

## Data Sheets on Quarantine Pests

# *Rhagoletis completa*

### IDENTITY

- *Rhagoletis completa*

**Name:** *Rhagoletis completa* Cresson

**Synonyms:** *Rhagoletis suavis* subsp. *completa* Cresson

**Taxonomic position:** Insecta: Diptera: Tephritidae

**Common names:** Walnut husk fly (English)

Mouche des brous du noyer (French)

**Notes on taxonomy and nomenclature:** In the previous edition of this data sheet (EPPO/CABI, 1992), *R. suavis* was treated as a synonym of *R. completa*. In this edition, it is treated as a separate species (see below).

**Bayer computer code:** RHAGCO

**EU Annex designation:** I/A1

- *Rhagoletis suavis*

**Name:** *Rhagoletis suavis* (Loew)

**Synonyms:** *Trypeta suavis* Loew

**Bayer computer code:** RHAGSU

**EU Annex designation:** I/A1

### HOSTS

- *Rhagoletis completa*

The principal hosts are *Juglans* spp. In North America, *J. nigra*, *J. californica* and *J. hindsii* are attacked (Bush, 1966). Under certain conditions peaches (*Prunus persica*) may be attacked (Bush, 1966) but the significance of this is not clear. Wild hosts are other *Juglans* spp. (Foote, 1981). In the EPPO region, the only economically significant host might be walnuts (*J. regia*). Although there was only one old record, possibly a misidentification, on this host in North America (Cresson, 1929), there were records of high levels of infestation of walnut fruits in 1991 in some Italian orchards.

- *Rhagoletis suavis*

Recorded from *Juglans ailanthifolia*, *J. cinerea*, *J. nigra* and walnuts (*J. regia*) (Bush, 1966). Peaches (*Prunus persica*) are also an occasional host (Dean, 1969).

### GEOGRAPHICAL DISTRIBUTION

*R. completa* and *R. suavis* are indigenous to North America. The former species has very recently been introduced into the EPPO region and has become established in a limited area.

- *Rhagoletis completa*

**EPPO region:** Italy - present in the north in Piemonte (in the area of Novara), Lombardia (in the areas of Milano, Varese, Pavia and Sondrio) and Friuli-Venezia Giulia; Switzerland - absent up to 1991, except for light-trapping reports from the Ticino area of nine males

and one female (1986-90). By monitoring trap catches, it was then found that *R. completa* was widely distributed in the canton (in the regions of Locarno, Lugano and Chiasso) in relatively large numbers. The Swiss authorities believe that the pest is established and that eradication is not feasible (R. Mani, Swiss Plant Protection Service).

**North America:** Mexico (possibly northern), USA (Arizona, Idaho, Iowa, Kansas, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New Mexico, Oklahoma, Oregon, Texas, Utah, Washington). Adventive in California since the early 1920s (Bush, 1966).

**EU:** Present.

**Distribution map:** See CIE (1975, No. 337), Foote *et al.* (1993).

- ***Rhagoletis suavis***

**EPPO region:** Absent.

**North America:** USA (Arkansas, Connecticut, Florida, Illinois, Indiana, Iowa, Kansas, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Virginia, West Virginia, Wisconsin).

**EU:** Absent.

**Distribution map:** See Foote *et al.* (1993).

## **BIOLOGY**

Eggs are laid below the skin of the host fruit and hatch after 3-7 days. The larvae usually feed for 2-5 weeks. Pupariation is in the soil under the host plant and this is the normal overwintering stage. Adults may live for up to 40 days under field conditions (Christenson & Foote, 1960).

## **DETECTION AND IDENTIFICATION**

### **Symptoms**

Attacked fruit will be pitted by oviposition punctures, around which some discoloration usually occurs.

### **Morphology**

- ***Rhagoletis completa***

#### **Adult**

**Colour:** Scutum not marked with yellow and black patches; scutellum entirely cream to yellow; if scutellum marked with black, the black areas are confined to the base and lateral areas; wing with a pattern of yellow or brown crossbands.

**Head:** Three pairs of frontal setae; genae usually less than one-quarter eye height; ocellar setae long, usually similar in length and strength to orbital setae; two pairs of orbital setae; 1st flagellomere usually with a small antero-apical point.

**Thorax:** Scutum red-brown with dorsocentral setae based close to a line between the anterior supra-alar setae; scutum with dorsocentral setae and presutural supra-alar setae; anatergite without long pale hairs, at most with a fine pubescence; scutellum flat and with four marginal setae (one basal and an apical pair).

**Wing:** Vein Sc abruptly bent forward at nearly 90°, weakened beyond this bend and ending at subcostal break; vein R1 with dorsal setulae; vein R4+5 usually without dorsal setulae, except sometimes at the base of the vein (except in some aberrant individuals); apex of vein M meeting C with a distinct angle; cup extension short, never more than one-fifth as long as vein A1+Cu2, and vein CuA2 straight along anterior edge of cup extension; cell cup always considerably broader than half depth of cell bm, and usually about as deep as cell bm. With a sub-basal crossband; discal and preapical crossbands separate; preapical and apical crossbands broadly joined between veins C and R4+5; cells r1 and r2+3 without any

markings between the discal and preapical crossbands; veins R4+5 and M without any isolated markings. Length 3-4 mm.

Abdomen: Female with an ovipositor that is shorter than the wing length, and straight. Syntergosternite 1+2 yellow-brown; tergites 3-5 brown in basal half and yellow-brown apically (White & Elson-Harris, 1992).

#### **Larva**

See Phillips (1946) and Steyskal (1973), who provides a key separating *R. completa* from two other species on walnut.

#### • *Rhagoletis suavis*

##### **Adult**

Differs from other pest species of *Rhagoletis* by the following combination of characters: scutellum without black marks; wing with a subbasal crossband; discal and preapical crossbands joined across entire depth of cell dm (see White & Elson-Harris, 1992 for illustration).

##### **Larva**

Similar to *R. pomonella* according to White & Elson-Harris (1992) who give a description derived from data presented by Phillips (1946) and Steyskal (1973).

#### **Detection and inspection methods**

Traps already in use within the EPPO region for *Rhagoletis cerasi* are suitable for monitoring any invasion of *R. completa*. They capture both sexes and are based on visual, or visual plus odour, attraction. They are coated in sticky material. Traps are usually either flat-surfaced and coloured fluorescent yellow to elicit a supernormal foliage response, or spherical and dark-coloured to represent a fruit; traps which combine both foliage and fruit attraction can also be used. The odour comes from protein hydrolysate or other substances emitting ammonia, such as ammonium acetate. See Boller & Prokopy (1976) and Economopoulos (1989) for a discussion of these traps.

#### **MEANS OF MOVEMENT AND DISPERSAL**

Adult flight and the transport of infected fruit are the major means of movement and dispersal to previously uninfected areas. However, *Rhagoletis* spp. are not known to fly more than a short distance (Fletcher, 1989). In international trade, the major means of dispersal to previously uninfested areas is the transport of fruit containing live larvae. There is also a risk from the transport of puparia in soil or packaging with plants which have already fruited.

#### **PEST SIGNIFICANCE**

##### **Economic impact**

In North America, *R. completa* is a pest of various *Juglans* spp. but has hardly been recorded on *J. regia*. In Switzerland, it attacks the mesocarp of European walnuts (*J. regia*), and in the case of severe infestation may also damage the pericarp and the nut itself (R. Mani, Swiss Plant Protection Service). It could become a problem for walnut fruit production. In 1991, 50% of harvested walnuts in some orchards were infested by *R. completa* (Ciampolini & Trematerra, 1992). There are four other *Rhagoletis* spp. attacking walnut husks in North America, of which *R. suavis* is one. None has been recorded as a pest.

##### **Control**

Control procedures already established in the EPPO region for *Rhagoletis cerasi* are similar to those used against the North American pest species and could therefore be implemented

against any outbreak of *R. completa* within the EPPO region. Upon detection, fallen and infected fruit must be removed and destroyed. If possible, wild and abandoned host trees should also be destroyed. Boller & Prokopy (1976) note that systemic organophosphates, such as dimethoate, are highly effective against most species, killing eggs, larvae and adults. Recently, Belanger *et al.* (1985) discussed the use of pyrethroids, but these were only of use when pest activity was low. More environmentally acceptable techniques have been tried; namely bait sprays (insecticide plus ammonia source) which can be applied as a spot treatment; soil application of insecticide to destroy pupae; and juvenile hormone analogues which can be applied to the soil (Boller & Prokopy, 1976). The IPM of walnut pests, including *R. completa*, was discussed by Haley & Baker (1982).

### Phytosanitary risk

*Rhagoletis completa* used to be included in the EPPO A1 quarantine list category "non-European Trypetidae" (OEPP/EPPO, 1983) with other *Rhagoletis* spp., although it was not previously known to affect European walnut. Because it has now been introduced into Switzerland and Italy, this species has been removed from the A1 list. However, there are no practical measures to prevent its spread and it is not considered to be a very important pest, so EPPO recently decided not to add it to its A2 list. It has not been individually considered to be a quarantine pest by any other Regional Plant Protection Organization. *R. suavis* is not a pest, and was not, in a recent review by EPPO, considered to merit individual mention in the EPPO A1 list.

### PHYTOSANITARY MEASURES

Consignments of fruits from countries where these pests occur should be inspected for symptoms of infestation and those suspected should be cut open in order to look for larvae. EPPO recommended (OEPP/EPPO, 1990), when only the North American origin was under consideration, that such fruits should come from an area where *Rhagoletis completa* does not occur or from a place of production subject to growing season inspection. Fruits may also be treated in transit by cold treatment (e.g. 40-42 days at -0.6°C) (FAO, 1983). Ethylene dibromide was previously widely used as a fumigant but is now generally withdrawn because of its carcinogenicity; methyl bromide is less satisfactory, damaging many fruits and reducing their shelf life, although treatment schedules are available for specific cases (FAO, 1983; Armstrong & Couey, 1989). Treatment methods against fruit flies are currently under review within EPPO and as part of an inter-RPPO programme.

Plants of host species transported with roots from countries where these pests occur should be free from soil, or the soil should be treated against puparia. The plants should not carry fruits. Such plants may indeed be prohibited importation.

If *R. completa* is added to the EPPO A2 list, the phytosanitary measures recommended against it are liable to be reviewed.

### BIBLIOGRAPHY

- Armstrong, J.W.; Couey, H.M. (1989) Fruit disinfestation: fumigation, heat and cold. In: *World Crop Pests 3(B). Fruit flies; their biology, natural enemies and control* (Ed. by Robinson, A.S.; Hooper, G.), pp. 411-424. Elsevier, Amsterdam, Netherlands.
- Belanger, A.; Bostanian, N.J.; Rivard, I. (1985) Apple maggot (Diptera: Trypetidae) control with insecticides and their residues in and on apples. *Journal of Economic Entomology* **78**, 463-466.
- Boller, E.F.; Prokopy, R.J. (1976) Bionomics and management of *Rhagoletis*. *Annual Review of Entomology* **21**, 223-246.
- Bush, G.L. (1966) The taxonomy, cytology and evolution of the genus *Rhagoletis* in North America (Diptera: Tephritidae). *Bulletin of the Museum of Comparative Zoology* **134**, 431-526.

- Christenson, L.D.; Foote, R.H. (1960) Biology of fruit flies. *Annual Review of Entomology* **5**, 171-192.
- Ciampolini, M.; Trematerra, P. (1992) Widespread occurrence of walnut fly (*Rhagoletis completa* Cresson) in northern Italy. *Informatore Agrario* **48**, 52-56.
- CIE (1975) *Distribution Maps of Pests, Series A* No. 337. CAB International, Wallingford, UK.
- Cresson, E.T. (1929) A revision of the North American species of fruit-flies of the genus *Rhagoletis* (Diptera: Trypetidae). *Transactions of the American Entomological Society* **55**, 401-414.
- Dean, R.W. (1969) Infestation of peaches by *Rhagoletis suavis*. *Journal of Economic Entomology* **62**, 940-941.
- Economopoulos, A.P. (1989) Control; use of traps based on color and/or shape. In: *World Crop Pests 3(B). Fruit flies; their biology, natural enemies and control* (Ed. by Robinson, A.S.; Hooper, G.), pp. 315-327. Elsevier, Amsterdam, Netherlands.
- EPPO/CABI (1992) *Rhagoletis* spp. (non-European). In: *Quarantine pests for Europe* (Ed. by Smith, I.M.; McNamara, D.G.; Scott, P.R.; Harris, K.M.). CAB International, Wallingford, UK.
- FAO (1983) *International plant quarantine treatment manual*, 220 pp. *FAO Plant Production and Protection Paper* No. 50. FAO, Rome, Italy.
- Fletcher, B.S. (1989) Ecology; movements of tephritid fruit flies. In: *World Crop Pests 3(B). Fruit flies; their biology, natural enemies and control* (Ed. by Robinson, A.S.; Hooper, G.), pp. 209-219. Elsevier, Amsterdam, Netherlands.
- Foote, R.H. (1981) The genus *Rhagoletis* Loew south of the United States (Diptera: Tephritidae). *Technical Bulletin of the U.S. Department of Agriculture* No. 1607, 75 pp.
- Foote, R.H.; Blanc, F.H.; Norrbom, A.L. (1993) *Handbook of the fruit flies of America north of Mexico*. Comstock, Ithaca, USA.
- Haley, M.J.; Baker, L. (Editors) (1982) *Integrated pest management for walnuts*, 96 pp. University of California, Berkeley, California, USA.
- OEPP/EPPO (1983) Data sheets on quarantine organisms No. 41, Trypetidae (non-European). *Bulletin OEPP/EPPO Bulletin* 13 (1).
- OEPP/EPPO (1990) Specific quarantine requirements. *EPPO Technical Documents* No. 1008.
- Phillips, V.T. (1946) The biology and identification of trypetid larvae. *Memoirs of the American Entomological Society* **12**, 1-161.
- Steyskal, G.C. (1973) Distinguishing characters of the walnut husk maggots of the genus *Rhagoletis* (Diptera, Tephritidae). *Cooperative Economic Insect Report* **23**, 522.
- White, I.M.; Elson-Harris, M.M. (1992) *Fruit flies of economic significance; their identification and bionomics*. CAB International, Wallingford, UK.