Ovipositional Activity of Periodical Cicada on Apple Varieties[1]

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Abstract

Adults of brood XIV of the periodical cicadas, *Magicicada* spp. emerged in southwestern Ohio in 1974. A survey of a 2 acre apple variety planting at Ripley, Ohio, in the spring of 1975, showed that there were differences in the amount of cicada ovipositional damage among certain apple varieties.

Female periodical cicadas, *Magicicada* spp., lay eggs in many species of deciduous trees or shrubs (5, 7). Apple, peach, pear and grape are noted to be particularly susceptible to cicada ovipositional injury which can result in up to 95% damage to terminal shoots of young fruit trees (2, 4). However, no information is available to substantiate a preference for a particular fruit variety and/or rootstock combination. This paper reports observations of periodical cicada (Brood XIV) ovipositional sites in 1974 in a planting of apples in southern Ohio.

Methods and Materials

A 2 acre, 360 tree apple variety planting located at the Southern Branch of OARDC at Ripley, Ohio, was the site for the cicada ovipositional survey. The orchard consisted of 38 varieties planted on seedling, 'M. 7', 'MM 104', 'MM 106', and 'MM 111' rootstocks in 1969 at a distance of 12' x 18' in a complete randomized design. All trees were approximately 10' in height at the time of the survey.

Data were recorded on the total number of individual egg slits occurring on 3 ft of 6 randomly selected terminal shoots per tree. Each variety per rootstock combination was replicated 5-6 times. Observations were also made on the proportion of ovipositional sites on the 1974 growth

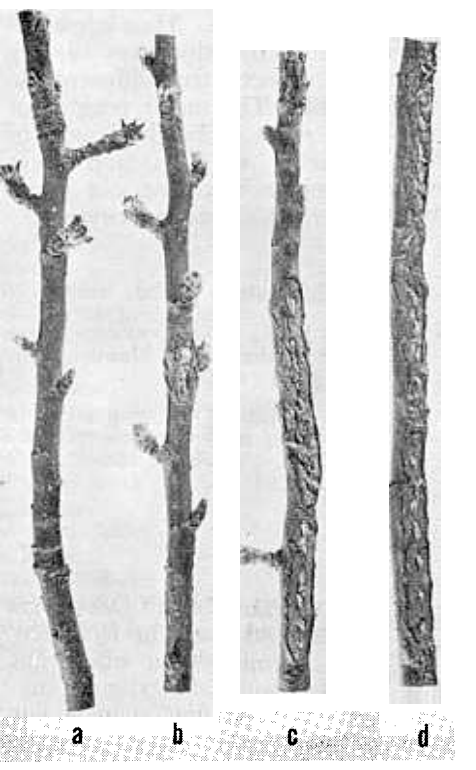

Fig. 1. An illustration of the susceptibility of apple varieties to ovipositional injury by periodical cicada: a. 'Wayne Spur Delicious' on seedling; b. 'Miller Sturdee Spur Delicious' on 'MM 106'; c. 'Double Red Jonathan' on 'M. 7'; and, d. 'Summerland Red Rome' on seedling rootstock.

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versus that occurring on the 1973 growth. All observations of twig injury were recorded in March 1975, the year following cicada emergence and prior to pruning operations.

Results and Discussion

Analysis of variance tests on data from varieties common to 2 rootstocks ('M. 7' and 'MM 106') showed no significant differences between rootstocks (5% level) (8). There was no significant interaction between variety and rootstock factors. However, as noted in Table 1, there are obvious differences between certain apple varieties. There did not appear to be an obvious relationship between the proportion of ovipositional activity on the current year's growth and the susceptibility of the variety.

Observations on other varieties which did not have the same rootstocks are presented in Table 2. If we assume the rootstock factor is not significant as in the previous data, then the low average egg slits/twig for the spur types become obvious

Table 1. Ovipositional activity of periodical cicada on terminal shoots of apple ('M. 7' and 'MM 106'). Ripley, Ohio 1974[a].

Variety	Avg. no. egg slits/twig[b]	% egg slits on 1974 growth[c]
Melrose	33.35 a	11.6
Hi Early Delicious	32.30 ab	8.7
Golden Delicious	28.30 bc	23.3
Gallia Beauty	27.64 bc	11.3
Double Red Jonathan	27.11 bc	18.4
Skyline Supreme Delicious	26.50 bc	12.8
Red King Delicious	24.82 bc	12.8
King Lucious	22.33 cd	22.5
Seeando Red Rome	21.42 cde	8.9
Red Stayman	15.45 de	11.7
Royal Red Delicious	14.45 de	30.15
Holiday	13.32 de	50.0

[a]Based on 6 twigs/tree, 6 trees/variety on 2 different rootstocks.
[b]Means followed by the same letter are not significantly different (LSD 0.05).
[c]Figure represents a proportion of the total no. egg slits observed on 1973 and 1974 growth from each twig sample.

Table 2. Ovipositional activity of periodical cicada on terminal shoots of apple varieties on various rootstocks.

Variety	Avg. no. egg slits/twig[a]				
	Seedling	M. 7	MM 104	MM 106	MM 111
Ruby	—	25.19	30.11	—	—
Goldspur	15.12	—	—	—	8.33
Wellspur Delicious	—	3.00	9.50	—	—
Sky Spur Delicious	27.12	—	—	—	—
Hardi Spur Delicious	—	—	2.76	—	—
Wayne Spur Delicious	1.00	—	—	—	—
Miller Sturdee Spur Delicious	—	—	—	3.90	5.70

[a]Based on 6 twigs/tree, 3-6 trees per variety per rootstock.

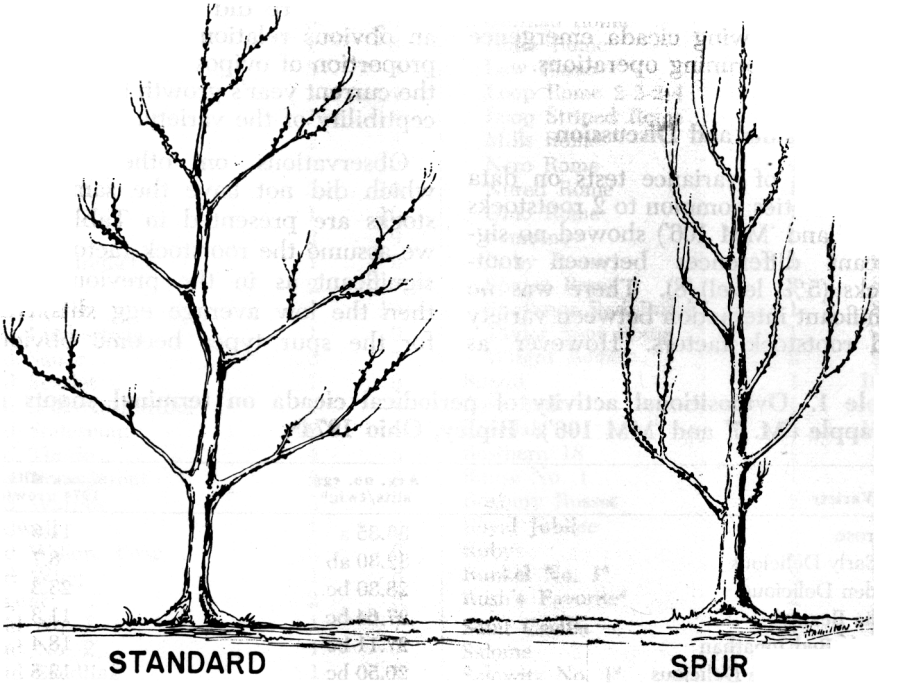

Fig. 2. Differences in tree form between standard and spur type apple trees.

and significantly lower (particularly 'Wayne Spur' and 'Hardi Spur Delicious') than the standard 'Red Delicious' such as 'Red King' or 'Hi Early'. Red and Yellow varieties were about equally preferred by the ovipositing cicadas, however, the presence of the "spur" factor in most cases resulted in decreased susceptibility of the variety to cicada oviposition by as much as 10-fold (Fig. 1).

Cory and Knight (3) reported apparent ovipositional preferences by the periodical cicada to activity between species of both *Azalea* and *Magnolia*. However, what was originally thought to be 1 species of cicada is now composed of 3 species, *Magicicada septendecim* (L.), *M. cassini* (Fisher) and *M. septendecula* Alexander and Moore (1). Specimens of all three species have been observed in the Brood XIV area in southern Ohio and it is possible that all three were present in this orchard.

Selection of terminal shoots for this survey was random and no size (twig diameter) preference by the cicada was apparent within the known range of $\frac{1}{5}$ - $\frac{1}{2}$ in. diameter (5, 7). Twig measurements, if accomplished during the time of cicada emergence and egg-laying activity, might have demonstrated a phenological correlation.

Moore and Alexander (6) observed that cicadas are more active when located in areas of higher daytime

sunlight intensity than in shaded areas. In this orchard, although tree heights were approximately the same, overall tree form and shape were different (Fig. 2). Thus, overall tree form may be a possible factor for the observed differences in ovipositional activity of cicada in standard versus spur type trees.

The data support the conclusion that in the presence of a "choice" of apple varieties, there was a statistically consistent trend of ovipositional preference for such varieties as 'Melrose' and 'Hi Early Delicious'. On the other hand, in the same orchard, such spur types as 'Wayne Spur', 'Hardi Spur' and 'Wellspur Delicious' remained relatively free from ovipositional activity by the periodical cicada. Consequently, when infestations of periodical cicada occur in apple growing areas, growers should apply protective measures, particularly to young plantings of the more susceptible varieties and the spur types would be less likely to incur severe injury from the cicadas.

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Inheritance of Pear Decline Resistance

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The present knowledge of pear decline disease indicates that phloem necrosis occurs in susceptible rootstocks of the bud union as a result of a mycoplasma whose vector is the insect pear psylla (*Psylla pyricola* Foers.) (1). Williams, et al. (3) showed that, based on phloem necrosis following psylla feeding, *Pyrus communis* L., *P. betulaefolia* Bunge, *P. calleryana* Dcne., *P. ussuriensis* Max. cv. Chieh Li and *P. pyrifolia* Mak. cv. Japanese Golden Russet were quite resistant to decline, while wild *P. pyrifolia* and cultivars 'Hawaii', 'Nijiseiki' and 'Mikado', and wild *P. ussuriensis* were susceptible. This is in general agreement with long term field studies of pear decline (2).

The present study was initiated in 1968 to study rootstocks of resistant and susceptible parents and those from resistant x susceptible crosses. All trees were grafted to 'Bartlett' and planted at the Lewis-Brown Horticulture Farm, Corvallis. In most cases 14 to 32 seedlings of each cross were used as rootstocks.

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