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ACCEPTABILITY OF CULTIVARS OF HIGHBUSH BLUEBERRY AT VARYING TEMPERATURES BY ADULT BLACK VINE WEEVILS (COL. :CURCULIONIDAE)[1]

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ABSTRACT

Adults of the black vine weevil, **Otiorhynchus (Brachyrhinus) sulcatus** (F.), fed and oviposited at normal, expected rates when fed excised foliage of the acceptable highbush blueberry cultivars, June and Stanley, in variable temperature regimes of 7 to 15, mean 10; 12 to 19, mean 15; and 16 to 29, mean 22°C. However, on the unacceptable cultivars, Cabot and Weymouth, they laid some eggs at the high and very few eggs at the medium regimes, whereas in earlier work they laid no eggs at a constant 20°C. These results indicate that Cabot and Weymouth provide barely adequate nutrition to the weevils and that environmental stresses such as a constant 20°C demand more nutrients than the unacceptable cultivars can provide. Variable conditions, probably due to a lower turn-over rate during the cool periods, allow the insect to obtain the nutrients necessary for fat body development and some oviposition.

INTRODUCTION

A clear pattern of unacceptability of the highbush blueberry cultivars Cabot and Weymouth to adults of the black vine weevil, *Otiorhynchus (Brachyrhinus) sulcatus* (F.), was shown at the constant laboratory conditions of 20°C and 16 hours photoperiod (Cram, 1970). Further tests at three variable temperature regimes were conducted to see if this response also occurred in somewhat more natural environmental conditions.

MATERIALS AND METHODS

The general methods were the same as those described earlier (Cram and Pearson, 1965). One half of the adults in each series was collected in the field, the rest were collected as mature larvae and allowed to transform to adults in the laboratory. Ten adults per treatment were observed for 13 weeks. The cultivars tested were the unacceptable Cabot and Weymouth, and the acceptable June and Stanley (Cram, 1970). All foliage was collected from the Makara farm.

The temperature regimes were selected to approximate a cold, a cool or a hot summer. The regimes were attained by setting the electronic programmer on three bench-top growth cabinets (Sherer-Gillett, Marshall, Mich., U.S.A.) to hourly settings which produced acceptable temperature curves with daily temperatures of 7 to 15, mean 10; 12 to 19, mean 15; and 16 to 29, mean 22°C. The photoperiod was kept at 16 hours. From six randomly selected survivors per cultivar per regime, data were collected on weight change in three weeks, preoviposition period, number ovipositing and numbers of total and viable eggs after eight weeks from the first egg.

These data were analyzed by computer and the egg data were found to be highly heterogeneous often with significant interaction between regimes and cultivars, thereby invalidating the very highly significant differences between the three regimes and between the two sets of cultivars. For this reason, significant differences are not given in Table 1, but examination of the means indicates the trends.

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TABLE 1. Response of adults of the black vine weevil fed excised leaves of highbush blueberry cultivars at 3 variable temperature regimes.

Cultivar	Temperature regime[1]	Mean wt change (mg) in 3 weeks[2]	Mean pre-oviposition period-days[2]	No. of 6 actually laying eggs	Mean total eggs[3]	Mean viable eggs[3]
Cabot	Low	-1.5	-	0	0.0	0.0
	Med.	-2.4	58.0	2	4.0	3.0
	High	4.2	41.2	6	147.2	24.5
Weymouth	Low	-4.1	-	0	0.0	0.0
	Med.	1.9	58.4	2	9.7	2.2
	High	6.0	39.5	6	188.2	40.0
June	Low	3.7	55.9	4	25.0	10.0
	Med.	7.5	34.7	6	76.8	47.7
	High	9.2	30.8	6	317.2	149.8
Stanley	Low	6.0	54.5	6	33.2	7.8
	Med.	4.9	40.7	6	101.8	67.8
	High	12.9	29.2	6	487.8	233.3

[1]Low 7 to 15, mean 10; Med. 12 to 19, mean 15; High 16 to 29, mean 22° C.
[2]No interaction effects; data from both temperature regimes and cultivars gave significant F values at $p = .01$
[3]High interaction effects.

RESULTS AND DISCUSSION

The responses of the adults to the four cultivars at variable temperature regimes (Table 1) were different from those recorded earlier at a constant temperature of 20° C (Cram, 1970). Weight changes were significantly different between regimes and between cultivars. Adults lost weight on the unacceptable cultivars at low and medium regimes, but there was some weight gain at the high regime. Adults gained weight normally at all regimes on the acceptable cultivars. Preoviposition periods were also significantly different between regimes and between cultivars. On the unacceptable cultivars all six adults laid a few eggs at the high regime; two laid a few eggs at the medium regime; and no eggs were laid at the low regime. On the acceptable cultivars all six adults laid many eggs at the high regime, several eggs at the medium regime and some eggs at the low regime. These results indicate that the unacceptable cultivars are nutritionally adequate for oviposition but barely so and that the nutrients are not present in ratios or amounts suitable to class the cultivars as acceptable. One explanation for the response to a constant temperature of 20° C may be that this unnatural regime forces the adults to such a high turnover rate that the levels of nutrients in Cabot or Weymouth do not provide the reserves necessary for growth of the fat body and ovaries prior to oviposition; thus the adults actually lose weight. This inadequate diet might also cause a reduction in feeding rate as suggested by Gordon (1961). At variable regimes the cooler nights may result in a slower turn-over rate allowing the normally nocturnal adult to accumulate reserves.

The low temperature regime approaches the 8 to 15° C range which was tested earlier for strawberry (Cram, 1965) and was found to result in a low oviposition rate similar to the results with acceptable blueberry cultivars. The effect here is undoubtedly related to temperature alone.

The wide difference between total and viable eggs recorded for all regimes and cultivars is not understood. Usually viability is well above 80 per cent.

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