impractical in New York to delay pruning grapes from winter and early spring to summer and autumn. Furthermore, vineyardists wait until spring to prune cultivars sensitive to low temperature so they can identify winter-killed canes. Studies to determine the duration of pruning wound susceptibility in grapevines, the time of year when pruning wounds are most susceptible, and the age of the most susceptible wood are in progress. Results of these studies combined with the ascospore availability studies presented here may provide information for pruning modifications that would reduce the chances for infection. At the present time, growers are advised to remove dead grape stumps from vineyards to reduce inoculum.

Seasonal pattern of ascospore discharge under field conditions was not as surprising as finding the same pattern occurring from stumps stored in the laboratory. The laboratory lacked windows, so only artificial fluorescent light was available, and the number of hours during which the lights were turned on was fairly uniform throughout the year. Temperature in the laboratory was also fairly constant. Moisture content of the air appeared to be the only environmental parameter in the laboratory that showed a seasonal fluctuation similar to that in the field. Perhaps, perithecial formation or ascospore production occurs during periods of high moisture content in the air (late spring, summer, and early autumn in New York) and is followed by release of mature ascospores in winter and early spring, regardless of periodic exposure to rainfall.

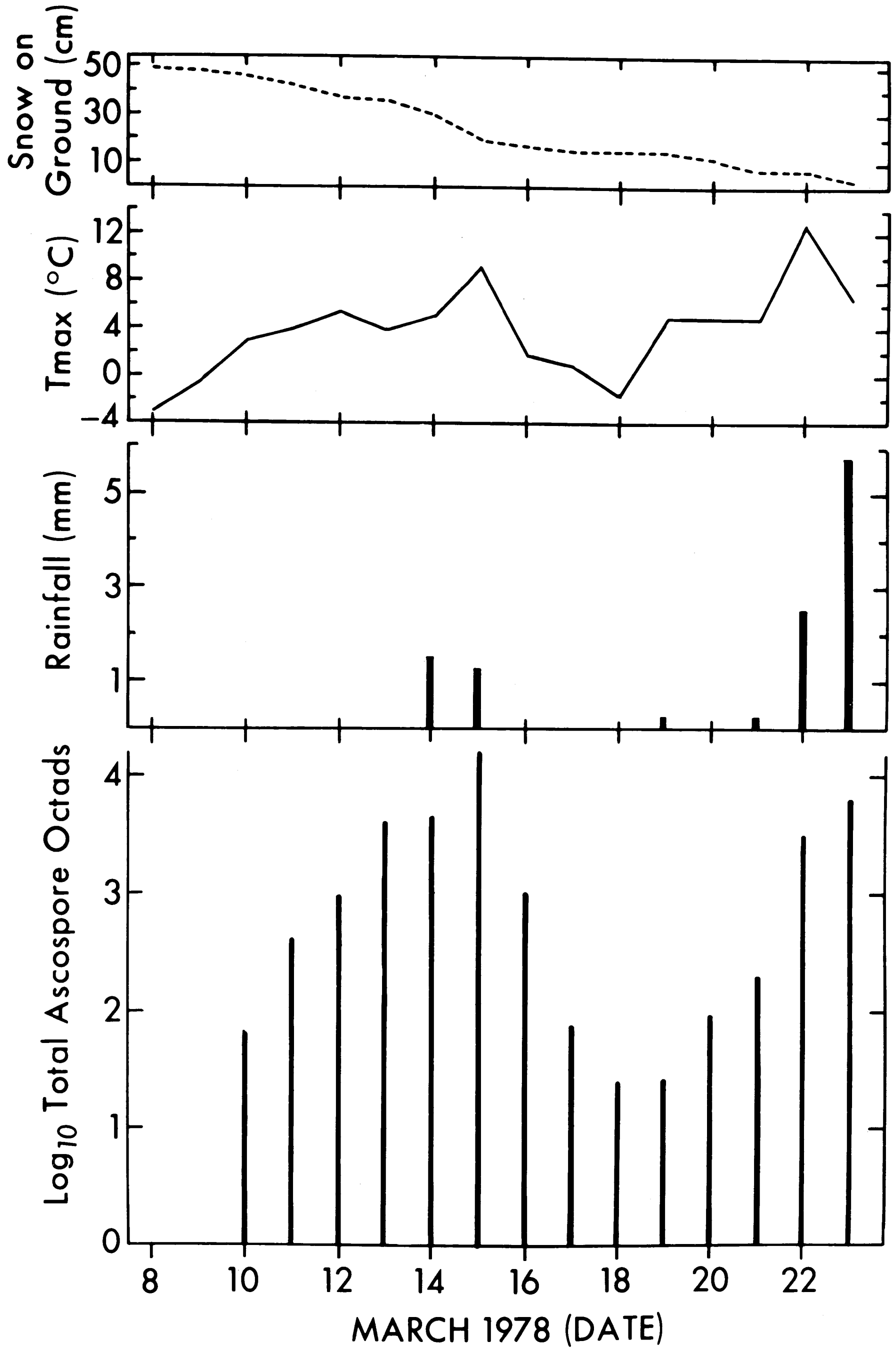

Fig. 3. Daily totals of airborne ascospore octads of *Eutypa armeniacae* compared with total rainfall, daily maximum temperature (Tmax), and snowmelt (indicated by depth of snow on ground) from 8 March to 23 March 1978 at Geneva, New York.

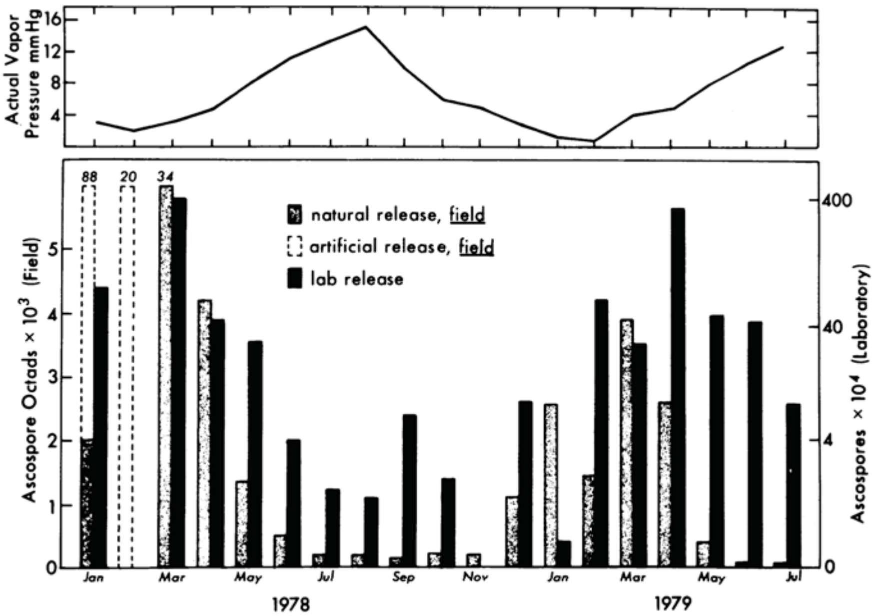

Fig. 4. Monthly totals of airborne ascospore octads of *Eutypa armeniacae* detected in the field with a Burkard spore trap compared with monthly totals of ascospores discharged into a spore tower from grape stumps stored in the laboratory. Monthly average vapor pressure was determined in the field. No laboratory data were collected in February and November 1978.

ACKNOWLEDGMENTS

I thank K. R. Dougherty and H. J. Newell for technical assistance, Rose McMillen for drafting, and Gertrude Catlin and Bernadine Aldwinckle for photography.

LITERATURE CITED

1. CARTER, M. V. 1957. *Eutypa armeniacae* Hansf. & Carter, sp. nov., an airborne vascular pathogen of *Prunus armeniaca* L. in Southern Australia. Aust. J. Bot. 5:21-35.
2. CARTER, M. V., and W. J. MOLLER. 1970. Duration of susceptibility of apricot pruning wounds to infection by *Eutypa armeniacae*. Aust. J. Agric. Res. 21:915-920.
3. CARTER, M. V., and W. J. MOLLER. 1977. Eutypa canker and dieback of apricots. EPPO Bull. 7:85-94.
4. CARTER, M. V., and T. V. PRICE. 1973. *Eutypa armeniacae* associated with vascular disease in grapevine and barberry. Aust. Plant Pathol. Soc. Newsl. 2:27.
5. GILPATRICK, J. D., C. A. SMITH, and D. R. BLOWERS. 1972. A method of collecting ascospores of *Venturia inaequalis* for spore germination studies. Plant Dis. Rep. 56:39-42.
6. KOUYEAS, H., A. CHITZANIDIS, A. PAPAS, and M. V. CARTER. 1976. *Eutypa armeniacae* on apricot and grapevine in Greece. Phytopathol. Z. 87:260-263.
7. MOLLER, W. J., A. J. BRAUN, J. K. UYEMOTO, and A. N. KASIMATIS. 1977. *Eutypa armeniacae* inoculum associated with dead arm-affected grapevines in New York and Ontario. Plant Dis. Rep. 61:422-423.
8. MOLLER, W. J., and M. V. CARTER. 1964. Prune in June—a new slogan for apricot growers. J. Dep. Agric. S. Aust. 67:322-324.
9. MOLLER, W. J., and M. V. CARTER. 1965. Production and dispersal of ascospores in *Eutypa armeniacae*. Aust. J. Biol. Sci. 18:67-80.
10. MOLLER, W. J., and A. N. KASIMATIS. 1978. Dieback of grapevines caused by *Eutypa armeniacae*. Plant Dis. Rep. 62:254-258.
11. MOLLER, W. J., A. N. KASIMATIS, and J. J. KISSLER. 1974. A dying arm disease of grape in California. Plant Dis. Rep. 58:869-871.
12. RAMOS, D. E., W. J. MOLLER, and H. ENGLISH. 1975. Production and dispersal of ascospores of *Eutypa armeniacae* in California. Phytopathology 65:1364-1371.
13. UYEMOTO, J. K., W. J. MOLLER, and A. C. GOHEEN. 1976. Isolation of *Eutypa armeniacae* from grapevines in New York and inoculation to apricot. Plant Dis. Rep. 60:684-686.