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RECORDS OF *CADRA FIGULILELLA* (GREGSON 1871) (PYRALIDAE, LEPIDOPTERA) AND CONTRIBUTION TO ITS PARASITOID ASSAMBLAGES IN BULGARIA

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Abstract

VELCHEVA, N. and A. ATANASSOV. Records of *Cadra figulilella* (Gregson 1871) (Pyralidae, Lepidoptera) and contribution to its parasitoid assamblages in Bulgaria. *Bulg. J. Agric. Sci.*, 21: 1254–1256

In 2008 we captured a great number of *Cadra figulilella* (Gregson, 1871) larvae in corrugated bands for monitoring *Grapholita funebrana* (Treitschke, 1835) in plum orchard near Plovdiv, Bulgaria, situated at 160 m a. s. l., 42° 9" N and 24° 45" E. Amounts of full grown larvae varied widely per band with an average 33.2 ± 8.6. In 2009 the pest was in very low density and we caught only 8 and 3 larvae in organic and chemical plots respectively.

Three parasitoid species of family Ichneumonidae were reared of collected of *C. figulilella* Gr larvae in 2008 - *Scambus elegans* Woldstedt, 1877, *Lissonota cruentator* Panzer, 1809, *Eriborus terebrans* Gravenhorst, 1829. The emergence took place during all June in 2009. *C. figulilella* Gr is new host of these parasitoids. Overall percentage of parasitism was 4.6%.

Key words: *Cadra figulilella*, plum orchard, parasitism, *Scambus elegans* Woldstedt, *Lissonota cruentator* Panzer, *Eriborus terebrans* Gravenhorst,

Corrugated paper bands with cotton layers used for monitoring plum fruit moth, *Grapholita funebrana* (Treitschke, 1835) surprisingly captured great numbers of larvae (Figure 1) of an unknown for us species along with of the target pest in a plum orchards near Plovdiv, Bulgaria situated at 160 m a. s. l., 42° 9" N and 24° 45" E. Amount of larvae ranged widely from 6 to 97 per band per tree with an average of 33.2 ± 8.6 larvae (n = 15). High variability of larvae found in bands could due to an uneven distribution of the species in this orchard in 2008. It looks like the species almost disappeared from the orchard in 2009 and we totally found 8 and 3 only larvae in corrugated bands (n = 15) in the organic and chemical plots, respectively. In 2008 larvae overwintered in bands placed on the bottom of wooden cases at temperature ranged from 0°C to 5°C. Moths emerged in mass in June 2009. Genitalia of fresh male adults were extracted (Figure 2) and using several keys to determinations (Zaguljaev, 1965; Sinev, 1986; Horak, 1994) we identified one only species, raisin moth *Cadra figulilella* (Gregson, 1871). As seen on the picture (Figure 2), the most typical characteristics of the species are the almost straight uncus and long thin costal outgrowth at nearly 90° angle. The moths of *C. figulilella* are pale grey to pale ochreus with wingspan 14-16 mm. Wing pattern is very similar with the other species of the genus and cannot be used for diagnostic (Horak, 1994; Olsen et al., 1996).

Prior to species determination we initially suggested that the presence of strange larvae in this orchard is connected with plum fruits. It was confirmed later when we observed literature sources and found that *C. figulilella* Gr is considered a primarily field pest attacking various mature, overripe, and dropped fruits and occasionally dried fruits and nuts in regions with of Mediterranean and subtropical climate (Donohoe et al., 1949; Aitken, 1963; Zaguljaev, 1965; Grigorov, 1974; Cox, 1974; Assari and Khajepour, 2013). According Roesler (1973) and Fauna Europaea (http://www.faunaeur.org) - the pest is distributed in Bulgaria, however nei-

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Fig. 1. Last instar larva of *Cadra figulilella* (Gregson 1871) (org.)

Fig. 2. Male genetalia of *Cadra figulilella* (Gregson 1871) with part of hairs tuft of adroconial organs (org.)

ther Tomov and Trencheva (2013) nor we found references in literature sources or elsewhere confirming this statement.

Cadra figulilella systematically belongs to family Pyralidae, subfamily Phycitinae. According to Roesler (1973) it is announced under several synonyms *Ephestia figulilella* (Gregson, 1871), *Ephestia ficulella* (Barrett, 1875), *Ephestia milleri* (Zeller, 1876), *Ephestia gypsella* (Ragonot, 1887), *Ephestia venosella* Turati, 1926, *Ephestia ernestinella* (Turati, 1927), *Cadra halfaella* Roesler, 1965, and *Cadra figulilella f. halfaella* Roesler, 1966.

The pest has a cosmopolitan distribution and occurs in Europe, North Africa, Asia, North, and South America and causes severe quantitative and qualitative losses throughout the world (Roesler, 1973; Sinev, 1986; Khajepour et al., 2012). Assari and Khajepour (2013) announced *Ephestia (Cadra) figulilella* Gr. to be the most important pest on fruit dates *Phoenix dactylifera* in Shadad, Iran and evaluated up to 90% of the production contaminated with the pest larvae. In California, raisin moth is an increasing concern for DOV[1] raisins that requires twice as long to dry than traditional raisin production (Crop Profile for Grapes (Raisin) in California).

Cadra figuliella Gr. attacks large number of stored products like grains, corn, cotton seeds, cocoa beans, various dried fruits (Zaguljaev, 1965; Roesler, 1973; Horak, 1994). It is the most common and widespread post-harvest pest of Californian raisins during storage (Crop Profile for Grapes (Raisin) in California. Zaguljaev (1965) considered raisin moth larvae extremely destroying pest in confectionary fabrics.

Burks and Johnson (2012) summarized the existed information about biology of the pest. Lower temperature threshold is 15°C and upper temperature threshold is 36°C. Development of one generation lasts 43 days at 28°C, the longevity of adults is 11-16 days, and mean fertility of females is 351 eggs with recorded maximum of 692 per female (Simmons and Nelson, 1975). Adults do not fly at temperature below 13°C. Eggs are small, round, and slightly yellow-orange. First instar larvae infest fruits immediately after hatch. Full grown larvae leave food substrate and seek for a suitable place to cocoon and pupate. In orchards thas is typically under trunk bark at the base of trees or vines, or in adjacent soil near the surface (Donohoe et al., 1949). Last instar larvae overwinter and adults fly from April through November in the field conditions in Central California (Donohoe et al., 1949).

Several parasitoids of Ichneumonoidea, Hymenoptera are known to attack the raisin moth. These are *Bracon hebetor* (Say, 1836), *Venturia canescens* (Gravenhorst, 1829) (= *Idecthis canescens* Gravenhorst = *Devorgilla canescens* Gravenhorst, = *Campoplex canescens* Gravenhorst 1829), *Mesostenus gracilis* Cresson, 1864 (Zaguljaev, 1965; Gürbüz et al., 2009; Jonson et al., 2001; Burks and Johnson, 2012; Beyarslan et al., 2014). Johnson et al. (2001) found also that *Psilochalcis brevialata* (Grissell and Johnson, 2001) successfully parasitized *C. fugulilella* Gr under laboratory conditions.

From collected larvae of *C. figulilella* Gr, we reared the following Ichneumonidae parasitoids -*Scambus elegans* Woldstedt 1877, *Lissonota cruentator* Panzer1809 (= *Lissonota insignita* Gravenhorst, 1829) and *Eriborus terebrans* Gravenhorst, 1829(= *Diadegma terebrans* Gravenhorst) . *C. figulilella* Gr is unknown so far host for all of these parasitoids. Overall percentage of parasitism was 4.6%.

S. elegans Wold. is known to parasitize 12 species of 5 Lepidoptera families (Kasparjan, 1981; Zerova et al., 1989).

[1]DOV - dried on vine raisin production

In Bulgaria, the parasitoid wasp was reared of *Rhyacionia buoliana* (Denis and Schiffermüller, 1775) (Cankov, 1972; Atanasov, 1986) and *Archips rosana* (Linnaeus, 1758) collected in apple orchard (Peeva, 2009). The parasitoid is widely distributed in Europe, Near East, North Africa, and Oriental region (Fauna Europaea - http://www.faunaeur.org/.

L. cruentator Panz. distribution matches the areal of S. elegans Wold. (Fauna Europaea - http://www.faunaeur.org/. However, from the literature we accessed, one only host, *Mitopoda punctalis* Fabricius, 1775 (= *Phalena punctalis* Fabricius, 1775), taxonomically close to *C. fugulilella,* was found (Dicky Sick Ki Yu © 1997-2012).

Eriborus terebrans Gravenhorst, 1829 is known mainly as a parasitoid of the European corn borer *Ostrinia nubilalis* Hübner, 1796 (Pyralidae). It was introduced to the USA for biological control of the pest in 1927. Except in Europe, the ichneumonid is distributed in Near East and Oriental region. Georgiev (1995) found that *E. terebrans* Grav. parasitizes up to 39% of *Paranthrene tabaniformis* Rottenburg, 1775 (Seseiidae) in some localities in Bulgaria. Dicky Sick Ki Yu © 1997-2012 reported 26 Micro- and Macrolepidoptera, Coleoptera, and Hymenoptera hosts of *E. terebrans* Grav., but not *C. figulilella* Gr. according summarized by Dicky Sick Ki Yu (1997-2012) reported 26 Micro- and Macrolepidoptera, Coleoptera and Hymenoptera hosts of *E. terebrans* Grav. *C. figuliella* Gr. is not listed in latter publication. Based on reviwed publications by Dicky Sick Ki Yu (1997-2012), we suggest that *C. figuliella* is a new host for all reared parasitoids.

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