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Dominance and Frequency of Coleoptera Found on Stored Cereals and Cereal Products in Central Greece¹

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ABSTRACT

Thirty Coleoptera taxa belonging to 14 families were found during samplings conducted in 4 different storage facilities at Farsala district, Central Greece, from January 1991 to February 1992. Among the most frequently found, *Sitophilus oryzae, S. granarius and Rhysopertha dominica* were more numerous on grain, *Tribolium confusum, T. castaneum* and *Cryptolestes ferrugineus* on flour, while *Oryzaephilus surinamensis* and *O. mercator* showed no significant preference to any commodity. An analysis of the results was performed, based on the «dominance» and «frequency» criteria. The population fluctuation of the 8 most significant species is given in graphs.

Introduction

The great majority of insects found in storage facilities belong to the order Coleoptera with the Lepidoptera coming next in order of frequency (Aitken 1975). Many species are feeding directly on the product itself causing its quantitative and qualitative degradation; the rest may do no direct damage having mycetophagous, predatory and parasitic habits. Their presence is often indicative of mouldy or infested condition (Cotton 1960, Mallis 1982, Sinha and Watters 1985).

The major importance of cereals in Greece makes imperative the need for constant surveillance on storage, handling and processing facilities by specialists, in order to avoid - or at least minimize-quantitative and qualitative loss caused by insects and other secondary degradations.

Apparently, Coleoptera are also the most important pests of stored cereals and other relevant products in Greece (Buchelos 1981). The present work was considered worthwhile to be undertaken therefore.

Materials and Methods

a. Storage facilities.

The storage rooms in which this study took place are located in at the plain of Farsala, in Thessaly, Central Greece. The samplings were conducted in four kinds of storage facilities referred to hereinafter as Rooms 1, 2, 3 and 4. Room 1 is a State warehouse with large quantities of wheat, barley and maize permanently stored. Room 2 is an old traditional flour mill, with quantities of wheat, flour and bran. Room 3 is a private warehouse containing wheat, maize, flour, bran and livestook feed. Room 4 is also a private warehouse containing wheat and flour.

b. Sampling.

The sampling was conducted from January 1991 to February 1992. From each Room and approximately every 10 days, samples weighing about 200 g were taken from the surface and depths up to 30 cm of the bulk, corners, machinery and residues. In total 160 samples, 40 from each Room, were examined.

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c. Dominance and Frequency.

Analysis of the data was made according to the criteria used by Curry (1973).

The term «dominance» signifies the percentage of individuals belonging to a particular species compared to the individuals of all the species indentified in total. Thus, species can be classified as:

«Dominant»: 5% or more of the total number of

individuals found, «Influent»: 2-5% of the total number of individuals found and «Recendent»: less than 2% of the total number of individuals found.

A species «frequency» is measured by the percentange of samples in which the particular species was detected. Thus, species can be classified as:

«Constant»: detected in more than 50% of the total number of samples, «Accessory»: detected in

TABLE 1. Total	number of	adults of ea-	ch species for	ound in every	Room in the survey.
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SPECIES	ROOMS				TOTAL	
Igen when you not not	1	2	• 3	4	A second second	
Anobiidae	260771000					
Lasioderma serricorne (F.)	26	48	10	109	193	
Stegobium paniceum (L.)		-	13	-	13	
Anthicidae						
Anthicus floralis L.	3		-		3	
Postmehidee						
Rhyzopertha dominica (F)	1769	411	172	293	2645	
Ruyzopenna aominica (1).	4.1.41.2					
Cleridae	24		S NOT THE WAY		24	
Necrobia rujipes (Degeer)	24	and the	a second of		24	
Cryptophagidae	10				40	
Cryptophagus sp.	48		-	_	40	
Cucujidae				63.12	10000	
Cryptolestes ferrugineus (Steph.)	682	2087	362	44	3175	
Cryptolestes spp.	25	81	30	1.00	136	
Curculionidae						
Sitophilus granarius (L.)	5703	489	2622	1731	10545	
Sitophilus oryzae (L.).	5324	58	2937	2018	10827	
Dermestidae						
Anthrenus spp.	9	12		200	21	
Attagenus sp.	15	10	8		33	
Trogoderma sp.	16	8	21	224	39	
Histeridae						
Carcinops pumilio (Erichson)	23				23	
Mycetonhagidae						
Typhaea stercorea (L.)	11		-	-	11	
Silvanidas						
Operannhilus suringmensis (1)	942	1371	384	552	3.249	
Owzaenhilus mercator (Fauvel)	733	1228	292	332	2.585	
Starkellador	100		u sulfini lu			
Staphylinidae	9	all a later of the	10 miles	and states	8	
Ougota granana Ericiison	0	1.0				
Tenebrionidae	(70)	2.124	262	500	2 756	
Tribolium confusum Duval	6/8	2.154	212	202 137	3.101	
Palanus subdemassus (Wolloston)	21	1.609	215	437	118	
Palorus subdepressus (Wissmann)	42	23	-		65	
Alphitobius diaperinus (Panzer)	47		22		69	
Alphitobius laevigatus (F.)	7	1123			7	
Tenebrio molitor L.	29	5	11	and which	45	
Tenebrio obscurus F.	5				5	
Latheticus oryzae Waterhouse	128		-		128	
Alphitophagus bifasciatus (Say)	146		-	-	146	
Blaps mucronata L.	9	1	5		15	
Trogositidae						
Tenebroides mauritanicus (L.)	118	8	67	16	209	
TOTAL	17224	10360	7535	6114	41242	

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25-50% of the total number of samples and «Accidental»: detected in less than 25% of the total number of samples.

Results and discussion

A total of 41242 Coleoptera adults corresponding to 30 at least taxa that belong to 14 families were accounted for. The total numbers resulting from the survey are given in Table 1. Table 2 is a representation of the dominance and frequency of each taxon. *Sitophilus oryzae* and *Sitophilus granarius* accounted for about 52% of the total number of adults found, thus being the most frequent insects in the survey. These species maintained an impressive and constant presence in Rooms 1, 3 and 4 whereas in the flour mill

TABLE 2. Dominance and	Frequency of t	the species t	found in the	survey
		the second s		

SPECIES	% of the total number of adults	DOMINANCE	% of the total number of samples	FREQUENCY
Anobiidae Lasioderma serricorne (F.) Stegobium paniceum (L.)	0.46 0.03	recendent recendent	43.7 6.2	accessory accidental
Anthicidae Anthicus floralis L.	0.01	recendent	1.8	accidental
Bostrychidae Rhyzopertha dominica (F.)	6.4	dominant	95.6	constant
Cleridae Necrobia rufipes (Degeer)	0.06	recendent	8.7	accidental
Cryptophagidae Cryptophagus sp	0.1	recendent	20.6	accidental
Cucujidae Cryptolestes ferrugineus (Steph). Cryptolestes spp	7.7 0.3	dominant recendent	94.3 47.5	constant accessory
Curculionidae Sitophilus granarius (L.) Sitophilus oryzae (L.)	25.6 26.3	dominant dominant	100 100	constant constant
Dermestidae Anthrenus spp Attagenus sp Trogoderma sp	0.05 0.08 0.09	recendent recendent recendent	9.3 11.8 13.7	accidental accidental accidental
Histeridae Carcinops pumilio (Erichson)	0.05	recendent	12.5	accidental
Mycetophagidae Typhaea stercorea (L.)	0.03	recendent	2.5	accidental
Silvanidae Oryzaephilus surinamensis (L.) Oryzaephilus mercator (Fauvel)	7.9 6.3	dominant dominant	100 100	constant constant
Staphylinidae Oligota granaria Erichson	0.02	recendent	3.7	accidental
Tenebrionidae Tribolium confusum Duval Tribolium castaneum (Herbst) Palorus subdepressus (Wollaston) Palorus ratzeburgii (Wissmann) Alphitobius diaperinus (Panzer) Alphitobius laevigatus (F.) Tenebrio molitor L. Tenebrio obscurus F. Latheticus oryzae Waterhouse Alphitophagus bifasciatus (Say) Blaps mucronata L. Transcittidae	$\begin{array}{c} 9.1 \\ 7.5 \\ 0.3 \\ 0.16 \\ 0.02 \\ 0.1 \\ 0.01 \\ 0.3 \\ 0.35 \\ 0.04 \end{array}$	dominant dominant recendent recendent recendent recendent recendent recendent recendent recendent recendent	$100 \\ 100 \\ 38.7 \\ 26.2 \\ 28.1 \\ 3.7 \\ 27.5 \\ 3.1 \\ 13.1 \\ 17.1 \\ 6.7 \\$	constant constant accessory accessory accidental accessory accidental accidental accidental accidental accidental accidental
Tenebroides mauritanicus (L.)	0.5	recendent	51.8	constant

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Figs. 1-8. The population fluctuation of the 8 most numerically significant species of the survey.

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(Room 2) their population was significantly lower (Table 1). Tribolium confusum and Tribolium castaneum dominated in the flour mill compared to Sitophilus, while the situation was reversed in stores. This is obviously due to species feeding preferences rather than the condition of the stores (Aitken 1975). Orvzaephilus surinamensis and Orvzaephilus mercator proportionally seem to be more balanced in terms of population in all 4 different Rooms being more numerous in the flour mill, in which case the incident must also be related to these species' feeding preferences (Howe 1956). The highest Cryptolestes ferrugineus population (66%) was found in the flour mill (Table 1), mainly in flour and bran although the insect is capable of infesting products of higher moisture content such as damaged seeds and has generally obtained a great adaptability to varius humidity levels (Bishop 1959). On the contrary, 67% of the total number of Rhysopertha dominica individuals was found inside Room 1, where cereal seeds were stored over a long period of time. Given that its reproductive rate is rather slow, it didn't have many population outbursts and recessions and its population steadily increased mainly while infesting products were left immovable during the sampling period (Howe 1950, Breese 1962) such as in Room 1. All 8 aforementioned species, representing about 97% of the total number of Coleoptera species found in all Rooms, are the ones classified as «dominant» (Table 2). The remaining 22 species are classified as «recedent» given that none of them overtop 0.5% of the total number; furthermore, these species simply play other roles in all 4 Rooms studied as predators (Necrobia rufipes, Carcinops pumilio, Oligota granaria), mycetophagous (Anthicus floralis, Cryptophagus sp., Typhaea stercorea, Alphitobius diaperinus, Alphitophagus laevigatus, A. bifasciatus) etc. although they are often observed in Greek storage facilities (Buchelos 1985).

Among the recedent species, *Tenebroides* mauritanicus was found mostly in Room 1 where hygienic conditions were poor and the infestation heavy enough to satisfy the insect's partly predatory habits (Sinha and Waters 1985). *Lasioderma serricorne* is a principal pest of stored tobacco feeding at the same time on an extremely large variety of material including weeds (Howe 1957); the fact that the windows in Room 4 remained open for long periods of time, can explain its large numbers. *L. oryzae* and *Palorus* spp. were found mainly in warm grain spots where they compete with success *T. confusum* and *T. castaneum* (Halstead 1967). The presence of *Cryptolestes* spp. was almost continuous mainly on the microflora of the flour mill (Room 2) where their development is favored compared to that of *C. ferrugineus* (Lefkovich 1962). The population fluctuation of the 8 most numerically significant species of the survey is given in Figs 1-8.

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KEY WORDS: Insecta, Coleoptera, stored cereals, survey, dominance, frequency.

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Κυριαρχία και Συχνότητα Ειδών Κολεοπτέρων σε Αποθήκες Σιτηρών και Υποπροϊόντων τους στην Κεντρική Ελλάδα

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ΠΕΡΙΛΗΨΗ

Κατά τη διάρχεια συστηματικών δειγματοληψιών που έλαβαν χώρα επί ένα έτος, σε τέσσερις αποθηκευτικούς χώρους σιτηρών και υποπροϊόντων τους, στην περιοχή Φαρσάλων, συλλέχθηκαν 41242 άτομα κολεοπτέρων εντόμων. Τα άτομα αυτά αντιστοιχούν σε 30 είδη που ανήκουν σε 14 οικογένειες. Η ανάλυση των μετρήσεων ως προς την «κυριαρχία» και τη «συχνότητα» των ειδών, έδειξε ότι τα είδη Sitophilus oryzae και S. granarius κυριαρχούν σε χώρους όπου αποθηκεύονται σπόροι σιτηρών ενώ υστερούν στον αλευρόμυλο. Τα Tribolium confusum και T. castaneum υπερισχύουν σε πληθυσμό του S. granarius στον αλευρόμυλο ενώ συμβαίνει το αντίθετο στις αποθήκες. Άλλα είδη που βρέθηκαν σε μεγάλους πληθυσμούς είναι τα: Oryzaephilus surinamensis και O. mercator, Cryptolestes ferrugineus και Rhysopertha dominica ενώ τα υπόλοιπα 22 είδη υπήρχαν σε σημαντικά μικρότερους πληθυσμούς και στους τέσσερις χώρους.