

NATIVE HOSTS OF WESTERN CHERRY FRUIT FLY (DIPTERA: TEPHRITIDAE) IN THE OKANAGAN VALLEY OF BRITISH COLUMBIA

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ABSTRACT

In the Okanagan Valley, bitter cherry, *Prunus emarginata* Dougl., the principal host of the western cherry fruit fly, *Rhagoletis indifferens* Curran, was found at 3 locations only but may occur elsewhere in the Okanagan Valley in restricted habitats. The rare occurrence and unreliable fruiting habit indicate its existence is marginal. Adult *R. indifferens* were trapped on this host even though no fruit was present. This indicates that bitter cherry and probably, the less preferred native host, western choke cherry, *P. virginiana* var. *demissa* (Nutt.) Torr., are both important to the ecology of isolated, low, endemic populations of *R. indifferens* in the central and possibly northern Okanagan Valley. No instances were found where endemic populations of *R. indifferens* on native hosts might have formed a host strain adapted to the earlier maturing, introduced, cultivated cherries. Widespread infestations of this pest have adapted to development on cultivated sweet and semi-sweet cherries and appear to be a recently introduced race that is distinct from the endemic populations on native hosts. *R. indifferens* on cultivated cherries had an earlier emergence peak than those on the native hosts and were not associated with the presence of bitter cherry.

INTRODUCTION

The western cherry fruit fly, *Rhagoletis indifferens* Curran, was first recorded in the Okanagan Valley in 1968 (Madsen, 1970). In 1969 and 1970, widely dispersed infestations were reported from Vernon in the north to Okanagan Falls about 66 miles south (Anon. 1969, 1970). None has been found in the Oliver-Osoyoos area at the southern end of the valley or immediately west in the Similkameen Valley.

In 1930, S. C. Jones recorded bitter cherry, *Prunus emarginata* Dougl. as a native host of *R. indifferens* in Oregon (Blanc and Keifer, 1955). In California, Blanc and Keifer traced adults from cultivated cherries to bitter cherry and believed the flies infesting cherry orchards originated from the native host. Frick *et al.* (1954), in Washington, showed that western choke cherry, *Prunus virginiana* var. *demissa* (Nutt.) Torr., was also a native host of *R. indifferens* but was less important than bitter cherry. According to Blanc and Keifer, the distribution of *R. indifferens* ranges from California into British Columbia and coincides with the distribution of bitter cherry. Bush (1966) defined the distribution of *R. indifferens* as ranging from north-central California to south-eastern British Columbia. Both descriptions of the distribution indicated it does not extend so far south or north as the extremes of distribution of bitter cherry.

Peters and Arrand (1968), stressed the im-

portance of bitter cherry as a host reservoir from which *R. indifferens* could reinfest cultivated cherries in the Kootenay Valley of British Columbia. Madsen (1970), conducted a cursory survey in the Okanagan Valley in 1969, for the occurrence of native host plants but encountered only western choke cherry. A more intensive search for both hosts was conducted in 1970. The results of this survey and discussion of the ecological relationships between *R. indifferens* and the native and cultivated hosts in the Okanagan Valley are presented here.

MATERIALS AND METHODS

A search for bitter cherry in the Okanagan Valley was conducted in April and May, 1970 in all locations known or suspected to have favorable habitats similar to those described by Lyons (1954) and Hosie (1969). An intensive search for this host was also made in the Okanagan Mission and Westbank areas near cultivated cherry plantings where crop damage was caused by *R. indifferens* in 1968 and 1969. Vigorous stands of choke cherry at 3 widely separated sites with no bitter cherry nearby, were sampled for *R. indifferens* as possible alternate hosts. These were at Lambly Creek, 6 miles north of Westbank, adjacent to an abandoned sweet cherry orchard; at the Research Station, Summerland, about 1 3-mile from sweet cherries; and at the Upper Bench, Penticton, adjacent to a block of sweet cherries.

Bitter cherry was found at 3 sites in the

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Okanagan Valley. These were: at Deeper Creek, 6 miles south of Okanagan Mission; at Caesars, 1 mile south of Nahun; and at Ewing, 2.5 miles north of Fintry. All sites were within 1/4-mile of the shoreline of Okanagan Lake. The largest stand at Caesars was scattered over an area of about 2.5 acres and the smallest at Deeper Creek consisted of 18 large trees and numerous seedlings. Unsprayed, cultivated sweet cherries were located 1/2- and 1/4-mile from these stands.

Host plants at all sites were sampled for adults by trapping with sticky boards similar to those described by Kaloostian and Yeomans (1944). These were made from 1/4-inch plywood 5 1/2 x 11 1/2 inches painted yellow on one face and covered with Stikem (polymerized butene, methylpropene and butane 97%; inert ingredients, 3%. Michel and Pelton Co., 5743 Landregan Street, Emeryville, California, 94608, U.S.A.). At each site, 5 to 12 traps were hung on branches of trees 4 to 8 feet above the ground. These were changed at about 14-day intervals. Two glycine-lye bait pans, described by Barnes and Madsen (1963), were set-out at one of these sites and 10 at another. Each 6-inch diameter bait pan was made from a 1-gallon plastic bleach container filled with 8 oz of glycine-lye mixture and suspended in a tree as described by Peters and Arrand (1968). Both types of trap were set-out commencing May 27, and inspected at 7- to 14-day intervals until September 24. The bait pans were serviced at each inspection by removing all trapped insects and other debris and either replacing the glycine-lye mixture or adding water to replace that evaporated from the original volume. Most identifications of *R. indifferens* on sticky board traps were made in the field with or without the aid of a hand lens. Specimens trapped in bait pans were identified in the field but when too many were present these were collected by straining the solution and taking them to the laboratory for identification. Adults were identified by wing patterns as illustrated by Bush (1966). The mature fruit of native host plants was also sampled and examined for larvae. If available, samples of not less than 5 lb of fruit were collected at each site. These were placed over 4-mesh wire screen for 21 days at room temperature to permit larvae infesting the fruit to mature and be extracted.

RESULTS

P. emarginata was found growing in association with the following trees and shrubs: Douglas fir, *Pseudotsuga menziesii* var. *glauca* (Beissn.) Franco; black cottonwood, *Populus trichocarpa* Torr. and Gray; Pacific willow, *Salix lasiandra* Benth.; mountain or thinleaf alder, *Alnus tenuifolia* Nutt.;

water birch, *Betula occidentalis* Hook.; western red cedar, *Thuja plicata* Donn.; Douglas maple, *Acer glabrum* Torr. var. *douglasii* (Hook.) Dipp.; and western choke cherry, *Prunus virginiana* var. *demissa* (Nutt.) Torr.

At all sites the peak of bitter cherry bloom was about May 5, similar to that of most cultivated varieties of sweet cherries. Following fruit set, there was a heavy June drop and a further heavy drop in the latter half of July. By August 5, no fruit remained on the trees at any site and all showed symptoms of stress from the hot, dry conditions.

Surveys conducted in Okanagan Mission and Westbank near cultivated sweet and semi-sweet cherry plantings where crops had been damaged by *R. indifferens* in 1968 and 1969, showed that choke cherry was abundant, particularly near Okanagan Mission. No bitter cherry was found; the closest known stand was at Deeper Creek, about 6 miles from two Okanagan Mission cherry orchards where damage was found. High hills separated these commercial blocks of cherries from the Deeper Creek site.

No bitter cherry was found during limited surveys in the Oliver-Osoyoos areas of the southern Okanagan Valley or in the adjacent Similkameen Valley. Bitter cherry was found at Armstrong, immediately north of the Okanagan Valley and was common at Salmon Arm, a further 20 miles north. Heavy crops of fruit matured at both locations.

Two adult *R. indifferens* were taken on sticky board traps at Ewing during the periods July 24 to August 5 and August 14 to 20, respectively. None was taken at Deeper Creek or Caesars on sticky board traps or in bait pans. Late season examination of bitter cherry fruit from Armstrong and Salmon Arm revealed abundant evidence of recent larval feeding damage including the presence of breather holes cut through the skin but all larvae had matured and left the fruit. *R. indifferens* adults have been found at Salmon Arm (Anon., 1969) and there have been unconfirmed reports of sporadic damage in cultivated cherries.

Western choke cherry is abundant and widespread in the Okanagan and Similkameen valleys and in the Armstrong and Salmon Arm districts. Heavy crops of fruit were observed in all areas. Black choke cherry, *P. virginiana* var. *melanocarpa* (A. Nels.) Sarg., is also abundant and widespread in the two latter areas. During the surveys, no evidence of larval feeding damage was found in mature fruit of either species. Western choke cherry was found wherever bitter cherry was recorded in the Okanagan Valley. No adult *R. indifferens* were taken on sticky board traps in stands of choke cherry at any of the 3 principal sites

sampled nor were any larvae extracted from fruit collected at these sites.

DISCUSSION

This study has established that bitter cherry is present in the Okanagan Valley but it occurs only in widely separated, restricted habitats. None of the stands was over 2.5 acres and all were within 1/4-mile of Okanagan Lake. Based on site studies at the 3 locations discovered, it is most likely to occur in protected areas with higher than normal humidity and soil moisture as are found in gullies and near streams. This and the fact that the plants suffered heat and moisture stress during the unusually hot, dry summer of 1970, resulting in a complete, premature fruit drop, confirms that the central Okanagan Valley is marginal to the greater distribution of this species (Lyons, 1954). None was found nor is likely to be found in the southern end of the valley or in the adjoining Similkameen Valley where summer conditions are even hotter and drier than those in the central areas where bitter cherry was found. The climate is more moderate at the north end of the Okanagan Valley, particularly at the north-west end of Okanagan Lake so that other bitter cherry sites may well be present.

The trapping of 2 adults in a stand of bitter cherry at Ewing, shows that this host plant is a factor in the ecology of isolated, low, endemic populations of *R. indifferens* in the central and possibly, northern Okanagan Valley. Trap catches were probably reduced by the lack of fruit to attract emerged adults and stimulate feeding, mating and oviposition. The presence of fruit on bitter cherry attracted adult *R. indifferens* at Creston, British Columbia, in 1970. Fly catches on sticky board traps were correlated directly with the presence or absence of fruit.

For endemic populations of *R. indifferens* to exist when bitter cherry produces no fruit, newly emerged females must seek cultivated cherry or the secondary native host, choke cherry, although no adults were taken on sticky board traps hung in this host nor were any larvae collected from fruit that was at a suitable stage of maturity for oviposition and larval development. Cultivated cherry is restricted to irrigated areas and annually produces light to heavy crops depending on spring frosts, whereas choke cherry is abundant, widespread and annually produces fruit. Two adult *R. indifferens* were taken on bitter cherry at Ewing, July 24 to August 5 and August 14 to 20. These dates are much later than the emergence peak of June 9 to 26, for this species in cultivated sweet and semi-sweet cherries and after crop harvesting. Choke cherry with abundant, immature fruit at these dates may enable *R. indifferens* to survive when fruit of the principal native

host is not available.

The rare occurrence of bitter cherry, apparently restricted to the central and possibly, northern Okanagan Valley, is unlikely to have influenced the rapid spread of *R. indifferens* in cultivated cherry plantings throughout most of the valley. Widespread infestations of this insect on cultivated cherries probably did not evolve from populations on bitter cherry in these areas. This is supported by lack of evidence to indicate that the endemic populations of *R. indifferens* on native hosts have formed a host strain adapted to development in fruits of the introduced, earlier maturing, cultivated host. No adults were trapped in 2 unsprayed, cultivated cherry plantings located 1/4- and 1/2-mile from stands of bitter cherry and both owners reported no infested fruit had ever been found. In addition, no other plantings of cultivated cherries up to 6 miles from bitter cherry have been infested with *R. indifferens* to indicate the possibility that a shift to the introduced host had occurred. These results are in contrast with those of Simkover (1953), who reported that in the laboratory *R. indifferens* exhibit a preference for cultivated cherries over the principal native host and with those of Bush (1966) who reported that a continual shift occurs from the native to the cultivated host in cherry growing areas of northern California. Both indicate the occurrence of adaption from the native to the introduced host. It is concluded that isolated, endemic populations of *R. indifferens* occur principally on bitter cherry and occasionally on choke cherry at such low levels that adaption to the cultivated host is unlikely in the Okanagan Valley.

The marginal existence of bitter cherry with occasional or frequent crop failures and the resulting necessity to depend on the less suitable choke cherry may explain why *R. indifferens* was not a pest in the Okanagan Valley before 1968. The sudden widespread occurrence of this pest in cultivated cherry plantings here may be similar to that in Montana. There, *R. indifferens* occurs in cherry growing areas beyond the range of bitter cherry and according to Bush (1966), is a recent introduction. Thus, in the Okanagan Valley, there may be 2 distinct host races of *R. indifferens*: an isolated, low, endemic race on the native hosts and a widespread, recently introduced race on cultivated sweet and semi-sweet cherries. Elsewhere, the rapid spread of this pest in commercial cherry plantings has occurred mainly in areas where bitter cherry is abundant. Recent examples include the Kootenay Valley of British Columbia (Arrand and Peters, 1968), the Yakima Valley, (Eide *et al.*, 1949) and the Wenatchee area (Frick *et al.*, 1954) of Washington.

In the Okanagan Valley, *R. indifferens* infesting

irrigated commercial cherries has a greater tolerance to summer temperature extremes than its principal native host. Irrigation, besides supporting the introduced host, may be essential for survival of the insect under these conditions. Bush (1966) reported that *Rhagoletis* species appear to be less tolerant of dry conditions than their hosts. The apparent lack of bitter cherry in the Oliver-Osoyoos areas at the southern end of the Okanagan Valley and in the

adjacent Similkameen Valley is unlikely to prevent the eventual establishment of this pest in these areas.

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Delete "The skunk was . . . three days" and insert: The skunk was placed in an outdoor cage, in a site known to be suitable for development of *D. andersoni*, and was infested with about 8000 larvae on 9 July 1968. No development of larvae was noted and no nymphs appeared. Later the skunk was caged over water and infested with about 6000 larvae on 10 September 1968. No fed larvae were seen on the skunk or in the water tray during the next three days.