Further observations on cranberry fungi in Nova Scotia[1]

C. O. Gourley

Sporonerna oxycocci, found on the leaves of native and cultivated cranberry and which causes fruit rot, is the principal disease parasite of cranberry in Nova Scotia. Twenty of the fungi identified on cranberry fruit and foliage have not previously been reported on this host in Nova Scotia. The incidence of fungal species from fruit decaying in storage differed from that of diseased berries immediately after harvest from a native bog.

Can. Plant Dis. Surv. 59:1, 15-17. 1979

Sporonerna oxycocci qu'on observe sur les feuilles de canneberge sauvage et cultivee dont elle cause la pourriture du fruit, est le principal cryptogame parasite de cette espece vegetale en Nouvelle-Ecosse. Vingt des espèces de champignons identifiées sur les fruits et les feuilles de canneberge n'avaient pas encore ete signalees auparavant sur cet hdte en Nouvelle-Ecosse. La mycoflore observee en entrepdt sur des fruits en voie de decomposition differe de celle qui colonise les fruits malades immediatement apres leur recolte dans une airelliere naturelle.

Introduction

Most of the principal decay-producing fungi of cranberry, ***Vaccinium macrocarpon*** Ait., in North America have been found in Nova Scotia (2, 3, 5, **7).** The relative importance of the rot fungi varies with location and with cultural practices (3, 4). Fruit rots are the most important cranberry diseases in Nova Scotia but they seldom occur until after harvest (3). The extent of fungal deterioration of harvested fruit depends on preharvest growing conditions and the inoculum potential in the cranberry plantation. This paper reports on some periodic observations of diseases of cranberry fruit from native and cultivated bogs and the identification of fungi associated with fruit and foliage.

Materials and methods

In November, 1969, cranberry fruit that had been raked from representative areas in a native stand near the sea at Long Point, Inverness County, Nova Scotia, were examined for the amount and cause of fruit decay. The condition of the fruit was determined on 400 berries from the bulked sample by classifying it as either frosted, diseased or healthy. Westerly sea breezes had lessened the chances of freezing injury to the fruit.

Within 2 days the diseased berries were sterilized in 70% (v/v) ethanol and the calyx and 3 sections of the skin and flesh of each berry were placed on potato dextrose agar (PDA) in a Petri plate. The healthy fruit was placed at 9°C for 16 days. At the end of this time the rotted berries were removed and isolations made as before.

One hundred and eight cranberry leaves in the sample with the fruit from the native stand were placed apart on moist filter paper in 15 cm Petri plates for 10 days at room temperature. At the end of this time the incidence of fungal species on the leaves was recorded. The dried buds from 2 blighted inflorescences were also placed on PDA in plates.

In mid December 1975, a sample of stored fruit which had been harvested 2 months previously from a commercial bog at Aylesford, Kings County, was examined for the cause of berry rot. The diseased fruit was removed, surface sterilized in 70% (v/v) ethanol, and sections dissected from the advancing edge of rots were ptaced on PDA in Petri plates. The species and frequency of fungal isolates were recorded. Pathogenicity tests were conducted with ***Penicillium variabile*** Sopp. on healthy fruit, surface sterilized as before, by inoculating sound berries and berries that had been artifically wounded with a flamed scalpel.

In early September 1976, cranberry leaves collected from an abandoned bog at Aylesford, Kings Co., that had been out of commercial production for about 5 years, were dipped into 70% (v/v) ethanol, shaken vigorously, flamed and placed on water agar in a Petri plate with the upper surface of the leaf uppermost. The fungi that developed on the leaves and in the agar adjacent to them were identified and recorded.

Results and discussion

Of the 400 berries of late harvested cranberry fruit from the native stand, 34% were classified as frosted, 32% were diseased and 34% were healthy. The amount of decay and the number of fungal species causing rot may have been increased by over-maturity. The infected fruit yielded most of the principal decay producing fungi (Table 1). Three fungi, ***Gloeosporium minus*** Shear, ***Penicillium thomii*** Maire and ***Phyllosticta putrefaciens*** Shear, considered by Shear ***et al.*** (6) to be of minor importance as initiators of fruit rot, have not heretofore been reported on cranberry in Nova Scotia. Six species

[1] ***Contribution No. 1649, Research Station, Agriculture Canada, Kentville, Nova Scotia, B4N 1J5.***

Accepted for publication August 24, 1978

Table 1. Incidence of fungi isolated from diseased cranberry fruit from a native stand in November, 1969

Organism	Percent of fruit infected	
	At Harvest	After 16 days @ 9°C
Acanthorh ynchus vaccinii Shear	**0**	0.6
"Arthrinium phaeospermum (Pers.) Grove	0.6	0
"Aureobasidium pullulans (deBy.) Arn.	8.4	16.2
Ceuthospora lunata Shear	0.6	0
"Chaetomium brevipilium Ames.	0	1.2
"Chaetomium spirale Zopf. 146885"*	**0**	0.6
"Coniothyrium olivaceum Bon. 142228	**0**	0.6
****Curvularia clavata*** Jain 146884	**0**	0.6
Diaporthe vaccinii Shear 147609	16.2	1.2
****Gloeosporium minus*** Shear 147608	**0**	1.8
Godronia cassandrae Pk. f. ***vaccinii*** Groves	1.8	7.5
Guignardia vaccinii Shear	10.8	0
"Myrothecium sp. 153473	**0**	0.6
****Penicillium thomii*** Maire 145742	12	16.5
Penicillium spp.	18.5	1.8
****Pezizella oenotherae*** (Cke. & Ell.) Sacc.	0	1.2
Phyllosticta putrefaciens Shear	0.6	0
Sporonema oxycocci Shear	44.9	23.7
****Thysanophora penicillioides*** (Roum.) Kend. 153471	**0**	0.6
Sterile breakdown	25.2	26.8
Unknown	10.8	10
Number of diseased fruit examined	167	160

* Not previously reported on cranberry in Nova Scotia.
** DAOM accession number, mycological herbarium, Biosystematics Research Institute, Ottawa.

Table 2. Frequency of fungi from diseased fruit in storage from a commercial bog in December, 1975

Organism	Percent of Fruit
Botrytis cinerea Pers.	8
Diaporthe vaccinii Shear	21
Godronia cassandrae Pk. F. ***vaccinii*** Groves	0.4
Penicillium thomii Maire	0.9
****Penicillium variabile*** Sopp. 200607"**; 155527"***	24
Penicillium sp.	2
Pestalotia svdowiana Bres.	0.4
Sporonema oxycocci Shear	51
Sterile	0.9
Number of fruit examined	228

* Not previously reported on cranberry in Nova Scotia.
** I.M.I. accession number, Commonwealth Mycological Institute, England.
*** DAOM accession number, mycological herbarium, Biosystematics Research Institute, Ottawa.

of fungi, ***Aureobasidium pullulans*** (deBy.) Arn., ***Chaetomium brevipilium*** Ames, ***Chaetomium spirale*** Zopf., ***Curvularia clavata*** Jain, ***Myrothecium*** sp. and ***Thysanophora penicillioides*** (Roum.) Kend. are not considered to be pathogenic. The fungi ***Cytospora delicatula*** Shear, ***Discosia artocreas*** Tode ex Fr. and ***Strasseria oxycocci*** Shear which normally occur on foliage or stems *(6)* appeared in culture plates and may have been associated with the calyxes rather than the skin or flesh of the fruit. These three fungi have not previously been reported on Vaccinium in this province.

The frequency of some fungi isolated from diseased berries immediately after the fruit was gathered and from refrigerated fruit differed (Table 1). The 9°C storage temperature may have enhanced the growth of some fungi more than others.

Zuckerman (8) noted the increasing importance of ***Sporonema oxycocci*** Shear in Massachusetts. In Nova Scotia it was the most commonly isolated fungus from damaged fruit and it occurred on the calyxes of 30 berries with sterile breakdown. On 5 occasions, ***P. thomii*** was the only organism isolated from rotted fruit, but usually it was associated with more aggressive pathogens. Other ***Penicillium*** spp. were not considered to be the primary cause of fruit rot. ***Acanthorhynchus vaccinii*** Shear, ***Guignardia vaccinii*** Shear and ***Stigmatea conferta*** (Fr.) Fr. (= ***Gibbera compacta*** (Pk.) Shear) have been shown to be associated with speckle or blotch of cranberry fruit (1, 3, 5). The 70% (v/v) ethanol surface sterilization of the fruit may have prevented the isolation of ***S. conferta.*** Recently it was shown that this fungus can be isolated from fruit following surface sterilization with a weak, 0.5% (v/v), Cl solution (5).

Only five species of fungi were found on the 108 cranberry leaves examined from the native stand. ***Sporonema oxycocci*** occurred on 91 leaves, ***G. vaccinii*** on 22, ***Strasseria oxycocci*** on 1, ***D. artocreas*** on 1, unknown on 1, and on 21 leaves, no fungus was found.

The dried buds from one inflorescence yielded only ***Colletotrichum dematium*** (Pers. ex Fr.) Grove, not previously reported here on this host, and from the other, only ***Sporonema oxycocci.***

Table 3. Fungi on and from cranberry leaves following 70% (v/v) ethanol treatment in September, 1976

Acanthorhynchus vaccinii Shear
**Alternaria alternata* (Fr.) Keissler
Arthrinium* state of *Apiospora montagnei* Sacc. 161168
Aureobasidium pullulans (de By.) Arn.
**Cochliobolus sativus* (Ito & Kurib. in Kurib.) Drechsler ex Dastur 160706
Diaporthe vaccinii Shear
Godronia cassandrae Pk. f. *vaccinii* Groves
Mucor sp.
**Papulospora anomala* Hotson
Pestalotia truncata Lev.
Sporonema oxycocci ;Shear
Stigmatea conferta (Fr.) Fr. 165742
An unknown ascomycete

*Not previously reported on cranberry in Nova Scotia.
**DAOM accession number, mycological herbarium, Biosystematics Research Institute, Ottawa.

Stored, decaying fruit from the commercial bog yielded the ripe rot fungus *Sporonema oxycocci* in more than 50% of the isolations (Table 2). *P. variabile,* although obtained from nearly 25% of the diseased fruit, did not produce rot in sound fruit or artifically wounded fruit and it did not colonize autoclaved cranberry fruit in Petri plates. It was often the only fungus isolated from decaying fruit from storage and because of its inability to utilize cranberries as a food source it may have existed as a mycoparasite rather than a symbiont.

Perithecia from natural infections of a *Stigmatea* sp. occurred mostly on the upper surface of more than 50% of the ethanol treated leaves from the abandoned commercial bog. Perithecia also formed on the undersides of some leaves and occasionally on the water agar adjacent to the leaves. The fungus was identified as S. *conferta.* It occurs naturally on the lower surface of cranberry leaves without causing any apparent damage (6). It is not known why perithecia form mostly on the undersides of leaves in nature but it may be a photophobic reaction. Several other fungi not normally found on this host appeared on the leaves or on the agar and none of them were recorded from more than 2 or 3 leaves (Table 3).

Sporonema oxycocci was the principal cause of cranberry fruit rot and appeared most frequently on the leaves of native and cultivated plants. The host range of twenty other fungi is extendled to cranberry in Nova Scotia.

Acknowledgement

Some of these observations are a completion of the work begun by Dr. K. A. Harrison, prior to his retirement, and R. W. Delbridge, Nova Scotia Department of Agriculture and Marketing. The assistance of R. A. Murray, Nova Scotia Department of Agriculture and Marketing is greatly appreciated. Dr. Donald Boone, University of Wisconsin, suggested the technique for producing perithecia of Stigmatea sp., and Dr. M. P. Corlett, mycologist, Ottawa, identified the fungus as S. *conferta* (Fr.) Fr.

Literature cited

1. Carlson, L. W., and D. M. Boone. 1966. A berry speckle disease of cranberry and its control. Plant Dis. Reptr. 50: 539-543.
2. Conners, I. L. 1967. An annotated index of plant diseases in Canada. Can. Dep. Agr. Pub. 1251.
3. Gourley, C. O., and K. A. Harrison. 1969. Observation on cranberry fruit rots in Nova Scotia, 1945-55. Can. Plant Dis. Surv. 49: 22-26.
4. Hall, I. V., L. R. Townsend, C. L. Lockhart, K. A. Harrison, G. W. Wood, and G. T. Morgan. 1969. Growing cranberries. Can. Dep. Agr. Pub. 1282 Rev.
5. Lockhart, C. L. 1970. Isolation of *Gibbera compacta* from cranberry and the effect of moisture and temperature on ascospore development. Can. Plant Dis. Surv. 50: 108.
6. Shear, C. L., N. E. Stevens, and H. F. Bain. 1931. Fungus diseases of the cultivated cranberry. U.S. Dep. Agr. Tech. Bul. No. 258.
7. Wehmeyer, L. E. 1950. The fungi of New Brunswick, Nova Scotia and Prince Edward Island. National Research Council of Canada Pub. No. 1890.
8. Zukerman, B. M. 1958. Relative importance of cranberry rot fungi during the storage and harvest seasons in Massachusetts, 1956-57. Plant Dis. Reptr. 42: 1214-1221.