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Monitoring of *Oxythyrea Funesta* and *Tropinota Hirta* Species in Fruit Shrub Plantations in Cluj County

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RESEARCH ARTICLE

Abstract

Two species of the family Cetoniidae are commonly found in agricultural ecosystems: *Oxythyrea funesta* (Poda, 1761) and *Tropinota hirta* (Poda, 1761). These are polyphagous, attacking annual plants, fruit trees and shrubs but also plants from spontaneous flora. In 2020-2022, the presence of these two pests in the blackberry and black currant plantations was monitored, using Barber traps and blue containers with ecomonal products, (E)-anethole & (E)-cinnamyl alcohol and (±)-lavandulol & 2-phenyletanol. Species have been identified by morphological characters. The studies were carried out in the blackberry collection from USAMV Cluj-Napoca and in the ecological currant plantation in Recea Cristur - Cluj County (Romania). In the variant with (E)-anethole & (E)-cinnamyl alcohol in the three years, 318 individuals were captured, of which 282 of *Tropinota hirta* Poda (representing 88.7% of the total catches) and 36 individuals of *Oxythyrea fatesta* Poda. In the variant with (±)-lavandulol & 2-phenyletanol in the three years, 218 individuals were captured of which 139 were *Oxythyrea funesta* Poda (representing 63.8% of the total catches) and 79 individuals of *Tropinota hirta* Poda. These ecomonal products may be useful in monitoring and/or control these species. In Barber traps, catches were very low and they are not recommended in monitoring of these species.

Keywords: *Oxythyrea funesta*, *Tropinota hirta*, monitoring, blackberry, black currant.

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INTRODUCTION

In the rich complex of pest species, there may be a specialisation of pests on different vegetative or generative organs of attacked plants. A special place is given to the group of pests attacking the floral organs of the plant (Banza et al., 2021). The damage caused by these species correlates with the numerical density of the pest population, but also with the degree of differentiation of floral buds in woody species and the level of flowering in herbaceous plants. The group of pest that attack flowers also includes *Oxythyrea funesta* (Poda, 1761) and *Tropinota hirta* (Poda, 1761) (Coleoptera; Cetoniidae). They are widely distributed species on the European continent and in the Near East (Barclay and Notton, 2015). Climate change appears to be favourable to an increase in population numbers and damage range, especially for *Oxythyrea funesta*, which after 1990 is reported over large areas in Central Europe (Horak et al., 2013; Bunalski et al., 2019; Hoffmann et al., 2021). There are polyphagous pests that cause economic damage in fruit growing (Tucă et al., 2009; Zovko et al., 2014), viticulture (Stan et al., 2009), field crops (Subchev et al., 2012; Bunalski et al., 2019), oilseed rape (Trotuș et al., 2015) and other plants (Bîrzanu and Mitrea, 2021). Adults also feed on the pollen of many wild flora plants, especially in spring, from where they migrate to

fruit trees and cultivated plants in the area. The damage is caused only by adults which feed on pollen, but they can consume the stamens and the pistils of flowers, sometimes also consuming the sepals or petals. The larva is oligopod and develops in the soil, feeding on decayed plant matter and does not cause damage (Zovko et al., 2014; Vondráček et al., 2018).

There are monovoltine species that overwinter as adults in the soil at depths of 10-20 cm. Overwintering adults, depending on zonal climatic conditions, appear from April and fly until June-July, on sunny days. In May, females lay their eggs in the ground at a depth of 2-7 cm, in clusters of 2-4 eggs. One female can lay up to 50 eggs. Incubation lasts up to two weeks; larval development can last up to two months and pupation 8-10 days. New adults emerge in August-September, but remain for the hiemal diapause in the pupal lodges.

MATERIALS AND METHODS

In the period 2020-2022, the presence of the species *Oxythyrea funesta* and *Tropinota hirta* in the blackberry and black currant plantations was monitored.

Two monitoring methods were used:

- Barber traps
- Testing the functionality of two ecomonal products in trapping adults

Every year, during May-July, the two species were monitored in two plots. Adults catching was done with Barber traps and ecomonal products placed in blue containers.

The studies were carried out in the blackberry collection at USAMV Cluj-Napoca and in the ecological currant plantation in Recea Cristur - Cluj County (Romania).

The collection of blackberries from the University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca, consists of 5 varieties: Thornless, Loch Ness, Thornfree, Thornless Evergreen and Navaho. The geographical coordinates are as follows: 46°45'35.0"N 23°34'23.1"E. In the vicinity of the blackberry collection there are according to the geographical orientation: to the east - the Botanical Garden of the university; to the west - the university orchard with collections of apple, pear, cherry and vines; to the north - forest with various species of deciduous, coniferous and wild shrubs; to the south - the dendrological park of the university.

In this location, monitoring was done by setting 6 Barber traps (1/4 antifreeze) (Figure 1 a) and weekly checks of catches were made.

The farm "Bio Farm Recea Cristur Srl", was founded in June 2015, having as main activity the production and sale of berries: raspberries, black currant, red currant, blueberry and gooseberry. The farm is located in the north of Cluj County, in the Recea Cristur commune, 45 km from Cluj-Napoca municipality. Geographical coordinates are: 47°04′29.0″N 23°30′13.6″E. The black currant plantation is spread over an area of 2 ha and 4 varieties are grown: Tisel, Tiben, Ruben and Gofert. Since 2017, the farm is BIO certified for fruit shrubs grown.

In this location, the effectiveness of two ecomonal formulations in capturing the species under study was tested compared to the control, which was the blue container. The formulations tested were: (E)-anethole & (E)-cinnamyl alcohol and (±)-lavandulol & 2-phenyletanol.

The products tested were placed in blue containers (Figure 1 b). Each variant was placed annually in 3 replicates. The traps were set in the last decade of April and catches were tracked until the end of May. The obtained results were statistically processed with the Anova three-factorial software.

(a) (b)

Figure 1. a) Barber trap, b) Blue container for catching insects

Species identification was done by the morphological characters. The two species under study are often confused by farmers, although there are numerous elements of external morphological and chromatic-ornamental colour features that differentiate them.

The adult of *Oxythyrea funesta* has a body size between 9-12 mm, black in color with a slight metallic sheen and greenish or purple reflections. The pronotum has 6 white spots arranged in two longitudinal rows, which are missing at *Tropinota hirta* and on the elytra, there are numerous white spots. The body is covered with a black pubescence, lesser compared to *Tropinota hirta*, rarer on the dorsal side and denser on the ventral side. The tibias of the forelimbs are provided with two teeth (Figure 2).

Figure 2. *Oxythyrea funesta*

Tropinota hirta has the body size of 8-10 mm, matte black in color, covered with a dense and long, gray pubescence, hence the name of hairy beetle. On the dorsal side of the pronotum there is a longitudinally arranged median hull. The elytra are black-gray, with yellowish-white spots (Petanec et al., 2016). The tibias of the forelimbs are provided with three teeth (Figure 3).

Figure 3. *Tropinota hirta*

RESULTS AND DISCUSSIONS

Figure 4 shows the catches of *Oxythyrea funesta* and *Tropinota hirta* made in the black currant plantation from the three experimental variants (Bio Farm Recea Cristur Srl – Cluj County).

In the control variant (blue water trap), in the three years (2020-2022) with the 9 traps (3 traps per year), 47 individuals of *Tropinota hirta* and 22 of *Oxythyrea funesta* were captured. The black currant plantation was established on a cleared area of a meadow. In the vicinity of the plantation there are no agricultural crops or fruit plantations, in which a high population of the two studied species is reported. From the observations carried out in the area, their sporadic presence on the spontaneous flora, especially on *Taraxacum officinale* Weber, was observed. As these species are potential pests and of the currant as well, it is mandatory to monitor them in order to detect early the tendency of population numerical increase, as they may soon gain economic importance and become a threat for all the fruit shrubs plantations in the farm. Given that this crop is BIO, two floral formulations were tested for their attractiveness and then used to control these species by mass trapping the adults.

In the (E)-anethole & (E)-cinnamyl alcohol variant, 318 individuals were captured in the three years (2020-2022), of which 282 individuals of *Tropinota hirta* (representing 88,7% of the total captures) and 36 individuals of *Oxythyrea funesta* . The highest catches of *Tropinota hirta* were obtained in 2021, with 149 adults representing 52.8% of the total catches during the test period. The total number of catches made by a trap during the experiment ranged from 10 adults to 61. As reported in the literature, the (E)-anethole component has specificity for *Tropinota hirta* (Tóth et al., 2003, 2005; Vuts et al., 2010; Subchev et al., 2011, 2012; Yaşar and Dahham, 2019; Özpinar and Erbay, 2020).

In the (±)-lavandulol & 2-phenyletanol variant, 218 individuals were caught in the three years (2020-2022), of which 139 individuals of *Oxythyrea funesta* (representing 63.8% of the total captures) and 79 individuals of *Tropinota hirta*. Also, for this species, the highest number of catches was in 2021, with 82 individuals, representing 59% of the total three years. The total number of catches made by a trap during the experiment ranged from 2 adults to 31.

In the three experimental years (2020-2022), 605 adults were captured in the three variants, of which 408 *Tropinota hirta* , representing 67.4% of the total, were the dominant species and 197 adults of *Oxythyrea funesta* were caught.

From the data presented, the effectiveness of the two products tested in capturing the two species can be seen. As regards *Tropinota hirta* in the variant with (E)-anethole & (E)-cinnamyl alcohol the number of adults collected is 6 times higher than the control and in the variant with (±)-lavandulol & 2-phenyletanol is 1,7 times higher. In *Oxythyrea funesta* the number of catches in the formulation with (±)-lavandulol & 2-phenyletanol is 6,3 times higher than in the control, and in the variant with (E)-anethole & (E)-cinnamyl alcohol formulation is 1.6 times higher. As reported in the literature, the floral formulations with (E)-anethole & (E)-cinnamyl alcohol can also be used in monitoring other pests of the Nitidulidae, which feed on flower pollen (Vuts et al., 2022).

The products tested can be recommended for both pest monitoring and control actions by mass trapping of adults. Chemical control of these species is very difficult, as the attack occurrs during flowering and the insecticides used affect the pollinators to a great extent. On the other hand, fruit shrubs are niche crops cultivated on small areas, which are very suitable for the use of traps in direct pest control.

However, statistically it can be seen that there are very significant differences in terms of species caught and ecomonal product used in all experimental years (Figure 4).

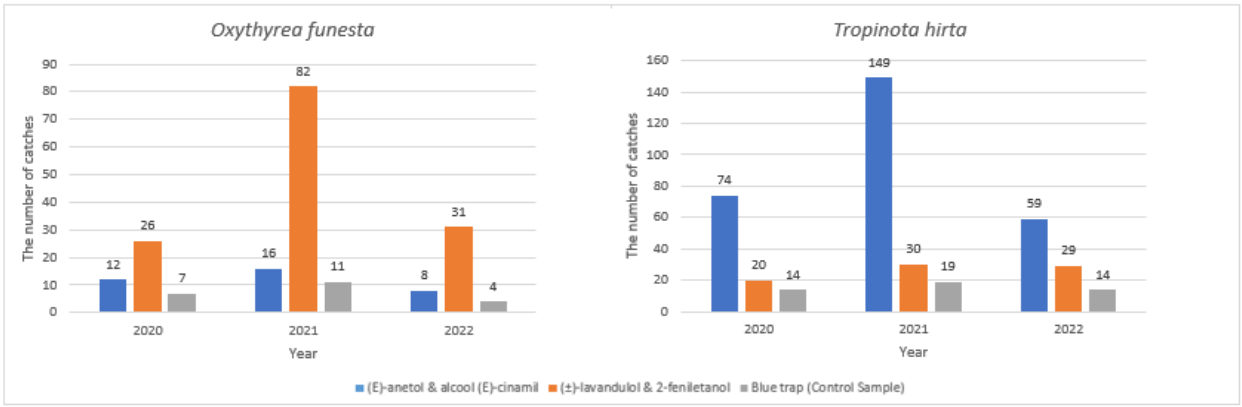

Figure 4. Statistical difference between the 3 variants used in monitoring the species *Oxythyrea funesta* and *Tropinota hirta* (2020-2022).

Analysis of Variance						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	7284,981[a]	17	428,528	17,103	0,000	0,890
Intercept	6556,019	1	6556,019	261,659	0,000	0,879
Species	904,483	1	904,483	36,098	0,000	0,501
Substance	1730,037	2	865,019	34,524	0,000	0,657
Year	813,037	2	406,519	16,225	0,000	0,474
Species * Substance	2631,148	2	1315,574	52,506	0,000	0,745
Species * Substance * Year	768,963	4	192,241	7,673	**0,000**	0,460
Error	902,000	36	25,056			
Total	14743,000	54				
Corrected Total	8186,981	53				

Figure 4. Statistical difference between the 3 variants used in monitoring the species *Oxythyrea funesta* and *Tropinota hirta* (2020-2022)(continued)

Figure 5 shows the number of adults of *Tropinota hirta* and *Oxythyrea funesta* captured annually in the 6 Barber traps located in the blackberry collection at USAMV Cluj-Napoca.

Through observations carried out in 2020-2022, the extent to which adults are moving on the ground and whether they can be successfully monitored with Barber traps was tested. As shown in the literature, both species are active on warm, sunny days, but at night and in cold or cloudy weather, they take shelter in the ground (Vuts et al., 2008).

In 2020, the first catches were of *Oxythyrea funesta* on May 25 and the last catches were of *Tropinota hirta* on July 6. Certainly, the flight of both species probably started much earlier, but the adults evolved into the existing cherry and raspberry plantation near the blackberry collection. The relatively long presence of adults in the blackberry collection is also due to the variety assortment, which have a delayed flowering period. In 2021, the adult collection period was between 17 May and 5 July, then in 2022, between 16 May and 12 July.

From the data presented, it can be seen that the number of catches is very low in Barber traps. At *Tropinota hirta* the number of catches in the 6 traps was between 11 adults in 2020 and 25 adults in 2021 and at *Oxythyrea funesta* between 7 adults in 2020 and 15 adults in 2021.

From the data presented on the two monitoring methods for these species, it can be concluded that the use of ecomonal baits is clearly superior to Barber traps.

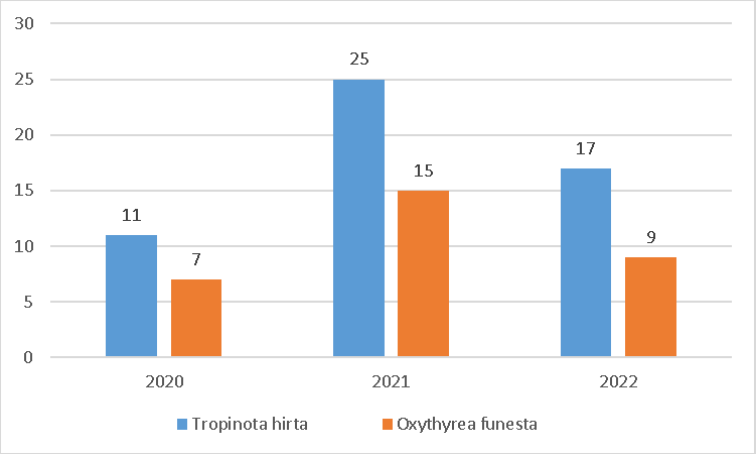

Figure 5. Number of catches in Barber traps (USAMV Cluj-Napoca, 2020-2022).

CONCLUSIONS

Following the research carried out in the period 2020-2022, in the 2 locations (USAMV Cluj-Napoca and Bio Farm Recea Cristur Srl - Cluj County), the two species taken in the study, *Oxythyrea funesta* and *Tropinota hirta* are potential pests in some fruit shrub crops, namely blackberry and black currant. Their monitoring is required to determine population density and damage assessment.

For *Tropinota hirta* species, (E)-anethole & (E)-cinnamyl alcohol baits works well and for the species *Oxythyrea funesta*, (±)-lavandulol & 2-phenyletanol baits are effective and these ecomonal products can be used in the monitoring of the two species and constitute an ecological method of their control in fruit shrubs plantations.

Barber traps, did not give satisfactory results in monitoring the two species studied.

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Conflicts of Interest

The authors declare that they do not have any conflict of interest.

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