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DIFFERENTIATING ADULTS OF APPLE MAGGOT, *RHAGOLETIS POMONELLA* (WALSH) FROM SNOWBERRY MAGGOT, *R. ZEPHYRIA* SNOW (DIPTERA: TEPHRITIDAE) IN OREGON

RICHARD L. WESTCOTT

Plant Division, Oregon Department of Agriculture, Salem 97310

Recent discovery of the apple maggot, *Rhagoletis pomonella* (Walsh), in the Pacific Northwest (Anonymous, 1980) poses a serious threat to tree fruit growers in this and surrounding areas. Therefore, it is imperative that accurate and timely identifications be made for ongoing survey and detection activities, biological studies, and management decisions for regulatory activities and control. A discussion of the apple maggot and its distribution in the Pacific Northwest was given by AliNiazee and Penrose (1981). Figure 1 updates this distribution, which now extends eastward in Washington to Stevenson, Skamania Co.; southward in Oregon to Brookings, Curry Co. The present paper attempts to expand and utilize earlier taxonomic studies as they relate to *R. pomonella* in the western United States, thereby facilitating identification in this area.

R. pomonella belongs to a group comprising four sibling species, and its hosts are in the family Rosaceae, mostly the subfamily Pomoideae (Bush, 1966). In Oregon it has been reared from apple, crabapple and ornamental hawthorn. Identification of *R. pomonella* in the eastern U.S. requires taxonomic discrimination from *R. cornivora* Bush and *R. mendax* Curran; while in the West concern is, at least for the present, only with *R. zephyria* Snow, a species restricted to snowberry, *Symphoricarpos* spp. This paper addresses taxonomic differentiation of known Oregon populations of *pomonella* and *zephyria* but its application should prove useful elsewhere, especially in the western U.S.

Specimens utilized in this study were taken during the summer of 1980, mostly from traps located in the Willamette Valley and immediate vicinity. Most specimens of *R. pomonella* were from the greater Portland area, while specimens of *R. zephyria* came from the northern and mid-Willamette Valley, and from the Columbia Gorge as far east as Hood River. Also utilized was a series of *R. zephyria* reared from snowberries, Corvallis, 1933, S. C. Jones (Oregon State Univ. Coll.). In the Pacific Northwest, actual and potential host plants for both species grow in association over a wide area.

Bush (1966), in his comprehensive work on the genus for North America, presented an array of taxonomic characters, but those which proved most useful were a wing band ratio, total wing length of female, length of the

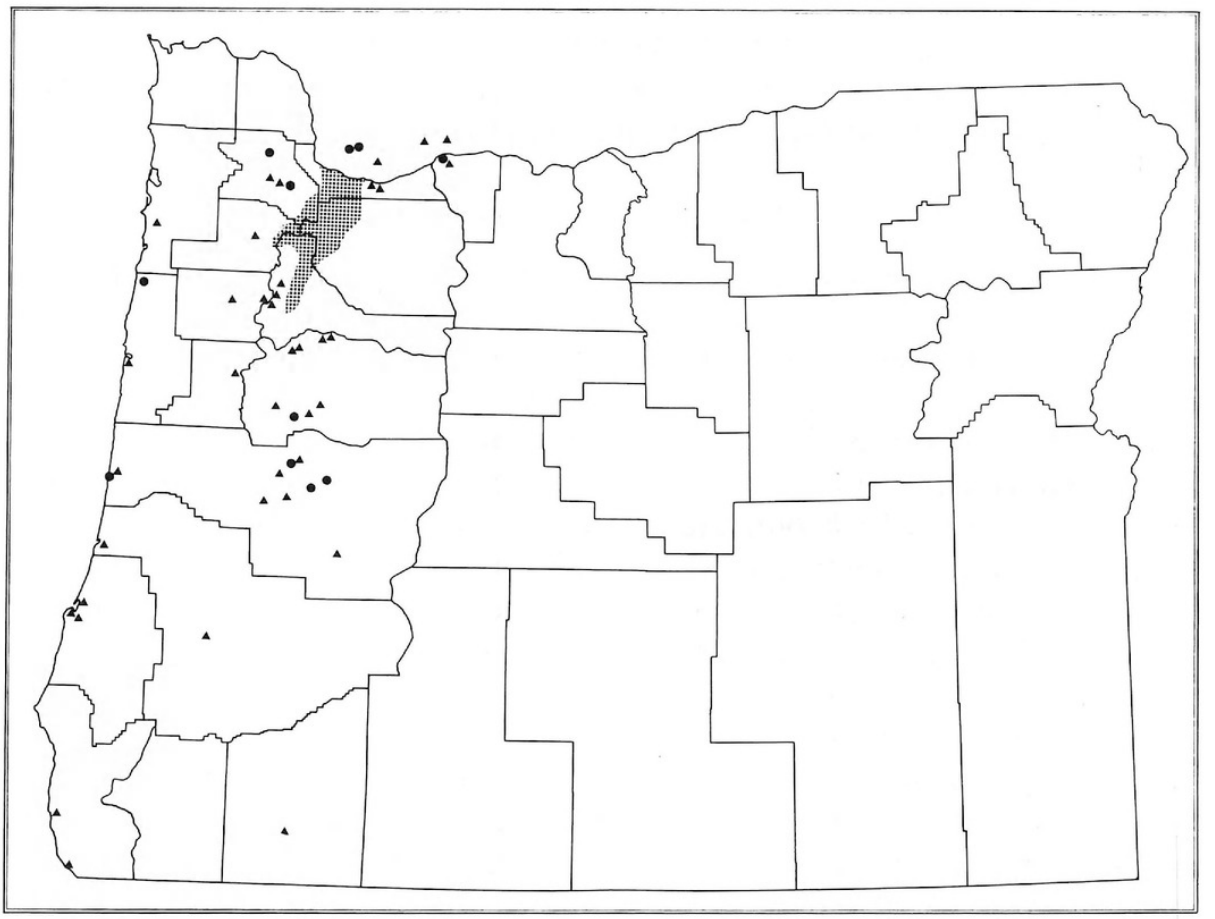
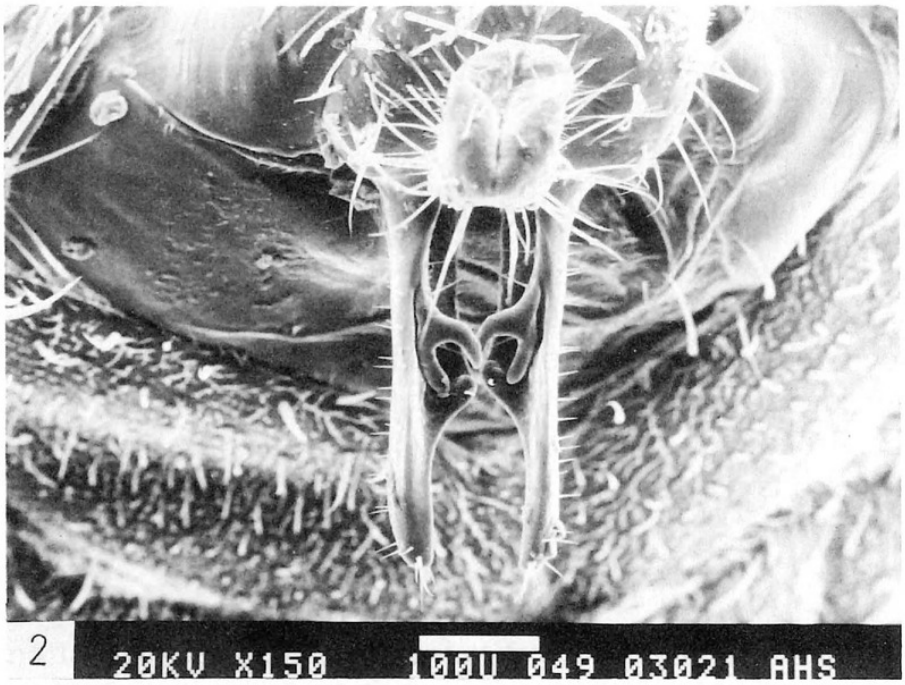


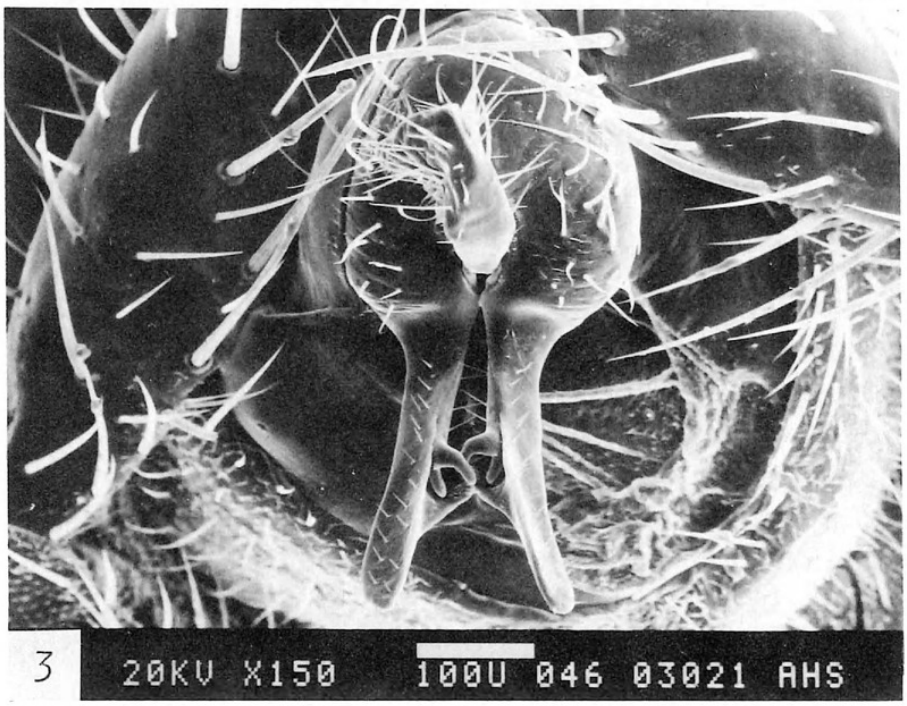
Fig. 1. Known distribution of the apple maggot, *Rhagoletis pomonella* (Walsh), in the Pacific Northwest: circles = 1980 survey data; triangles = 1981 survey data; stippled = generally infested.

ovipositor and shape of the male claspers (surstyli). He studied various populations of *R. pomonella* from different hosts. Wasbauer (1963) compared specimens of a New York population of that species with a California population of *R. zephyria,* utilizing the above characters which were suggested to him by Bush (in litt.). Based on these studies and my work in identifying hundreds of specimens of the two species, it is clear that the most reliable and facile differentiating character is the configuration of the surstyli, followed by the length of the ovipositor. Therefore, this paper focuses on those characters in an attempt to simplify and clarify their use.

Males

In my opinion, males of *R. pomonella* and *R. zephyria* are readily separable if one utilizes the genital structures; in fact, this appears in many cases to be the only way to positively identify them. It is not necessary to remove and specially prepare these structures for study, thus saving time; and it is best to view their posterior aspect. The detail and depth provided by SEM





Figs. 2–5. Fig. 2. Male genitalia showing surstyli of *Rhagoletis pomonella* (Walsh). Fig. 3. Same, *R. zephyria* Snow. Fig. 4. Ovipositor, *R. pomonella*. Fig. 5. Same, *R. zephyria* (illustration shows variation common to both species).

photos (Figs. 2, 3) provides a more accurate comparison than available line drawings, clearly showing the parallel surstyli of *R. pomonella* with their broad surfaces facing directly laterad, versus the divergent surstyli of *R. zephyria* with their broad surfaces arranged obliquely. This configuration is

best observed on a freshly killed or relaxed fly, so the legs may be moved if they obscure one's view; however, if a dry specimen is expendable, simply break off the offending appendages! Occasionally, a specimen of *R. pomonella* prepared from a sticky trap will have one surstylus (rarely both) distorted from the natural position depicted in Fig. 2. However, this is a minor problem and does not preclude positive identification. I have found this distortion to be insignificant in *R. zephyria*.

An additional character of the surstylus which may be of value in separating the two species is the presence of much longer apical setae in *R. pomonella*. However, these are sometimes difficult to see with a light microscope or may be broken off, especially on specimens prepared from traps. I examined numerous males of *R. zephyria* and found no evidence of these longer setae.

Females

When confronted with one or a very few flies for identification, most often they were females. Traps captured many more females than males. Normally this poses no problem, as identification can usually be made by measuring the length of the ovipositor, often from the combination of a wing band ratio and wing length. Very large specimens can usually be determined as *R. pomonella* on the the basis of size alone.

Some clarification is necessary with regards to measuring the ovipositor, which exhibits similar variation in both species (Figs. 4, 5). Usually there exists a variably-developed basal sclerotized dorsal extension or process (Fig. 4). My measurements were made from the apex of the ovipositor to the apex of this process; it can only be assumed that previous authors mentioned herein did likewise. In some cases, especially when the ovipositor is darkly sclerotized, an accurate measurement can be made without removing the ovipositor from the specimen. However, it usually is best to place it on a slide in a mixture of mounting medium and glycerine sufficient to restrict its movement. If the distal sheath is poorly translucent it may have to be cleared. Problems may arise with lightly sclerotized or freshly emerged specimens (see discussion below on *R. zephyria*).

Previous studies (Wasbauer, 1963; Bush, 1966) clearly showed that ovipositor length was the most reliable character for differentiating females of the two species. With the exception of a few anomalous specimens of *R. pomonella* reared from plum and fire thorn in Florida and Texas, respectively, there was no overlap. In *R. pomonella* (N = 155) the length ranged (R) from .90 mm (Florida specimens reared from hawthorn; otherwise the smallest was .98 mm) to 1.49 mm, means ($\bar{x}$) of the different populations varied from 1.13–1.33 mm. In *R. zephyria* N = 47, R = .63–.88 mm, $\bar{x}$ = .75 and .78 mm. Data from an Oregon sample of specimens are as follows:

R. pomonella: N = 93, R = .92–1.38 mm, $\bar{x}$ = 1.14 mm. *R. zephyria*: N = 121, R = .72–.88 mm, $\bar{x}$ = .81 mm. Although these figures are in close agreement with those of prior workers, several specimens (for two of which data were not included) indicate a very small character overlap between species. Including both species, only five females had ovipositors measuring in the "problem area" (.88–.98 mm). Three of these (.92, .93 and .97 mm) were identified as *R. pomonella* based on supplementary objective criteria (wing length; wing band ratio) and subjective characters.[1] Of those excluded from the sample data, one (.95 mm) was questionably placed in *R. zephyria* and another (.94 mm) combined characters of both species.

It should be noted that correlation in size of the fly (which is indicated by wing length) with length of the ovipositor appeared insignificant. Although extensive comparisons were not made, some of the smallest specimens of *R. pomonella* possessed ovipositors of above average length, and the opposite was true in *R. zephyria*.

In addition to the sample above I made hundreds of identifications, all from trap catches. Eight females were found with ovipositor lengths ranging from .90–.98 mm. All but one were determined as *R. pomonella,* including one with the ovipositor measuring .90 mm. The eighth (.90 mm, too) was identified as *R. zephyria*.

A sample taken from the extensive reared series of *R. zephyria* produced the following data: N = 23, R = .69–.81 mm, $\bar{x}$ = .77 mm. The smaller average ovipositor length could be an artifact of measurement, since sclerotization was very light and a basal dorsal process was rarely evident. However, it could also be a result of the picked host fruit deteriorating in quality before larval maturity, as alluded to by Benjamin (1934:15). Investigations to determine the latter effect are necessary, as the desirability of using reared material in taxonomic studies is obvious. The need is specially evident for further studies utilizing positively host-associated (preferably by rearing) material from the western states, for biological investigations as well.

In summary, it appears that a small percentage of female flies cannot be identified with certainty; however, the chance of dependency on such specimens is low. If an identification is critical, such as in regulatory work, effort must be made to secure additional material from which positive identification may be made.

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Footnote

[1] After examining many specimens, I came to recognize that most specimens of *R. pomonella* possess a subtly lighter wing band color (perhaps perceptible only in fresh or recently collected material) and, in the female, the wing is very slightly less broadly rounded apically.