

## NOTES ON THE TENEBRIONIDAE (COLEOPTERA) FAUNA COLLECTED BY HIBERNATION TRAP-BANDS AND PITFALL TRAPS IN BOZDAĞLAR MOUNTAIN, WESTERN TURKEY\*

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ABSTRACT: Tenebrionidae specimens collected by pitfall traps and hibernation trap-bands in Bozdağlar Mountain, western Turkey during the years of 2003-2007 have been evaluated. A total of 14 species belonging to two subfamilies and some ecological considerations on those species were given. The species are (alphabetic order): *Blaps jeannei* Ferrer & Soldati 1999; *Dailognatha quadricollis* Brullé 1832; *Graecopachys quadricollis* (Brullé 1836); *Idastrandia mucoreus* (Waltl 1838); *Pachyscelis villosa* (Drapiez 1820); *Pimelia subglobosa polita* Soliér 1836; *Tentyria rotundata mittrei* Soliér 1835; *Zophosis punctata* Brullé 1832 in the subfamily Pimeliinae; *Dendarus messenius* Brullé 1832; *Euboes mimonti* Boieldieu 1865; *Gonocephalum granulatum pusillum* (Fabricius 1791); *Odocnemis crenatostriatus* (Allard 1877); *Opatroides punctulatus* Brullé 1832; *Probatiscus tenebricosus* (Brullé 1832) in the subfamily Tenebrioninae. *Dailognatha quadricollis* and *Pimelia subglobosa polita* were the most abundant species in the study with percentages of 39,7 % and 26,8 %, respectively.

KEY WORDS: Ecology, faunistics, hibernation trap-bands, pitfall trap, Turkey, Tenebrionidae.

The Tenebrionidae, also known as Darkling beetles, is a big family, distributed in all parts of the world and comprising more than 15.000 species belonging to 96 tribes of 10 subfamilies (Bouchard et al., 2005). They occur in many terrestrial ecosystems, mostly in decaying vegetation matter, under stones or bark. They can be found in desert or semidesert habitats. Relatively only a few Tenebrionidae species are of great economic importance.

So far, more than 310 species and subspecies of Tenebrionidae have been recorded from Turkey (Tezcan et al., 2004). The publications of Mercan et al. (2004) and Aslan et al. (2008) are the studies focusing on ecology of Tenebrionidae of Turkey, while all other contributions e.g. Fairmaire (1866) and Anlaş et al. (2004) for the Turkish Tenebrionids are concerned with taxonomic or faunistic problems.

The aim of this study is to evaluate the Tenebrionidae fauna in Bozdağlar mountain in Western Turkey. The results of this study also provide some ecological and faunistic data of Tenebrionids in Turkey.

### MATERIAL AND METHOD

#### Study Area

Studies have been conducted at four counties (Dağmarmara and Çıkrıkçı counties by pitfall traps; Kuşlar, Ovacık and Çıkrıkçı counties by hibernation trap-

bands) at Bozdağlar Mountain (2157 m), Western Turkey (Fig. 1), (also see Anlaş et al., 2010). Type of vegetation and agricultural practices determination the environment found in the counties:

**1. Natural areas** (chestnuts, pines and oaks forest):

**Chestnuts biotopes:** Aged 40 to 70 years *Castanea sativa* Miller is the common plant species. There are also *Trifolium bocconeii* Savi, *Salvia fruticosa* Miller, *Anthemis tinctoria* L., *Rubia tinctorum* L., *Medicago xvaria* Martyn, *Prunella vulgaris* L., *Juniperus oxycedrus* L., *Spartium junceum* L., *Rosa canina* L., *Rubus canescens* Dc., *Polypodium vulgare* L., *Cistus salviifolius* L. and *Styrax* sp. as they are rarely seen in the study area.

**Pines biotopes:** *Pinus brutia* Ten. and *Pinus nigra* (Arnold) are the common plant species in the biotopes. There are also occur *Cistus laurifolius* L. and *Polypodium* sp.

**Oaks biotopes:** Being the abundant plant species aged 10-35 years is *Quercus ithaburensis* Dacne. subsp. *macrolepis* (Kotschy) and *Quercus infectoria* Olivier. There are also rare ones as *Cistus creticus* L., *Stachys cretica* L. ssp. *smyrnaea* Rech., *J. oxycedrus*, *Pyrus amygdaliformis* Vill., *R. canina* and *Astragalus* sp.

**2. Seminatural areas** (near edges of running water, various types of unforested habitats such as meadows and other grassland, burnt forest, maquis forest):

**Meadow biotopes:** *Euphorbia anacampseros* Boiss, *Coridothymus capitatus* (L.), *P. vulgare*, and *J. oxycedrus*, are the common plant species in meadow biotopes.

**Maquis biotopes:** *Q. infectoria*, *C. salviifolius*, *R. canina*, *J. oxycedrus*, *Sarcopoterium spinosum* L., and *C. capitatus*, are the common plant species in the biotopes.

**Fire-influenced biotopes:** Once being an oak forest, this habitat that was burnt in July 2000. *J. oxycedrus*, *P. amygdaliformis*, *R. canina*, *Cistus laurifolius* L., *Thymus longicaule* C. Presl and *Verbascum* sp. are common plant species. In the biotope, there are also occur burnt wood pieces and trees.

**3. Cultivated landscapes** (orchards of cherries, walnuts, apples, figs, pears and olives):

In the gardens which have only occur the related trees (each orchard has only one tree species).

The material referred to in this study is deposited in the Lodos Entomological Museum (LEMT), Department of Plant Protection, Ege University (Izmir, Turkey), Entomological Museum of Zoology Department, Ege University (ZDEU-Ent) and in the private collection of S. Anlaş. Material were identified by B. Keskin and S. Anlaş. Classification and nomenclature of darkling beetles suggested by Lawrence & Newton (1995), Iwan (2001), Soldati & Soldati (2003) and Bouchard et al. (2005) have been followed. Material have been collected by two methods. Those were pitfall traps method and using hibernation trap bands.

## Sampling

### a) Pitfall traps:

A total of 6 pitfall traps were placed in each biotope. Pitfall traps consisted of 200 ml cups buried in the soil in such a way that the lip of the trap would be at ground level. They were half filled with ethylen glycol and water mixture at 1:1 ratio. Traps were cleared in two weeks intervals from beginning of April to end of October and then collected material were determined.

Detailed information on the biotopes of pitfall trapping is given in Table 1.

**b) Hibernation trap-bands:**

At each biotope hibernation trap bands in 70 x 250 m size made of hemp sack were rounded to the trunk of six trees in the beginning of October and removed in next February and collected material were determined. A total of 18 hibernation trap-bands were placed in each biotope.

Detailed information on the biotopes of hibernation trap-bands is given in Table 2.

**RESULTS**

In total, 1174 specimens of 14 species belonging to two subfamilies of Tenebrionidae have been recorded by pitfall traps and hibernation trap-bands in Bozdağlar Mountain, western Turkey during the years of 2003-2007 have been evaluated. Those species are *Blaps jeannei* Ferrer & Soldati, 1999; *Dailognatha quadricollis* Brullé, 1832; *Graecopachys quadricollis* (Brullé, 1836); *Idastrandiella mucoreus* (Waltl, 1838); *Pachyscelis villosa* (Drapiez, 1820); *Pimelia subglobosa polita* Soliér, 1836; *Tentyria rotundata mittrei* Soliér, 1835; *Zophosis punctata* Brullé, 1832 (Pimeliinae); *Dendarus messenius* Brullé, 1832; *Euboeus mimonti* Boieldieu, 1865; *Gonocephalum granulatum pusillum* (Fabricius, 1791); *Odocnemis crenatostriatus* (Allard, 1877); *Opatroides punctulatus* Brullé, 1832; *Probaticus tenebricosus* (Brullé, 1832) (Tenebrioninae).

**Pitfall trap studies**

A total of 845 specimens representing 12 species of Tenebrionidae were collected at two counties between the years of 2003-2006 (Table 3). Among these, eight species belonged to Pimeliinae, while the other four species are members of Tenebrioninae.

The most abundant species is *D. quadricollis* with 429 specimens and percent dominance value of 50.77 %. *P. subglobosa polita* and *D. messenius* followed it with percent dominance values of 37.16 % and 6.04 %, respectively. Those three species were found in all two counties during collecting period. The species of *B. jeannei*, *G. quadricollis*, *P. villosa* *T. rotundata mittrei* *Z. punctata* *E. mimonti* and *G. granulatum pusillum* were collected only occasionally, with the abundance being less than 1 %.

The total number of the specimens collected during two years' collection in Dağmarmara was 386 (45.68 %) and in Çıkırıkçı was 459 (54.32 %). The number of collected specimens and species by pitfall traps at each biotope is given in Table 4.

Among the biotopes, the majority of the specimens were collected from oaks biotope (253), meadow (198) and fire-influenced biotopes (185); the least specimens were collected from semiaquatic biotopes (7) and chestnuts biotopes (49). The number of species was 9 at oak biotopes; 8 at meadow; 6 at pines; 5 at chestnuts and maquis, 4 at fire-influenced biotopes; only 1 species at semiaquatic biotopes.

**Seasonal dynamics**

Of 12 species recorded during this study, only *Dailiognatha quadricollis*, *Pimelia subglobosa polita* and *Dendarus messenius* were collected in higher number of specimens that allows us to evaluate their seasonal dynamics on the localities (Fig. 2).

*D. quadricollis*, and *P. subglobosa polita* sampled during the period from April to October. The number of specimens of *D. quadricollis*, and *P. subglobosa*

*polita* increased from April to June and reached peak level in June. *D. quadricollis*, in the period of July-October it decreased and in October the number decreased up to 28. *P. subglobosa polita*, showing low abundance in July with number of 26 and increased in August. In the period of September-October it decreased again and October the number decreased up to 11. *D. messenius* was not recorded April and October, the peaks were recorded in June and August.

### **Hibernation trap-band studies**

Totally 329 specimens representing seven species of Tenebrionidae were collected at three counties during the autumn and winter periods of the years of 2005-2007 (Table 5). Among these, three species (*B. jeannei*, *D. quadricollis* and *P. villosa*) belong to Pimeliinae, while four species (*D. messenius*, *O. crenatostratus*, *O. punctulatus* and *P. tenebricosus*) belong to Tenebrioninae.

The most frequently collected species in three counties was *O. crenatostratus*, with percent dominance value of 73.86 %; and also *D. quadricollis* and *O. punctulatus* with percent dominance value of 11.25 % and 11.25 %, respectively.

The total number of specimens collected during two years in Çıkrıkçı was 75 (22.80 %) and in Ovacık 87 (26.44 %). It was 167 (50.76 %) in Kuşlar during three years collection period.

The number of collected specimens and species of each biotope is given in Table 6.

The number of specimens at chestnuts was 90 and apple was 64 among eight biotopes. Their numbers changed between 8 and 54 in other biotopes. Number of species was 4 at fig and it was 3 at pear and chestnut biotopes. The number of species was one at the biotope of olive, it was 2 at the rest of biotopes.

## **DISCUSSION**

The first study on the fauna of Bozdağ have been conducted by Fairmaire (1866) and in this study a total of 23 species recorded. In this study to determine the Tenebrionidae fauna of west and northwest Bozdağlar Mountain, pitfall traps and hibernating trap bands were used to collect material. Using pitfall traps is a standard method to collect tenebrionids. But hibernation trap-bands were used for the second time with respect to Tenebrionidae. This method previously was used in ecological cherry orchards in Izmir and Manisa by Tezcan & Keskin (2004). Artificial hibernation trap-bands have great importance in both the protection of fauna and also in extending their life-span. In this study, the artificial hibernation places that have been used as hibernation trap-bands, are utilized for the evaluation of fauna of different biotopes.

In total, 1174 specimens of the Tenebrionidae were collected at all location by different methods. 845 of which were collected by pitfall traps and 329 by hibernation trap-bands. *D. quadricollis* is the most abundant species with 466 specimens (39,7 %), 429 of which were collected by pitfall traps and 37 by hibernation trap-bands. *P. subglobosa polita* other dominant species with 314 specimens (26,8 %), all of them were collected by pitfall traps. *O. crenatostratus* is collected with 243 specimens (20,7 %), only by hibernation trap-bands. Collecting of more adults of *O. crenatostratus* probably overlapping of the activation period of this species and the collection of hibernation trap-bands. Detailed information on the biology, damage etc. of the collected species in ecosystems is not available in Turkey. It is expected that knowledge on darkling beetles will rise with further studies.

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Table 1. Detailed information on biotopes of pitfall trap methods.

Region	Prov.	County	Period	Biotopes	Coordinate	Altitude (m)
1	Manisa	Dağmarmara	2003 & 2006	Oak forest	38°22'14"N/ 27°50'39"E	980
				Fire-influenced biotopes	38°22'07"N/ 27°50'16"E	960
				Pine forest	38°22'49"N/ 27°52'12"E	930
				Meadow	38°22'39"N/ 28°04'56"E	880
				Chestnut forest	38°23'37"N/ 27°49'09"E	620
2	Manisa	Çıkrıkçı	2005 & 2006	Oak forest	38°28'19"N/ 27°49'44"E	220
				Meadow	38°28'19"N/ 27°49'38"E	200
				Pine forest	38°28'23"N/ 27°49'47"E	180
				Semiaquatic biotopes	38°28'24"N/ 27°49'17"E	110
				Maqui forest	38°28'24"N/ 27°49'20"E	150

Table 2. Detailed information on biotopes of hibernation trap-band methods (\*setting period of trap-bands (October), collected February the following year).

Region	Prov.	County	Years*	Biotopes	Coordinate	Altitude (m)
1	Manisa	Çıkrıkçı	2005 & 2006	Fig	38°28'24"N/ 27°49'30"E	120
				Olive	38°28'22"N/ 27°49'28"E	120
				Pear	38°28'21"N/ 27°49'31"E	120
2	Manisa	Kuşlar	2004, 2005 & 2006	Cherry	38°21'44"N/ 27°49'58"E	820
				Chestnut	38°21'48"N/ 27°49'57"E	820
				Walnut	38°21'41"N/ 27°49'56"E	820
3	Manisa	Ovacık	2005 & 2006	Apple	38°22'45"N/ 27°51'06"E	930
				Cherry	38°22'45"N/ 27°51'06"E	930
				Pine	38°22'45"N/ 27°51'06"E	930

Table 3. Number of specimens collected by pitfall traps in different counties and their percent dominance values.

Subfamilies	Location and year	Dağmarmara		Çıkrıkçı		Sum	Dominance Value (%)
		2003	2006	2005	2006		
Pimeliinae	<i>B. jeannei</i>		1	1		2	0.24
	<i>D. quadricollis</i>	84	52	131	162	429	50.77
	<i>G. quadricollis</i>				1	1	0.12
	<i>I. mucoreus</i>	2	1	5	4	12	1.42
	<i>P. villosa</i>			3	4	7	0.83
	<i>P. subglobosa polita</i>	79	118	23	94	314	37.16
	<i>T. rotundata mitrei</i>		1		1	2	0.24
	<i>Z. punctata</i>	2	2		1	5	0.59
Tenebrioninae	<i>D. messenius</i>	16	7	6	22	51	6.04
	<i>E. mirmonti</i>				1	1	0.12
	<i>G. granulum pusillum</i>	2	1			3	0.36
	<i>P. tenebricosus</i>	3	15			18	2.13
<b>Totally</b>	<b>188</b>	<b>198</b>	<b>169</b>	<b>290</b>	<b>845</b>	<b>100</b>	
		<b>386</b>		<b>459</b>	<b>845</b>		

Table 4. The number of collected specimens and species by pitfall traps at each biotope in Western Turkey [Ch (Chestnuts), Ma (Maquis), Me (Meadow), Oa (Oaks), Sa (Semiaquatic), Pi (Pines), Fi (fire-influenced)]

Biotopes	Ch	Ma	Me	Oa	Sa	Pi	Fi	Total
<i>B. jeannei</i>				2				2
<i>D. quadricollis</i>	11	57	98	156	7	16	84	429
<i>G. quadricollis</i>				1				1
<i>I. mucoreus</i>		1	9	1		1		12
<i>P. villosa</i>		1	3	3				7
<i>P. subglobosa polita</i>	29	27	75	64		31	88	314
<i>T. rotundata mitrei</i>			1			1		2
<i>Z. punctata</i>				3			2	5
<i>D. messenius</i>	6	9	10	22		4		51
<i>E. mirmonti</i>			1					1
<i>G. granulum pusillum</i>	1		1	1				3
<i>P. tenebricosus</i>	2					5	11	18
<b>Number of specimens</b>	<b>49</b>	<b>95</b>	<b>198</b>	<b>253</b>	<b>7</b>	<b>58</b>	<b>185</b>	<b>845</b>
<b>Number of species</b>	<b>5</b>	<b>5</b>	<b>8</b>	<b>9</b>	<b>1</b>	<b>6</b>	<b>4</b>	<b>12</b>

Table 5. Number of specimens collected by hibernation trap-bands at different counties and their percent dominance values.

Location and year Species	Ovacık		Kuşlar			Çıkrıkçı		Sum	Dominance Value (%)
	2006	2007	2005	2006	2007	2006	2007		
<i>B. jeannei</i>		1		1				2	0.61
<i>D. quadricollis</i>			3	2		13	19	37	11.25
<i>P. villosa</i>						2	1	3	0.91
<i>D. messenius</i>						2	1	3	0.91
<i>O. crenatosstriatus</i>	36	47	96	20	44			243	73.86
<i>O. punctulatus</i>						16	21	37	11.25
<i>P. tenebricosus</i>	1	2			1			4	1.21
<b>Totally</b>	<b>37</b>	<b>50</b>	<b>99</b>	<b>23</b>	<b>45</b>	<b>33</b>	<b>42</b>	<b>329</b>	<b>100</b>
		<b>87</b>		<b>167</b>		<b>75</b>		<b>329</b>	

Table 6. Biotopes of Tenebrionidae species collected by hibernation trap-bands in Western Turkey [Ol (Olive), Ap (Apple), Fg (Fig), Pe (Pear), Ce (Cherry), Wl (Walnut), Pi (Pine), Ch (Chestnut)].

Biotopes	Ol	Ap	Fg	Pe	Ce	Wl	Pi	Ch	Total
<i>B. jeannei</i>						1	1		2
<i>D. quadricollis</i>	8		10	14	2			3	37
<i>P. villosa</i>			3						3
<i>D. messenius</i>			2	1					3
<i>O. crenatosstriatus</i>		61			52	33	11	86	243
<i>O. punctulatus</i>			12	25					37
<i>P. tenebricosus</i>		3						1	4
<b>Number of specimens</b>	<b>8</b>	<b>64</b>	<b>27</b>	<b>40</b>	<b>54</b>	<b>34</b>	<b>12</b>	<b>90</b>	<b>329</b>
<b>Number of species</b>	<b>1</b>	<b>2</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>7</b>





Figure 1. Study areas at Bozdağlar Mountain, western Turkey.

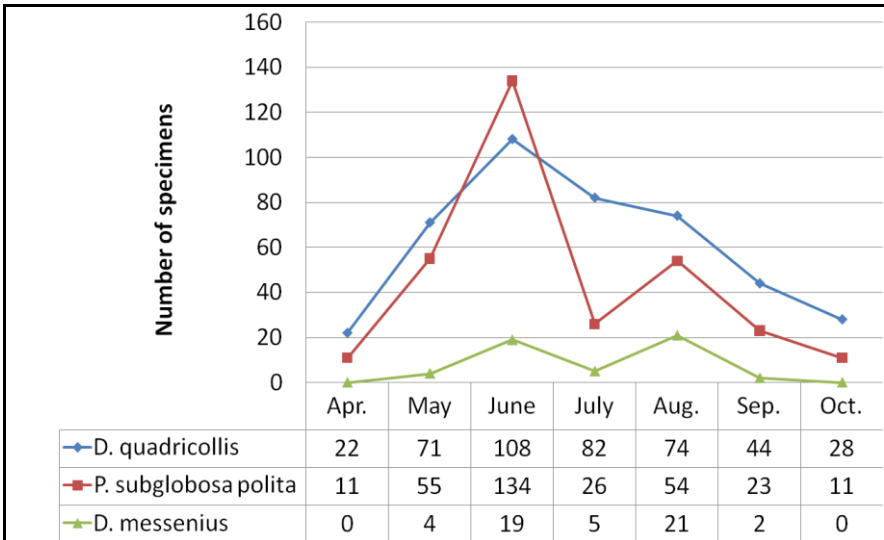


Figure 2. Seasonal dynamics of specimens of *Dailognatha quadricollis*, *Pimelia subglobosa polita* and *Dendarus messenius* during sampling period, April to October, by pitfall traps.