Crop Protection Compendium

Datasheet Type(s): Pest

Identity

Preferred Scientific Name

Grapholita funebrana Treitschke

Preferred Common Name

red plum maggot

Other Scientific Names

Carpocapsa funebrana (Treitschke)
Cydia funebrana (Treitschke, 1835)
Enarmonia funebrana (Treitschke)
Grapholitha funebrana (Treitschke)
Laspeyresia funebrana (Treitschke)
Opadia funebrana (Treitschke)
Tortrix funebrana (Treitschke)

International Common Names

English

plum fruit moth, prune moth

Spanish

gusano de las ciruelas, polilla de las ciruelas

French

carpocapse des prunes, carpocapse ver des prunes, ver des prunes

Portugese

bichado das ameixas

Local Common Names

Denmark

blommevikler

Finland
kriikunakääriäinen

Germany
Pflaumenmade, Pflaumen-Wickler

Hungary
szilvamoly

Italy
cidia delle susine, tignola delle susine, verme delle susine

Netherlands
Pruimemot, Pruimenmade

Norway
plommevikler

Sweden
plommonvecklare

Turkey
erik ic kurdu

EPPO code
LASPFU (Cydia funebrana)

Taxonomic Tree

Domain: Eukaryota
Kingdom: Metazoa
Phylum: Arthropoda
Subphylum: Uniramia
Class: Insecta
Order: Lepidoptera
Family: Tortricidae

Genus: Grapholita

Species: Grapholita funebrana

Notes on Taxonomy and Nomenclature

C. funebrana was first described in 1835 by Treitschke as Grapholita funebrana, and has since been referred to under many generic names (Bovey, 1937). Records with other specific names seem to be due to misidentification. For example, Danilevsky (1958) states that Cydia (Laspeyresia) cerasana described by Kozhantshikov is C. funebrana.

Description

Bovey (1937) gives a detailed description of various stages of the life cycle.

Eggs

Eggs are flattened, slightly elliptical, about 0.6 x 0.7 mm, and with very fine surface sculpturing. They are laid singly; when freshly laid they are translucent and the upper surface is regularly convex. They soon yellow and differentiate, forming a central dome-shaped area, circled by a flat ring. After eclosion, the chorion remains on the surface on which it was laid, becoming a more visibly brilliant spot.

Larvae

Fully-grown larvae are 10-12 mm long, reddish dorsally, with a dark head, and clearly tapered at both ends. The prothoracic shield and the anal plate are light brown. An anal comb is present.

Pupae

Pupae are 6-6.5 mm long and light brown.

Adults

Adults have a wingspan of 10-15 mm. The forewings are dark grey-brown with a grey 'mirror' close to the termen, bearing four short dark longitudinal striae.

Distribution

C. funebrana is largely restricted to the Palearctic region. Only one unconfirmed record exists for Argentina (Miatello, 1913). In Himachal Pradesh, India, C. funebrana had been reported to occur on apricots, but Bhardwaj (1987) failed to catch C. funebrana in pheromone traps during a 2-year survey in this region. C. funebrana is the greatest single economic threat to fruit production in Central and Eastern Europe (Van der Geest and Evenhuis, 1991). The European distribution of C. funebrana is reviewed by Karsholt and Razowski (1996).

Distribution Table

Country	Distribution	Last Reported	Origin	First Reported	Invasive	References	Notes
ASIA							
Armenia	Present, no further details					Kasumyan & Mnatsakanyan, 1986; EPPO, 2009	
Azerbaijan	Present, no further details					Kostandyan, 1990; EPPO, 2009	
China	Restricted distribution					EPPO, 2009	
-Jilin	Present, no further details					Kang et al., 1989	
-Liaoning	Present, no further details					Woo, 1961; EPPO, 2009	
Georgia (Republic of)	Present, no further details					EPPO, 2009	
Iran	Present, no further details					EPPO, 2009; Zoebelein, 1996	

Japan	Present, no further details					EPPO, 2009	
Kazakhstan	Present, no further details					EPPO, 2009	
Kyrgyzstan	Present, no further details					EPPO, 2009	
Syria	Present, no further details					EPPO, 2009	
Tajikistan	Present, no further details					EPPO, 2009	
Turkey	Present, no further details					EPPO, 2009	
Turkmenistan	Present, no further details					EPPO, 2009; Saparmamedova, 1988b	
Uzbekistan	Present, no further details					Pospielov, 1914; EPPO, 2009; Radestky, 1913; Atanov & Gummel', 1991	
AFRICA							
Algeria	Restricted distribution					Balachowsky & Mesnil, 1935; EPPO, 2009	
SOUTH AMERICA							
Argentina	Unconfirmed record					Miatello, 1913	
EUROPE							

Albania	Present, no further details					EPPO, 2009	
Austria	Widespread			****		Glaeser, 1979; Pindur, 1980; Böhm, 1948; EPPO, 2009	
Belgium	Present, no further details					Belmans, 1993; EPPO, 2009	
Bosnia-Hercegovina	Present, no further details					Batinica & Muratovic, 1972; Radman & Batinica, 1980; EPPO, 2009	
Bulgaria	Widespread			****		Vasev, 1985; Tchorbadzhiev, 1925; Tchorbadzhiev, 1929; EPPO, 2009	
Cyprus	Present, no further details					Morris, 1938; EPPO, 2009	
Czech Republic	Widespread					Komarek, 1987; Hrdy et al., 1989; Hrdy et al., 1994	
Czechoslovakia (former)	Widespread			****		Komarek, 1987; Hrdy et al., 1989; Molnar, 1988; Hrdy et al., 1994; EPPO, 2009	
Denmark	Present, no further details					Ferdinandsen & Rostrup, 1920; EPPO, 2009	

Estonia	Present, no further details						
Finland	Present, no further details					EPPO, 2009	
France	Restricted distribution					Touzeau, 1972; Touzeau, 1975; Carlot, 1993; EPPO, 2009	
-France (mainland)	Restricted distribution					EPPO, 2009	
Germany	Widespread			****		Anon, 1972; EPPO, 2009	
Greece	Present, no further details						
Hungary	Widespread			****		Papp, 1972; EPPO, 2009	
Ireland	Present, no further details						
Italy	Present, no further details					Molinari, 1995; Molinari et al., 1997; EPPO, 2009; Viggiani & Cancellara, 1975	
-Italy (mainland)	Present, no further details					EPPO, 2009	
-Sicily	Present, no further details					EPPO, 2009	
Latvia	Present, no further details						

Lithuania	Present, no further details					EPPO, 2009	
Luxembourg	Present, no further details						
Netherlands	Present, no further details					EPPO, 2009	
Norway	Restricted distribution					Schoyen, 1917; EPPO, 2009	
Poland	Present, no further details					Kagan & Lewartowski, 1978; Walczak et al., 1993; Kozlowski, 1994; EPPO, 2009	
Portugal	Present, no further details						
Romania	Present, no further details					EPPO, 2009	
Russian Federation	Restricted distribution					EPPO, 2009	
-Russia (Europe)	Restricted distribution					EPPO, 2009	
-Russia (Europe)	Restricted distribution					EPPO, 2009	
-Russia (Europe)	Restricted distribution					EPPO, 2009	
-Russian Far East	Present, no further details					EPPO, 2009	
-Siberia	Present, no further					Sundukova et al., 1988;	

	details					Glazunova, 1994; EPPO, 2009	
Slovakia	Widespread					Hrdy et al., 1994	
Spain	Present, no further details					EPPO, 2009	
-Spain (mainland)	Present, no further details					EPPO, 2009	
Sweden	Widespread					EPPO, 2009	
Switzerland	Widespread					EPPO, 2009	
Ukraine	Present, no further details					Kudina & Misyurenko, 1987; EPPO, 2009	
United Kingdom	Widespread					EPPO, 2009	
-England	Widespread					EPPO, 2009	
-Scotland	Restricted distribution					EPPO, 2009	

Hosts / Species Affected

C. funebrana bores into the fruits of sloe (Prunus spinosa), and cultivated plums (Prunus domestica and Prunus insititia). Records of C. funebrana damaging cherry (Prunus avium; Kostrovsky, 1914), sour cherry (Prunus cerasus) and apricot (Prunus armeniaca; Bovey, 1937) are not uncommon; presence on peach (Prunus persica; Kostrovsky, 1914) is uncommon and only a few old records refer to C. funebrana damaging apple (Malus domestica; Radetsky, 1913; Pospielov, 1914). Bovey (1937) and Saringer and Deseö (1968) give reviews of the host plants of C. funebrana.

Host Plants and Other Plants Affected

Plant name	Context
Castanea sativa (chestnut)	Other
Malus domestica (apple)	Other
Prunus armeniaca (apricot)	Main
Prunus avium (sweet cherry)	Main
Prunus cerasus (sour cherry)	Main
Prunus domestica (plum)	Main
Prunus dulcis (almond)	Other
Prunus persica (peach)	Other
Prunus salicina (Japanese plum)	Other
Prunus spinosa (blackthorn)	Wild host

Growth Stages

Fruiting stage

Symptoms

Larvae bore into fruits after hatching. Entrance holes are barely visible. Feeding activity of the larvae in young fruits usually damages sap vessels near the peduncle, causing a colour change in the fruit from green to violet and fruit drop. Growing fruits may exude gum, and frass is often visible mixed with exudate from the entrance hole. In the latter part of the season, when fruits are fully-grown, infested ones can be easily detected as they ripen earlier.

List of Symptoms / Signs

Sign

Fruit

- gummosis
- premature drop
- internal feeding
- obvious exit hole

frass visible
discoloration

Biology and Ecology

Bovey (1937), refers to Kostrovsky (1914) as the first author to make a significant contribution to knowledge of the biology of C. funebrana. Bovey (1966) gives a complete account of work on the biology of C. funebrana that had been performed to date. The biology of the insect has been studied in a number of different countries: in Yugoslavia, Batinica (1970) and Stamenkovich et al. (1984) recorded two or three generations per year; in Italy, Molinari (1995) recorded three generations in Poland (Kozlowski, 1994), Switzerland (Staubli and Höhn, 1988), Hungary (Saringer and Deseö, 1972), the former Soviet Union (Popova, 1971), Czechoslovakia (Molnar, 1988), and in Belgium (Belmans, 1993), two generations per year have been recorded. In Northern Europe (including the UK) there is only one generation per year (Vernon, 1971).

In the areas where two or three generations per year occur, the species overwinters as mature larvae and pupation takes place during February or March. The first flight occurs from April to June and peaks in May. A second and, in warmer areas, a third flight period occurs later in the summer. The threshold for development is 10°C (Charmillot et al., 1979). The development time (in day-degrees C) averages 75 for eggs, 175 for larvae and 160 for pupae. Allowing 10 day-degrees for the pre-oviposition period, the complete life cycle takes 420 day-degrees. The first captures in sex-attractant traps in the field occur at 30 day-degrees, and the flight of the second generation begins at 450-500 day-degrees. Adults emerge in the morning; sexual activity begins about 2 h before sunrise and ends at sunrise. Eggs are laid mainly in the afternoon and evening.

Plant Trade

Plant parts liable to carry the pest in trade / transport	Pest stages	Borne internally	Borne externally	Visibility of pest or symptoms
Fruits (inc. pods)	larvae	Yes	No	Pest or symptoms usually visible to the naked eye

Plant parts not known to carry the pest in trade / transport

Bark
Bulbs, Tubers, Corms, Rhizomes
Flowers, Inflorescences, Cones, Calyx
Growing medium accompanying plants
Leaves
Roots
Seedlings, Micropropagated plants
Stems (above ground), Shoots, Trunks, Branches
True seeds (inc. grain)
Wood

Notes on Natural Enemies

Muesebeck (1932) collected Macrocentrus instabilis from larvae of C. funebrana in Washington DC, USA. Bovey (1937) gives a detailed account of parasitoids and hyperparasitoid found in connection with C. funebrana in Switzerland. Ephialtes sp. and Ascogaster quadridentata were the most effective parasitoids of C. funebrana (10-20% parasitized larvae). Saparmamedova (1988a,b) found that 45-55% of the mortality of C. funebrana larvae in Turkmenistan is caused by its parasitoid complex, of which Ascogaster quadridentata made up ca 80% in terms of numbers. Batinica and Muratovich (1972) found that more than 30% of C. funebrana larvae in Yugoslavia are parasitized by Ascogaster quadridentata.

Natural enemies

Natural Enemy	Type	Life Stages	Specificity	References	Biological Control in	Biological control on
Angitia exareolata	Parasite	Larvae				
Ascogaster quadridentatus	Parasite	Larvae				
Bacillus thuringiensis galleriae	Pathogen	Larvae				

Bacillus thuringiensis subsp. dendrolimus	Pathogen	Larvae		
Bacillus thuringiensis thuringiensis	Pathogen	Larvae		
Beauveria bassiana	Pathogen			
Brachymeria rugulosa	Parasite		Turkmenistan	plums
Bracon hebetor	Parasite	Larvae		
Dibrachys cavus	Parasite		Turkmenistan	plums
Ephialtes	Parasite	Larvae		
Eurytoma verticillata	Parasite			
Hockeria micula	Parasite			
Iconella laspeyresiella	Parasite	Larvae		
Lissonota artemisiae	Parasite	Larvae		
Mesostenus transfuga	Parasite			
Pimpla spuria	Parasite		Turkmenistan	plums
Pseudopericharaeta nigrolineata	Parasite			
Trichogramma cacoeciae	Parasite	Eggs	Germany	
Trichogramma dendrolimi	Parasite			
Trichogramma evanescens	Parasite	Eggs		
Trichogramma telengai	Parasite	Eggs		

Trichogramma turkeiensis	Parasite	Eggs
Venturia canescens	Parasite	

Impact

Damage caused by C. funebrana is easily quantified as only the fruits are affected. Where two or three generations occur in a region, the first one usually causes little damage. In Central and Eastern Europe, this pest may damage over 50% of fruit. Early-ripening varieties are less damaged. Fruits of some late varieties, such as Angeleno, can be seriously damaged (Molinari, 1995). Batinica and Muratovich (1972) recorded 37.96% damage on mid-ripening varieties, as compared with 43.78 and 51.45% on two later-ripening varieties. Ghizdavu (1982) recorded up to 38% damage in untreated plots in Romania.

Detection and Inspection

At least 10 compounds have been found in the natural pheromone of C. funebrana, but the principal components are reported by Arn et al. (1976) to be Z8-12Ac and E8-12Ac, present in the ratio 100:4.

Pheromone traps are widely used for monitoring C. funebrana (Charmillot & Blaser, 1982), and although the synthetic pheromone blend that is used is quite similar to that used for C. molesta, useful information may be obtained on the flight pattern of the insect (Touzeau, 1979; 1980; Belmans, 1993; Cravedi and Molinari, 1993). Sundukova et al. (1988) suggest a threshold for control based on trap catches. Egg sampling is feasible during flight periods.

Similarities to Other Species/Conditions

C. funebrana can be mistaken for Cydia molesta at the larval and adult stages. Balachowsky and Mesnil (1935), Bovey (1937), Baker (1963) and Bollow and Otte (1963) studied the morphological characteristics of the larvae. Bovey (1966) gives a comparison table for fully-grown larvae: C. molesta is pale-pink with light brown head and is slender and cylindrical, only slightly tapered at the tips. Fresh specimens of C. funebrana are silver coloured on the ventral side of the abdomen and the legs. Analysis of genitalia is often required to confirm identification (Van der Geest and

Evenhuis, 1991).

Prevention and Control

Introduction

Van der Geest and Evenhuis (1991), and Charmillot (1991) reviewed natural and chemical control of the Tortricidae.

Chemical Control

The type of control measure employed should depend on the number of generations of C. funebrana which are present in a season. Organophosphorus insecticides and insect growth-regulators are widely used against C. funebrana.

Biological Control

Telenga (1939) and Meier (1941) had some success releasing Trichogramma evanescens against C. funebrana. Wiackowski and Kot (1962), Wiackowski et al. (1963) and Wiackowski and Wiackowska (1966) estimated that a reduction of fruit damage by up to 91% was possible after releases of T. cacaeciae, where perfect timing of Trichogramma release was achieved. Lipa (1975), Seskevicius (1977) and Hassan (1993) confirmed the efficacy of Trichogramma spp (see also G'onev, 1975).

Insect pathogens

Wiackowski and Wiackowska (1966) used a preparation of Beauveria bassiana against C. funebrana. Sogoyan (1967) achieved satisfactory levels of control using Bacillus thuringiensis galleriae, and Beauveria bassiana and insecticide. Fedorinchik and Sogoyan (1975) found that C. funebrana had only five species of microorganisms in its gut and the pH value was 6.3; it was more resistant to Bacillus thuringiensis than Cydia pomonella and Cydia molesta; these authors found Beauvaria bassiana was completely ineffective against C. funebrana (see also Sogoyan, 1967).

Mating disruption

Arn et al. (1976), Mani et al. (1978), Charmillot et al. (1982), and Ghizdavu (1982) used pheromones to disrupt the mating of C. funebrana, with widely differing results (Audemard, 1992).

Mass-trapping

Arn et al. (1976) failed to protect crops in Switzerland using mass trapping of adults, whilst Ghizdavu (1982) had satisfactory results.

References

Anon., 1972. Annual report for 1972 of the Rhineland-Palatinate Regional Plant Protection Service. CA: German Federal Republic, Landespflanzenschutzdienst Rheinland-Pfalz., 90 pp.

Arn H, Delley B, Baggiolini M, Charmillot PJ, 1976. Communication disruption with sex attractant for control of the plum fruit moth, Grapholitha funebrana: a two-year field study. Entomologia Experimentalis et Applicata, 19(2):139-147.

Atanov NM, Gummel' eR, 1991. Pheromone traps. Zashchita Rastenii^breve~ (Moskva), No. 3:49-50.

Audemard H, 1992. Mating disruption control in stone fruit orchards. Bulletin OILB/SROP, 15(5):43-51.

Baker CRB, 1963. Notes on the larvae and pupae of two fruit moths, Grapholita funebrana Treitschke and G. molesta Busck (Lepidoptera: Olethreutidae). Proceedings of the Royal Entomological Society of London (A), 38:212-222.

Balachowsky A, Mesnil L, 1935. Laspeyresia funebrana Treits. In: Balachowsky A, Mesnil L 'Les insectes nuisibles aux plantes cultivées', Paris, France, 161-164.

Batinica J, 1970. A contribution to knowledge of the elements for determining the economic threshold of injuriousness for the species Grapholitha funebrana Tr. Zastita Bilja, 21(110/111):309-314.

Batinica J, Muratovic S, 1972. Importance of the plum moth (Grapholitha funebrana Tr.) for the plum variety 'Bilska rana'. Zastita Bilja, 23(117/118):11-24.

Belmans K, 1993. Integrated control in plums. Fruitteelt, 6(17):6-7.

Bhardwaj SP, 1987. Investigations on the response of lepidopteran sex pheromones of temperate fruit pests in Himachal Pradesh, India. Agriculture, Ecosystems and Environment, 19(1):87-91.

Böhm H, 1948. Investigation on the biology and control of the plum tortricid. Pflanzenschutzberichte, 2:1-15.

Bollow H, Otte W, 1963. Anleitung zur erkennung der drei hSufigsten wicklerraupen des Stein- und Kernobstes. Pfl. Sch. Informationen Bayr. Landesanst. f. Pfl. Bau u. Pfl. Schutz, 5:1-7.

Bovey P, 1937. Recherches sur le Carpocapse des prunes Laspeyresia (Grapholita) funebrana Tr.. Revue de Pathologie végétale et d'entomologie agricole de France, 24:189-317.

Bovey P, 1966. Super-famille des Tortricoidea. Les carpocapse des prunes. In: Balachowsky AS "Entomologie appliquée à l'agriculture", Vol. II (1), Ed. Masson et Cie, Paris, 746-763.

Carlot D, 1993. Phytosanitary protection. Arboriculture Fruitiere, No. 460:23-25.

Charmillot PJ, 1991. Possibilities and limitations of selective methods of control of tortricid pests of orchards. Revue Suisse de Viticulture, d'Arboriculture et d'Horticulture, 23(6):363-374; 83 ref.

Charmillot PJ, Blaser C, 1982. Mating disruption against the plum fruit moth (Grapholitha funebrana Tr.): II. Contribution to the study of adult behaviour and observations on the persistence of the attractant in dipensers. Mitteilungen der Schweizerischen Entomologischen Gesellschaft, 55(1/2):65-76

Charmillot PJ, Blaser C, Baggiolini M, Arn H, Delley B, 1982. Mating disruption against the plum fruit moth (Grapholitha funebrana Tr.): I. Control trials in orchards. Mitteilungen der Schweizerischen Entomologischen Gesellschaft, 55(1/2):55-63.

Charmillot PJ, Vallier R, Tagini-Rosset S, 1979. Plum fruit moth: (Grapholitha funebrana Tr.): a study of the cycle of development in relation to temperature sums and observations on the activity of adult moths. Mitteilungen der Schweizerischen Entomologischen Gesellschaft, 52(1):19-33.

Cravedi P, Molinari F, 1993. Synthetic pheromones in integrated pest management in peach and plum orchards in Italy. Bulletin OILB/SROP, 16(10):170-173.

Danilevski AS, 1958. The species of fruit moths (Lepidoptera, Pyralidae, Carposidinae, Tortricidae) injurious to fruit trees in the Far East. Rev. Ent. URSS, 37:282-293.

EPPO, 2009. PQR database. Paris, France: European and Mediterranean Plant Protection Organization. www.eppo.org.

Fedorinchik NS, Sogoyan RS, 1975. Microbial preparations for the control of tortricids in orchards on the Black Sea coast of the Krasnodar region. Trudy Vsesoyuznogo Nauchno-issledovatel'skogo Instituta Zashchity Rastenii, 42:110-121.

Ferdinandsen C, Rostrop S, 1920. Report on insect pests and fungus diseases of the field and orchard in 1918. Tidsskrift for Planteavl, Copenhagen, 26:683-733.

Geest LPS van der, Evenhuis HH(Editors), 1991. Tortricid pests: their biology, natural enemies and control. Amsterdam, Netherlands; Elsevier Science Publishers, xviii + 808 pp.

Ghizdavu J, 1982. Test on control of the plum moth, Grapholitha funebrana Tr., using the synthetic sex attractant. Revue Roumaine de Biologie, Biologie Animale, 27(2):145-154.

Glazunova IN, 1994. Insegar against tortricid plum moth. Zashchita Rastenii (Moskva), 11:33.

Glpser G, 1979. Report on the occurrence of important diseases and pests on cultivated plants in Austria in the year 1977. Pflanzenschutzberichte,

45(7/12):153-164.

G'onev G, 1975. Integrated and biological control in apple and plum orchards in the Stara Zagora district. Rastitelna Zashchita, 23(9):31-34.

Hassan SA, 1993. The mass rearing and utilization of Trichogramma to control lepidopterous pests: achievements and outlook. Pesticide Science, 37(4):387-391.

Hrdy I, Liska J, Hochmut R, 1989. New records on sex attractants for males and faunistic comments on moths (Lepidoptera) from Czechoslovakia. Acta Entomologica Bohemoslovaca, 86(4):252-268.

Hrdy I, Marek J, Krampl F, Kuldovß J, Barabßs L, 1994. Distribution of the fruit tree pests Cydia molesta, Cydia funebrana and Anarsia lineatella (Lepidoptera: Tortricidae, Gelechiidae) in former Czechoslovakia as recorded by pheromone traps. Acta Societatis Zoologicae Bohemicae, 58(1-2):53-60; 25 ref.

Ilieva S, 1973. The results of yield trials. 1. Control of Cydia funebrana and Tranzschelia pruni-spinosae. Rastitelna Zashchita, 21(3):5-6.

Kagan F, Lewartowski R, 1978. Characteristics of development, intensity of occurrence and noxiousness of the more important pests of fruit trees and small fruits in Poland in 1976. Biuletyn Instytutu Ochrony Roslin, 62:331-421.

Kang ZX, Zhang FY, Sun Q, Lu X, Guo MZ, 1989. Application of sex attractant of Grapholitha molesta for forecasting and control of Grapholitha funebrana. Insect Knowledge, 26(3):142-145.

Karsholt O, Razowski J, 1996. The Lepidoptera of Europe: a distributional checklist. Stenstrup, Denmark: Apollo Books, 380 pp.

Kasumyan SA, Mnatsakanyan LS, 1986. When should the plum fruit moth be controlled? Zashchita Rastenii, 7:42.

Komarek S, 1987. Study on the species composition and the population dynamics of the family Tortricidae in some orchards in southern Bohemia

using pheromone traps. Pflanzenschutzberichte, 48(1):2-23.

Kostandyan LV, 1990. Prognosis of the times of oviposition of the plum tortricid by the method of Podol'skii. Sadovodstvo i Vinogradarstvo, 5:19-20.

Kostrovsky K, 1914. Cydia (Grapholita) funebrana, Tr., its bionomics and methods of fighting it. Agriculture of Turkestan, 133-138.

Kozlowski J, 1994. Forecasting the occurrence and signalling the control date of the plum moth (Laspeyresia funebrana Tr.) in Wielkopolska. Prace Naukowe Instytutu Ochrony Ros^acute~lin, 35(1/2):48-52; 5 ref.

Kudina ZhD, Misyurenko IP, 1987. Attractiveness of the pheromone of the Oriental peach moth to tortricids. Zashchita Rastenii, 4:51.

Lipa JJ, 1975. Achievements in biological control in Poland during 1945-1975 and prospects for the future. Biuletyn Instytutu Ochrony Roslin, 59:39-54.

Mani E, Arn H, Wildbolz T, Hauri H, 1978. A field trial of the mating disruption technique for the control of the plum fruit moth at high population density. Mitteilungen der Schweizerischen Entomologischen Gesellschaft, 51(4):307-313.

Meier NF, 1941. Results of the work of the laboratory of biological control at the Institute for Plant Protection. 121-124.

Miatello H, 1913. Enfermedades del ciruelo. Gaceta Rural, Buenos Aires, 76:333-337.

Molinari F, 1995. Notes on the biology and monitoring of Cydia funebrana (Treitschke). Bulletin OILB/SROP, 18(2):39-42.

Molinari F, Tiso R, Butturini A, 1997. Field validation of a developmental model for Cydia funebrana (Treitschke) (Lepidoptera: Tortricidae) in northern Italy. In: Cravedi P, Hartfield C, Mazzoni E, eds. Proceedings of the meeting on Integrated plant protection in stone fruit, Zaragoza, Spain, 24-26/9/1996, Bulletin OILB/SROP 20(6):1-115.

Molnar J, 1988. Observation of flight time of the plum fruit moth (Cydia funebrana Tr.) in relation to temperature. Vedecke Prace Vyskumneho Ustavu Ovocnych a Okrasnych a Okrasnych Drevin v Bojniciach, 7:69-81.

Morris HM, 1938. Annual Report of the Entomologist for 1937. Rep. Dep. Agric. Cyprus, 1937, 42-47.

Muesebeck CFW, 1932. Revision of the Nearctic Ichneumon-flies belonging to the genus Macrocentrus. Proc. U.S. Nat. Mus. Art. 23, n. 2923, 55.

Papp J, 1972. New Apanteles Forst. species from Hungary (Hymenoptera, Braconidae: Microgasterinae), I. Annales Historico-Naturales Musei Nationalis Hungarici, 64:335-345.

Pindur W, 1980. Practical experiences of the plant protection warning service in fruit culture. In: Proceedings of the international symposium of IOBC/WPRS on integrated control in agriculture, forestry. Workshop sessions. Vienna, Austria: International Organization for Biological Control of Noxious Animals and Plants, West Palearctic Regional Section, 403.

Popova AI, 1971. The biology of the plum fruit worm Grapholitha funebrana Tr. (Lepidoptera, Tortricidae) on the Black Sea coast of the Krasnodar territory. Entomologicheskoe Obozrenie 50(2):323-334.

Pospielov Th, 1914. A short review of the state of agriculture in the district of Katta-Kurgan in 1913. Agriculture of Turkestan. 6:560-569.

Radetsky AF, 1913. Carpocapsa pomonella, L., in the territory of Turkestan and the struggle against it. Turkestan Entomological Station Reports. Tashkent, 52.

Radman L, Batinica J, 1980. The advantages of supervised control on the plum tree against injurious insects and diseases in Yugoslavia (Bosna i Hercegovina). In: Proceedings of the international symposium of IOBC/WPRS on integrated control in agriculture, forestry. Workshop sessions. Vienna, Austria: International Organization for Biological Control of Noxious Animals and Plants, West Palearctic Regional Section. 586-587.

Saparmamedova NK, 1988. On the study of natural enemies of the plum

moth Grapholitha funebrana Tr. (Lepidoptera, Tortricidae) in the Prikopetdag zone. Izvestiya Akademii Nauk Turkmenskoi SSR. Seriya Biologicheskikh Nauk, 4:40-43.

Saparmamedova NK, 1988. The role of entomophages in reducing the numbers of the plum tortricid in the foothill zone of the Koptedag. Izvestiya Akademii Nauk Turkmenskoi SSR. Seriya Biologicheskikh Nauk, 3:34-38.

Saringer G, Deseö KV, 1972. The annual development of the plum fruit moth (Grapholitha funebrana Tr., Lep.; Tortricidae) in Hungary. Acta Phytopathologica Academiae Scientiarum Hungaricae, 7(4):427-438.

Schoyen TH, 1917. Beretning over Plantesygdome i Norge 1916. [Report on Plant Diseases in Norway in 1916]. Saertryk ur Landtbruksdirectörens Aarsberetning for 1916, Christiania, 1917, 37-85.

Seskevicius A, 1977. The effectiveness of Trichogramma against orchard pests. Lietuvos Zemdirbystes Mokslinio Tyrimo Instituto Darbai, 21:77-82.

Sogoyan RS, 1967. Tests with Entobakterin and Boverin against the plum fruit moth in the Black Sea zone of the Krasnodar territory. Byulleten Vsesoyuznogo Nauchno-issledovatel'skogo Instituta Zashchty Rastenii, 2(10):12-15.

Sogoyan RS, 1976. Biological data on fruit moths. Zashchita Rastenii, 12:33.

Stamenkovic T, Stamenkovic S, Pantelic Z, 1984. The population dynamics of Cydia (Laspeyresia) funebrana Treitsche (Lepidoptera, Tortricidae) and its harmfulness. Zastita Bilja, 35(2):141-151.

Staubli A, Hohn H, 1988. The enemies of our orchards. A new series of 8 colour plates. Revue Suisse de Viticulture, d'Arboriculture et d'Horticulture, 20(6):347-354, 359-366.

Sundukova NE, Sazonov AP, Baryakina IK, 1988. Possibilities for the use of synthetic sex pheromones to control the plum fruit moth. Feromony nasekomykh i razrabotka putei ikh prakticheskogo ispol'zovaniya (Sazonov, AP, ed.). Leningrad, USSR; Vsesoyuzyni Nauchno-issledovatel'skii Institut Zashchity Rastenii, 87-94.

Tchorbadzhiev P, 1925. A review of injurious insects in Bulgaria in 1924 and their control. Mitt. bulgar. ent. Ges., 57-61.

Tchorbadzhiev P, 1929. Pests of cultivated plants in Bulgaria during 1927. Svedeniya po Zemled. Period. Byul., 10:3-59.

Telenga NA, 1939. Testing Trichogramma evanescens Westw. for the control of Laspeyresia funebrana Tr. Bull. Plant Prot., 1:77-78.

Touzeau J, 1972. The plum moth in France in the years 1966-1970. Phytoma, 24(236):21-28.

Touzeau J, 1975. Preliminary investigations for the introduction of integrated control in orchards of Ente plums in the region of Agen. Groupe de Travail pour la Lutte Integree en Arboriculture: Proceedings of the Fifth Symposium on Integrated Control in Orchards. Bolzano, 3-7 ix. 1974.: Comptes rendus du 5eme symposium sur la lutte integree en vergers. Bolzano, 3-7 ix. 1974. Wageningen, Netherlands: Section Regionale Ouest Palearctique, Organisation Internationale de Lutte Biologique contre les Animaux et les Plantes Nuisibles, 199-210.

Touzeau J, 1979. The use of sexual traps for agricultural warnings and risk forecasting. Annales de Zoologie, Ecologie Animale, 11(4):547-563.

Touzeau J, 1980. Use of pheromone traps in agricultural warning systems. Bulletin, Organization Europeenne et Mediterraneenne pour la Protection des Plantes, 10:97-104.

Vasev A, 1985. Studies on damage, fruit quality and effectiveness of plant protection in plum orchards. Pochvoznanie, Agrokhimiya i Rastitelna Zashchita, 20(6):85-92.

Vernon JDR, 1971. Observation on the biology and control of the plum fruit moth. Plant Pathology, 20(3):106-110.

Viggiani G, Cancellara I, 1975. Observations on Grapholitha funebrana (Tr.) in Campania, with the use of a synthetic sexual attractant. Bollettino del Laboratorio di Entomologia Agraria 'Filippo Silvestri', Portici, 32:131-139.

Walczak F, Grendowicz L, Kagan F, Piekarczyk K, Romankow-Zmudowska A, 1993. Harmfulness of most important agrophages of cultivated plants in Poland in 1992 and preliminary forecasting for 1993. Materiay Sesji Instytutu Ochrony Ros^acute~lin, 33(1):202-224; 3 ref.

Wiackowski SK, Kot J, 1962. Preliminary tests on the biological control of Cydia funebrana by the introduction of the egg-parasite T. cacoeciae. Zeszyt. Prob. Postep+w Nauk roln., 35:167-175.

Wiackowski SK, Wiackowska I, 1966. Biological, microbiological and chemical control of the plum moth Laspeyresia funebrana Tr. (Lep. Tortricidae) in Poland. Entomophaga, 11:261-267.

Wiackowski SK, Wiackowska I, Crumpacker J, Kot J, 1963. The biological control of the plum-moth Cydia funebrana by means of the egg-parasite T. cacoeciae. Part 2. The influence of the parasite on the first and second generation of the pest. Roczn. Nauk roln., 87 (A):545-557.

Woo Wei-Chün, 1961. A new record of two species of fruit tree pests from North China. Acta ent. sin., 4-6:395-400.

Zoebelein G, 1966. Problems of the control of injurious insects in agriculture in Iran. Anz. SchSdlingsk., 39:3-8.

Images

Picture	Title	Caption	Copyright
	Damage symptoms on plum fruit	Plum fruit damaged by C. funebrana larvae.	Fabio Molinari
	Larva	Larva in a plum fruit.	Fabio Molinari

	Adult males	Adult males on a pheromone trap.	Fabio Molinari

Date of report: 06/01/2011