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Epithrix hirtipennis, a New Pest of Tobacco in Greece, with Notes on its Morphology, Bioecology and Control[1]

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The tobacco flea beetle, *Epithrix hirtipennis* (Melsheimer) (Coleoptera: Chrysomelidae) was first noticed on tobacco in Agrinio area in early May 1988. In the next year it was also found to attack tobacco in the same area. Heavy attacks were also recorded on eggplant while a low infestation was noticed on potato and pepper. To date this species is widespread in several areas of Phthiotis (Central Greece) where tobacco is grown developing quite large populations.

The adult feeds on the leaves causing almost circular holes, usually 1-2 mm in diameter, and irregular shape ones when they are larger (Figs. 1 and 2). The adult starts feeding usually from the upper surface of the leaves and to a lesser extent from the underside. When large numbers of adults are present, larger holes are caused on the tobacco leaves while in higher population densities, the whole lamina except of nerves can be eaten, leading to severe damage of the crop (Fig. 2). The adult was usually found on the upper surface of the lower tobacco leaves. It showed a strong feeding preference for the lower then the upper leaves of tobacco, as well as plants of reduced growth. The latter preference could be taken into account in an integrated pest management programme for tobacco pests.

E. hirtipennis is of nearctic origin (Metcalf et al. 1962), known in U.S.A., Canada, Cuba, Mexico, Guatemala, Panama, Colombia and possibly occurs in other areas of Central and South America (Sannino et al. 1985). It is a polyphagous species attacking cultivated plants and weeds such as tobacco, eggplant, potato, tomato, pepper, Jimson weed, ground cherry, nightshade, horse nettle and to a lesser extent many other plants (Metcalf et al. 1962). In tobacco, one adult has been estimated that can eat leaf quantity equal to ten times of its own weight in a day (Metcalf et al. 1962). Therefore, it can lower both the quantity and quality of leaves.

E. hirtipennis was unknown to European countries until 1983. The first record in Europe was on tobacco in the area of Benevento, in the Campania region, South Italy (Sannino and Balbiani 1984, Sannino et al. 1984). Later, it was recorded in Toscana (Boni 1988), whilst Sannino and Balbiani (1990) reported that it was already present in the provinces of Campania, Basilicata, Lazio, Puglia, Abruzzo, Toscana and Umbria; Toscana and Umbria are the last areas in which the species was recorded. Af-

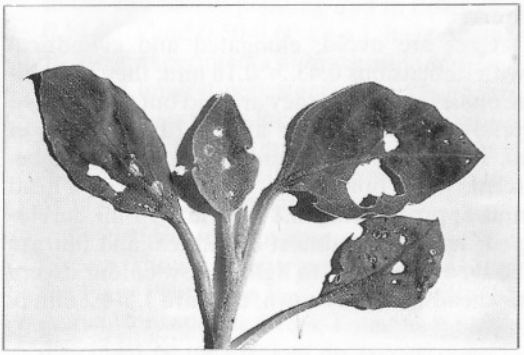

FIG. 1. Young eggplant plant severely injured by *Epithrix hirtipennis*.

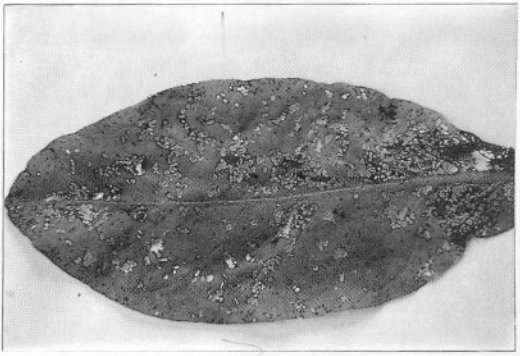

FIG. 2. Tobacco leaf, from a mature plant, severely injured by *Epithrix hirtipennis*.

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ter its appearance, it has progressively spread into South and Central Italy causing damage which depends upon tobacco type (Sannino et al. 1984, Boni 1988). The record of *E. hirtipennis* at first in Agrinio area and later in other areas of Central Greece reveals that it rather invaded West Greece through transport from Italy and has spread to other areas.

Morphology

The adult (Fig. 3) has about 2 mm length and yellowish reddish colour, bearing a number of thin and relatively short yellow reddish setae. Antennae are yellow reddish in colour with darker the last segments. Pronotum is transverse and bears yellow setae, being more dense laterally. Elytra have the same colour as pronotum except on their central area and the inner sides where the colour is almost black; each of them bears ten spotted lines and thin yellow setae as in the case of pronotum. Legs are yellow reddish except hind femora which are darker in colour.

Eggs are ovoid, elongated and cylindrical with dimensions 0.43 × 0.16 mm; they are white opalescent when they are laid but they turn to yellow straw-coloured afterwards (Sannino et al. 1986). The newly emerged larvae are pubescent, white opalescent, with light brown head and approximately 0.8 mm long. Full developed larvae have almost cylindrical and filiform body, and whitish to light yellow colour except the head which is brown; they are 3.5-4.2 mm in length (Sannino et al. 1986). Pupae have white pearl colour at the beginning but they become darker later on. Their dimensions are 1.9 × 0.75 mm.

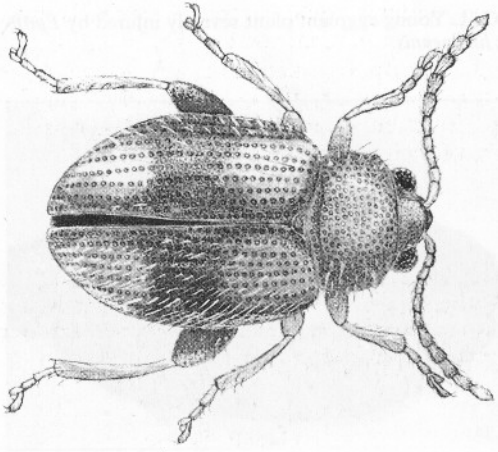

FIG. 3. Adult of *Epithrix hirtipennis* (Courtesy of Sannino and Balbiani).

According to Sannino et al. (1985) *E. hirtipennis* is easily distinguishable from other species of the same genus which are found in Italy, such as *Epithrix atropae* (Foudras), *Epithrix intermedia* (Foudras) and *Epithrix pubescens* (Koch) by characteristics of its colour. Also, according to the above authors, *E. hirtipennis* can be distinguished from other american species belonging to the same genus, such as *Epithrix fasciata* Blatchley, *Epithrix cucumeris* (Harris), *Epithrix tuberis* (Gentner), *Epithrix similaris* (Gentner) and *Epithrix subcrinita* (LeConte), from the shape of aedeagus and spermatheca.

Bioecology

E. hirtipennis overwinters as adult under leaves and grass or in litter in margins around tobacco fields and along the margins of woods (Metcalf et al. 1962, Dominick 1971, Sannino et al. 1985). According to Dominick (1971), a considerable number of tobacco flea beetles may overwinter into the soil of tobacco fields in which early and complete stalk and root destruction has not taken place.

Adults appear in the seedbeds where they start feeding in spring. Dominick (1967) reports that new plants may be particularly injured by overwintered adults, and high population densities of the second generation can severely damage the lower leaves of mature plants. The worst damage caused by adults, in Italy, occurs at transplanting time and towards the end of the cultivation period at the end of July-August, especially for the cigar-wrapper tobacco (Sannino et al. 1986). The effect of adult population density on the yield and growth of flue-cured tobacco has been investigated by Semtner (1984). It was found that densities of 5, 10, 15 and 20 adults, when they were confined in sleeve cages in each of which a tobacco plant was placed immediately after transplant and remained for 3 weeks, caused yield reduction in cured-leaf 18, 25, 38 and 38% respectively.

Egg laying occurs from the end of April till the beginning of September under ambient room temperature and humidity, completing three generations per year, with adult emergence at mid June, end of July-beginning of August

and in September, in Campania, Italy (Sannino et al. 1986). Eggs are laid individually or in small groups of 3-5 in the ground near host plants. After hatching, the little larvae burrow into the soil and feed on the roots. Larvae complete their development passing through three instars. They pupate into the soil.

The duration of egg, larval and pupal stages in summer in Campania was 6, 15-21 and 5 days, respectively, while adult longevity was about 2 months (Sannino et al. 1986). Under controlled conditions of 27 ± 2.8°C, 80 ± 6% RH. and a 14:10 (L:D) cycle, the egg, larval, prepupal and pupal stages lasted approximately 4, 13, 3 and 5 days, respectively (Martin and Herzog 1987). According to the same authors the whole developmental period, from egg laying till adult emergence, lasted 24 days while adult longevity was about 70 days; there had been a preoviposition period of 13 days, while the mean reproductive capacity per female was found to be 138.6 ± 14.7 eggs.

Different levels of N, P and K, applied to three different types of tobacco, have been found to affect the abundance of *E. hirtipennis* (Semtner et al. 1980). As P was increased from low to high levels, tobacco flea beetle populations were significantly decreased. Low levels of K resulted in significant decreases of the tobacco flea beetle population, while N had significant influence on the species abundance in some periods, but not over the entire season.

E. hirtipennis has two different kinds of natural enemies which could contribute to its biological control. These are, a parasitoid named *Microctonus epitricis* (Viereck) (Hymenoptera: Braconidae) (Elsey 1976 from Sannino et al. 1985) and a nematode species belonging to the genus *Howardula* (Elsey 1977 a, b).

Control

Chemical control of the tobacco flea beetle has been the subject of several research papers (Dominick 1957, 1965, 1967, Harrisson 1971, Jones and Thurston 1973, Johnson 1980, Sannino et al. 1986, Piro et al. 1990, Sannino and Balbiani 1990). Phorate has given moderate control of the overwintered adults, when it was applied broadcastly before planting, while it achieved a good control of the species during the growing season (Dominick 1965). Disulfoton was effective on the larvae, resulting in reduction of the flea beetle population, but it had no effect on adults feeding on the foliage (Harrison 1971). Generally, several soil insecticides have been demonstrated to cause reduction of the population of larvae which live on the tobacco root system (Dominick 1957, 1967, Harrison 1971). However, acephate gave good control of *E. hirtipennis* early in the season when it was applied through transplant water, on newly transplanted flue-cured tobacco (Johnson 1980); in that study the systemics carbofuran and oxamyl gave similar control to that of acephate, while foliar applications of methomyl and Pencap M gave also good control.

Control experiments in Italy showed that pyrethroids had generally longer persistence and better control than organophosphorous insecticides (Sannino et al. 1986). It was also found that the most effective insecticides, for tobacco flea beetle control, were phorate, terbufos and benfuracarb (Sannino and Balbiani 1990, Piro et al. 1990); these insecticides should be applied in the soil before planting and in doses of 1.13, 0.54-0.67 and 0.50-0.60 kg a.i./ha, respectively. In those experiments phorate and terbufos showed the longest persistence and a high level of control; insecticide localization was more effective than broadcasting, and moreover had the advantage of using 2-6 times lower rates of active ingredient per hectare.

E. hirtipennis, as a new pest for tobacco in Greece, should receive particular attention by the Plant Protection Services of the Ministry of Agriculture and the Greek Tobacco Board. Studies must be undertaken on several aspects on its bioecology, while particular emphasis must be given on its control through an integrated management programme. In such a programme other pests, mainly aphids, should also be included but attention must be paid on the preservation of their natural enemies.

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KEY WORDS: *Epithrix hirtipennis*, Tobacco flea beetle, Tobacco pests, Chrysomelidae.

Epithrix hirtipennis, ένα Νέο Έντομο-Εχθρός του Καπνού για την Ελλάδα, με Αναφορά στη Μορφολογία, Βιοοικολογία και Αντιμετώπισή του

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Το Κολεόπτερο *Epithrix hirtipennis* (Melsheimer) της οικογένειας Chrysomelidae βρέθηκε από το συγγραφέα για πρώτη φορά στην Ελλάδα, να προσβάλλει τον καπνό, στην περιοχή του Αγρινίου στις αρχές Μαΐου 1988. Το είδος αυτό παρατηρήθηκε επίσης να έχει προξενήσει σοβαρή ζημιά στη μελιτζάνα, ενώ μόνο μικροί πληθυσμοί παρατηρήθηκαν σε πατάτα όπου και η προσβολή ήταν μικρή. Τώρα, το *E. hirtipennis* έχει εξαπλωθεί και συναντάται σε πολλές περιοχές της Στερεάς Ελλάδας, προσβάλλει δε κυρίως τον καπνό και τη μελιτζάνα, πάνω δε σε αυτούς τους ξενιστές δύναται να αναπτύξει μεγάλους πληθυσμούς. Η πλέον πιθανή εκδοχή είναι ότι το είδος αυτό ήλθε στην Ελλάδα από την Ιταλία με κάποιο μεταφορικό μέσο.

Το ενήλικο έχει μήκος περί τα 2 mm και κιτρινο-ερυθρωπό χρώμα. Κάθε έλυτρο φέρει 10 στικτές γραμμές. Η εσωτερική πλευρά των ελύτρων καθώς και η περιοχή περί το κέντρο τους έχουν σχεδόν μαύρο χρώμα. Το αυγό έχει ωοειδές σχήμα, είναι υπόλευκο στην αρχή αλλά λαμβάνει χρώμα αχύρου αργότερα. Η προνύμφη είναι επιμήκης και λευκή, στην πλήρη δε ανάπτυξή της αποκτά μήκος περί τα 4 mm.

Το *E. hirtipennis* διαχειμάζει στο στάδιο του ενήλικου κυρίως κάτω από φύλλα και φυτικά

υπολείμματα, περιφερειακά των καπνοχώραφων και στις παρυφές κατά μήκος των δασών. Τα ενήλικα εμφανίζονται την άνοιξη και προσβάλλουν τα φυτά στα καπνοσπορεία προξενώντας τρύπες στο έλασμα των φύλλων. Τα αυγά εναποτίθενται στο έδαφος και στη συνέχεια οι μικρές προνύμφες εισέρχονται στο έδαφος και εγκαθίστανται επί των ριζών όπου αρχίζουν να τρέφονται. Οι προνύμφες αφού συμπληρώσουν την ανάπτυξή τους, νυμφώνονται στο έδαφος, ακολουθεί δε κατόπιν η έξοδος των ενηλίκων όπου αρχίζουν να προσβάλλουν ξανά τα φύλλα των φυτών.

Η αντιμετώπιση του είδους αυτού βασίζεται κατεξοχή στη χημική καταπολέμηση, η οποία συνίσταται κυρίως στην εφαρμογή διασυστηματικών εντομοκτόνων εδάφους και λιγότερο στην εφαρμογή ψεκασμών φυλλώματος με πυρεθροειδή. Επίσης υπάρχουν φυσικοί εχθροί όπως το παρασιτοειδές *Microctonus epitricis* (Viereck) (Hymenoptera: Braconidae) καθώς και νηματώδεις του γένους *Howardula* που ίσως να μπορούσαν να συμβάλλουν στη βιολογική καταπολέμησή του.