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Employing Floral Baited Traps for Detection and Seasonal Monitoring of *Tropinota* (*Epicometis*) *hirta* (Poda) (Coleoptera: Cetoniidae) in Bulgaria

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Abstract: The potential of commercially available light blue VARb3k traps and baits for *T. hirta* (Csalomon®, Plant Protection Institute, Budapest, Hungary) as a new tool for detection and describing the seasonal flight patterns of *Tropinota* (*Epicometis*) *hirta* (Poda) was proved in eight sites in Bulgaria in 2009 and 2010. The traps showed very high efficiency in both cases of high and low population level of the pest. Significant catches of *T. hirta* were recorded in Dryanovo, Karnobat, Knezha, Kyustendil, Petrich and Plovdiv. As a whole the beetles appeared in the very end of March – beginning of April and reached their peak flight in the second half of April – beginning of May; catches were recorded up to the middle of July. The bait/traps system used in our field work showed very high species selectivity. In nine out of ten cases the catches of *T. hirta* exceeded 90% and in six of these this percent was equal or more than 99%, including Petrich where only *T. hirta* were caught in 2009.

Key words: *Tropinota (Epicometis) hirta*, detection, seasonal monitoring, Bulgaria, floral baited traps

Introduction

Scarabaeids are important group of beetles in regard to both systematics and economics. Adults of many species are phytophagous and feed on leaves and flours of cultural plants (Hurpin 1962). Family Cetoniidae (Coleoptera: Scarabaeoidea) includes several important pests like *Tropinota hirta* Poda, *Cetonia aurata* L., *Oxythyrea funesta* Poda, etc. This was the reason for organizing a survey on the distribution and seasonal appearance of some of the main beetle pests belonging to this family using floral baited colour traps.

The first object of our investigation was *T. hirta.* It is known as an important pest attacking many cultural plants by feeding on stamens, pistils and other parts of their flowers in different countries in Europe, e.g. Austria (Böhm 1950), Bulgaria (Chorbadjiev 1932; Buresh, Lazarov 1956, Popova 1962, 1968), Croatia (Ražov *et al.* 2009), Hungary (Homonnayné, Homonnayné-Csehi 1990), Serbia (Stamenković, Milenković 1996). Popova (1962) listed 37 food plants for *T. hirta* in Bulgaria belonging to seven families. To this list 11 more species should be added (Chorbadzhiev 1932, Buresh, Lazarov 1956). According to Zashev, Keremedchiev (1968) *T. hirta* attacks also different forest trees, including *Salix* sp. and *Populus* sp.

Tóth *et al.* (2003) found three compounds attracting *T. hirta* in field: cinnamyl alcohol, trans-anethol and cinnamyl acetate. Further tests showed that the combination of light blue colour and a bait of 1:1 mixture of cinnamyl alcohol and trans-anethol used in dry funnel traps are very effective tool for catching both males and females of the pest (Schmera *et al*. 2004). Later, as a result of ellectrantenographic screening of 27 synthetic compounds (most of them floral) and further testing of the most active ones among them, a new coattractant increasing the attractiveness of cinnamyl alcohol/trans-anethol mixture was found: 4-methoxyphenethyl alcohol significantly increases catches of *T. hirta* when added to the known binary attractant mixture (Vuts *et al.* 2010b). Floral baited blue dry traps have already been successfully used for detection and/or seasonal monitoring of *T. hirta* in Bulgaria (Mircheva *et al*. 2004), Hungary, Croatia and Italy (Tóth *et al*. 2009).

The objective of the present research was to prove the potential and species-specificity of floral baited traps as a new tool for establishing the possible presence of *T. hirta* in several regions in Bulgaria and describing the seasonal flight patterns of the pest in the sites where its population level allows this to be done. Information about other species of superfamily Scarabaeoidea captured in the traps is also given.

Materials and Methods

Commercially available VARb3k traps with a light blue upper funnel and baits for *T. hirta* were purchased from Csalomon® (Plant Protection Institute, Budapest, Hungary) and used in our field work. Two traps (together with two traps for each *C. aurata* and *O. funesta*) were set in eight sites in Bulgaria in 2009-2010 in: Dryanovo, Gabrovo, Karnobat, Knezha, Kyustendil, Petrich, Plovdiv and Troyan. Details of the experimental work are shown in Table 1. The traps, installed on the ground or at a height of 50-100 cm above, were visited weekly and the beetles caught were collected and identified in laboratory using Baraud (1992) and Medvedev (1965). Only in Gabrovo the traps were visited irregularly at 10-15 day intervals.

Results

Significant catches of *T. hirta* were recorded in six of the experimental sites during 2009. No beetles of this species were caught in Troyan and only three beetles were caught in Gabrovo in 2009 which was the reason not to go on with the observations at these sites in 2010. We failed to organize further observation in Petrich and this site was also excluded in 2010 but another site, Knezha, was added. Significant catches were recorded in all five sites investigated during 2010. The most numerous catches were recorded in Kyustendil and Petrich in 2009 and in Knezha and Kyustendil in 2010 (Table 2).

The trend of the seasonal flight of *T. hirta* in all the sites of investigations was similar in both 2009 and 2010. As a whole the beetles appeared in the very end of March – beginning of April and reached their peak flight in the second half of April – beginning of May. The latest catches were recorded in Karnobat (July 2, 2010) and Kyustendil (July 14 2010), (Fig. 1-5).

The bait/traps system used in our field work showed very high species selectivity. In nine out of

Table 1. Details of the field tests. The altitude of towns is taken from: http://bg.guide-bulgaria.com/

Region	Altitude	Vegetation	Date of setting the traps		Date of collecting the traps	
			2009	2010	2009	2010
Dryanovo	200-299 m	Mixed orchard	25.03	27.03	31.08	26.07
Gabrovo	300-499 m	Mixed orchard	02.04	-	15.08	-
Karnobat	200-299 m	Mixed park (tress and bushes) vegetation	25.03	12.03	31.08	30.07
Knezha	100-199 m	Various cereals (maize, sunflower, wheat, oats)	-	12.03	-	27.08
Kyustendil	500-699 m	Mixed orchard	30.03	17.03	25.08	28.07
Petrich	100-199 m	Peach orchard	17.03	-	31.08	-
Plovdiv	100-199 m	Mixed orchard	27.03	19.03	28.08	27.07
Troyan	300-499 m	Mixed orchard	25.03	-	31.08	-

Table 2. Catches of *T. hirta* in two target traps in each of eight sites in Bulgaria during 2009 and 2010.

Site	Total number of beetles caught	
	2009	2010
Dryanovo	90	34
Gabrovo	3	-
Karnobat	165	15
Knezha	-	1408
Kyustendil	1700	660
Petrich	701	-
Plovdiv	157	274
Troyan	0	-

ten cases the catches of *T. hirta* exceeded 90% and in six of these this percent was equal or more than 99%, including Petrich where only *T. hirta* were caught in 2009. The other scarabaeid beetles, besides the target one, caught in the traps were *O. funesta, C. aurata*, *Protaetia (Netocia) cuprea* (Fabricius), *Valgus hemipterus* (L.), *Blitopertha lineolata* (Fischer von Waldhein), *Anisoplia (Autanisoplia) austriaca* (Herbst) and *Trichius fasciatus* (L.); all of them with the exception of the last one are pest species (Fig. 6).

Discussion

Our results have shown that the commercially light blue VARb3k traps and baits for *T. hirta* (Csalomon®, Plant Protection Institute, Budapest, Hungary) are very potent tool for attracting and capturing the beetles of this species in both cases of a high population level and low population level of the pest.

T. hirta is known as widely distributed pest in Bulgaria. One of the first reviews on the distribution and host plants of *T. hirta* in Bulgaria is that of Chorbadjiev (1932). More recent publications also showed that the pest is polyphagous and widely distributed in this country (Buresh, Lazarov 1956; Popova 1962; 1968). The results of our recent investigations confirmed to a great extent this. It worth mentioning the absence of the pest in Troyan in 2009 which is in accordance with the results obtained earlier at the same spot – only few beetles of this species were caught in 25 traps operating whole season in

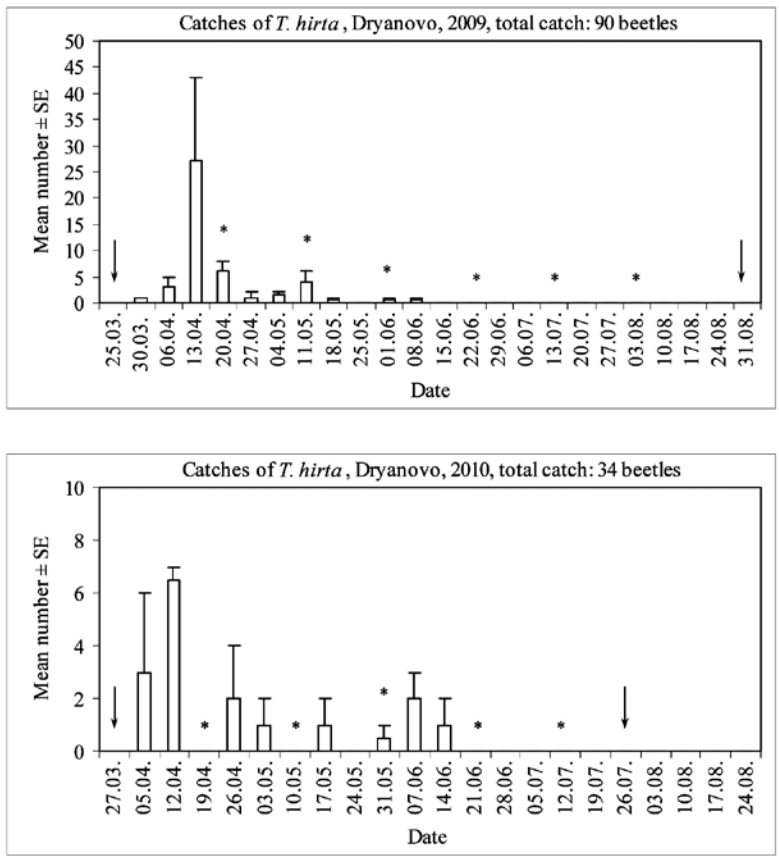

Fig. 1. Seasonal flight of *T. hirta* in Dryanovo, 2009 and 2010. Arrows (↓) show the dates of installing and reinstalling the traps in the field. Asterisks (*) mark the date when the baits were renewed.

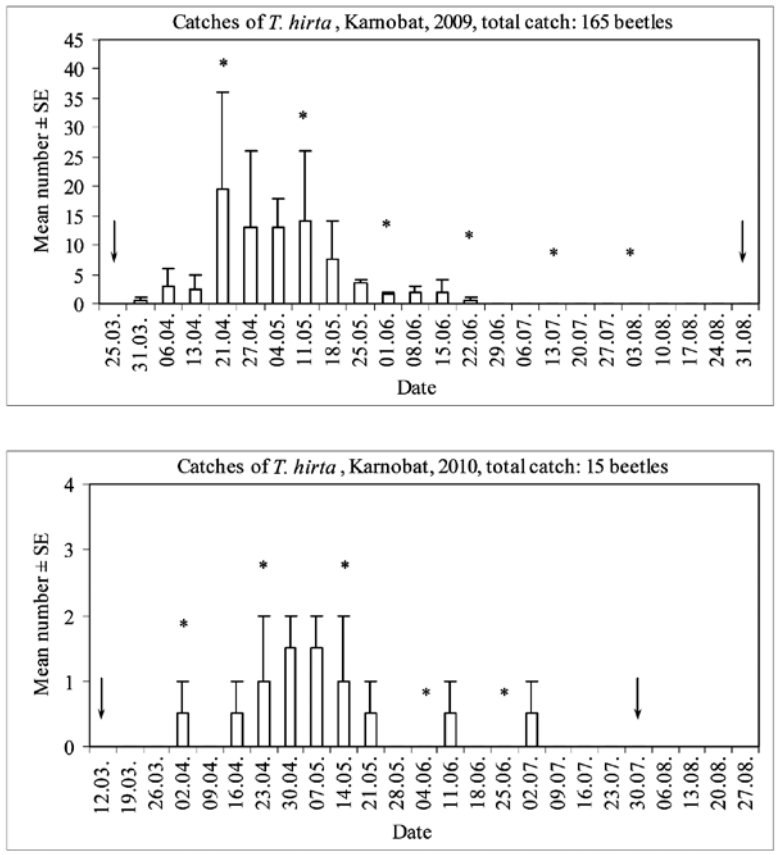

Fig. 2. Seasonal flight of *E. hirta* in Karnobat, 2009 and 2010. For symbols see the legend for Fig. 1.

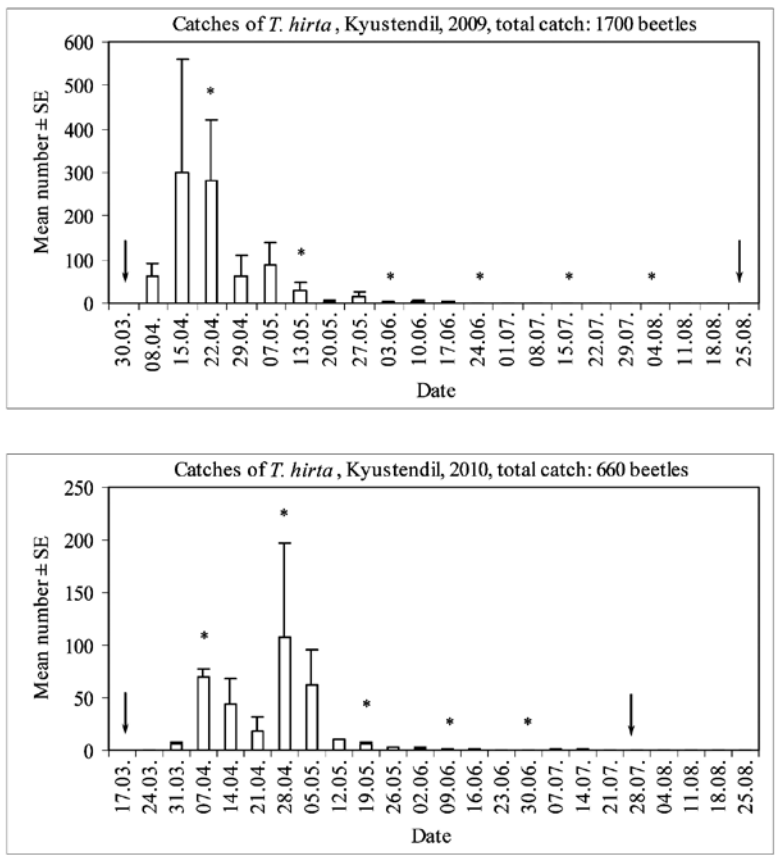

Fig. 3. Seasonal flight of *T. hirta* in Kyustendil, 2009 and 2010. For symbols see the legend for Fig. 1.

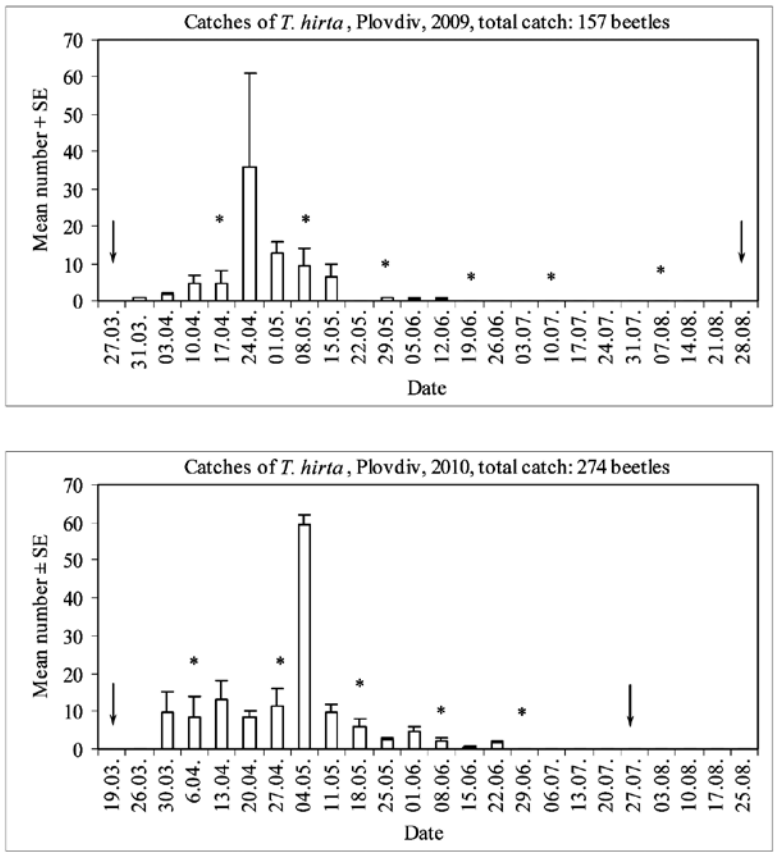

Fig. 4. Seasonal flight of *T. hirta* in Plovdiv, 2009 and 2010. For symbols see the legend for Fig. 1.

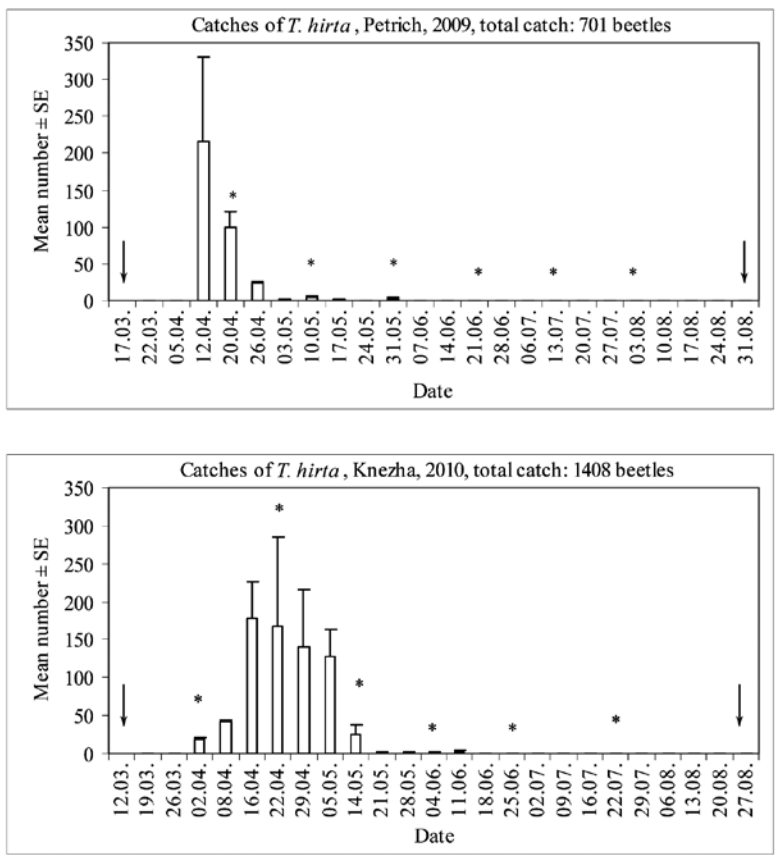

Fig. 5. Seasonal flight of *T. hirta* in Petrich, 2009 and Knezha, 2010. For symbols see the legend for Fig. 1.

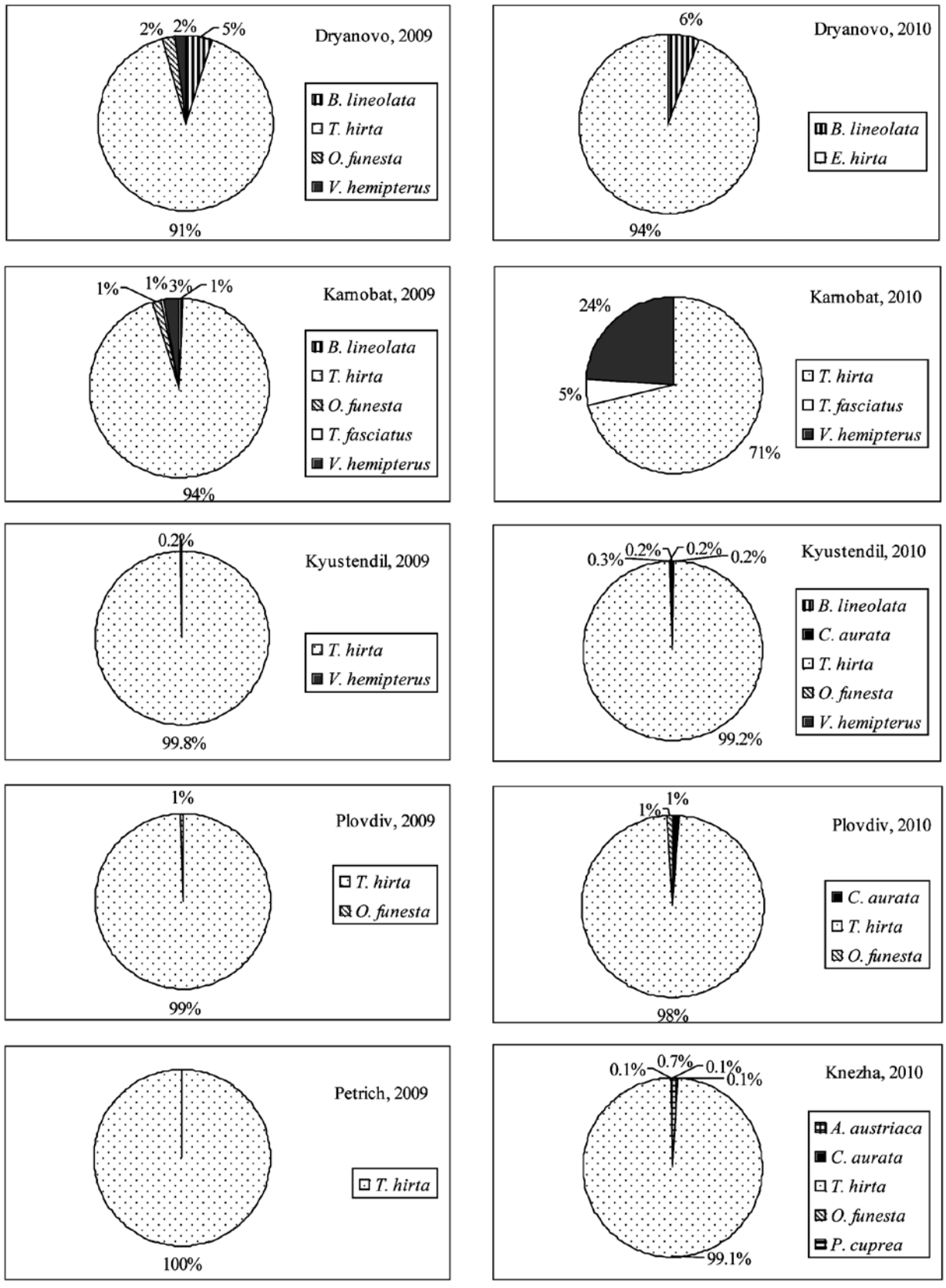

Fig. 6. Percentage distribution of scarabaeid beetles caught in traps with baits for *T. hirta* at six sites in Bulgaria in 2009-2010.

2006 (Subchev, Spasova unpublished data). On the other hand a total of 25 *T. hirta* beetles were caught in traps for *C. aurata* and *O. funesta* at the same site in 2010 (Subchev *et al*. unpublished data). This low population level of the pest in Troyan is difficult for explanation. One possible reason could be the relatively high altitude but we recorded very high population level of the pest at another site, Kyustendil, located at almost the same altitude.

According to Chorbadjiev (1932), *T. hirta* beetles appeared in April, reached their peak in the beginning and the first half of May and then disappeared in the middle of June after which only single exemplars were observed. The more accurate study of Popova (1962) carried out in 1957-1959 showed that *T. hirta* appeared in the field from March 5 to April 4 and the flight lasted until July 8 – July 24. The results of our earlier field investigations with same VARb3k traps and carried out in 2000 in Kyustendil showed an earlier flight of the pest as compared to the results at the same site reported in the present paper for 2009 and 2010. Summarizing the data available we could conclude that in Bulgaria *T. hirta* appeared in March – beginning of April and could be observed in the field up to the end of July depending on the climatic conditions of the year. Similarly the term of the peak flight vary in the period of the second half of April – first half of May. Tóth *et al.* (2009) reported similar results obtained by the same traps: in Hungary, Croatia and Italy the pest appeared at the end of March or early April and the peak flight was recorded in April. According to Negrobov (2009) in Voronezh province, Russia, *T. hirta* belongs to the 'late spring – early summer' phenological group with an abundance peak in May.

Our results showed also a very high species-specificity of the VARb3k traps which exceeded 90% in nine of the all ten cases and well correlates with the literature data. Field experiments organised earlier in Hungary, Croatia, Bulgaria and Italy have shown more than 50% *T. hirta* caught in the traps for this species in whole season observation but at the time of *T. hirta* flight this percent rise up to 75% (Vuts *et al.* 2010a). Of course this ratio between catches of the target and non-target species such as *O. funesta, C. aurata, V. hemipterus*, etc. depends on the occurrence or absence of some of these species at a certain site and their population level when present – in the case of a very low population level of the target species and high population level of the not-target species the ratio of the beetles caught could be changed in the favour of the non-target species. In Italy, another *Tropinota* species, *Tropinota (Tropinota) squalida* (Scopoli) was also attracted into the traps for *T. hirta* (Tóth *et al.* 2009). *T. squlaida* occurs also in Bulgaria in orchards, vine yards and also on colza and rye (Buresh, Lazarov 1956) but never found in our traps during the recent investigations.

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