Volume (1) Issue (2)

20 Jun 2025

Rawafed Journal of Scientific Studies and Research

Study on the types of arthropods associated with stored materials in Libya

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Abstract:

According to what was stated in the available and documented references from 1934 which dealt with arthropods on stored product in Libya, it became clear that mites associated with stored materials as pest in Libya were related to order Astigmata, all of this species found in flour but *T. entomophagus* found in flour and rice. Order meso-stigmata and order pro-stigmata recorded as predators of fungi and lepidopteran eggs. insect species that infected materials stored in Libyan environment is about 71 species belonging to three orders, Order Coleoptera, 61 species belonging to 16 families, order Lepidoptera 9 species belonging to two families and order Hymenoptera one species only. Bruchidae was the most abundant Family of order coleoptera in storage products in 19.67%, and then Tenebrionidae in 13.115%, at the end the rest of families came from 4.92% to 1.64%.

insect pests of stored product materials belong to three orders. Coleoptera order is considered to have the highest presence at 85.92%, followed by the Lepidopteran order at 12.68%, and the Hymenoptera order is the least abundant at 1.40%. highest parasitism and predation are coming from order Hymenoptera at a rate of 77.78%, while the Hemiptera and Diptera orders had a same rate 11.11% for both. but parasites and predator insects according to references were came as 9 species belonging to 3 orders, 7 species of them belong to order Hymenoptera, 2 species of this seven were internal parasites, 1 specie was an external parasite and 4 species were parasitoids, and from the order Hemiptera there is one specie predator, also order Diptera, only one specie parasite.

Keywords: arthropods, insects, mites, stored product materials, Libya

Introduction

Arthropods of Libyan in general was first documented in 1934 by (26), when he presented his work on the organization of plant species present in warehouses and the contamination of contributory materials. Also in 1940, (20) reported 3 Lepidoptera species and one coleoptera specie, recorded in 1956 (18) recorded 25 species attacking stored products, then in 1959 (5) reported 20 species of Coleoptera and Lepidoptera affected stored materials, in 1961 (6) documented 35 species of insects associated with stored materials,in 1977 (12) reported 12 species attacking wheat in storage in Libya, in 1981 (3) recorded 30 species of insects as storage pests. 1998 (2) documented 40 species of storage insects in Tripoli Also In 2002 (13) recorded 4 species of mites in flour in Eastern Libya and stated that the most widespread and dense of them is *Acarus siro* L. (12) estimated losses in stored products happened by Arthropods was about 38.8% recently, At 2003 in western Libya, (1) recorded 4 species of mites on wheat & rice and reported that two of them were more abundant in summer than in winter.

Objective and Importance

-Collect Knowledge about the types of arthropods associated with stored products in Libya, it considered as a first study that covers all the arthropods of stored materials in the Libyan warehouse environment.

-Based on our knowledge of the arthropods associated with stored products, we can develop a plan for controlling them at the lowest cost and most effectively, thus reducing the loss of stored materials.
-Stored product pests also reduce product quality and harmful the health of users and consumers.
-This work could help researchers in the field of stored products because it collects pests through history.
-This is the first study that covers all the arthropods of stored materials in the Libyan warehouse environment.

Result and Discussion

Table (1) Detection of Mites in Libyan storage Environment

Host	Fam.	Order	Sci. name	Common name	Ref.
Flour	Acaridae	Astigmata	Acarus siro L.	grain mite	13
Flou	Acaridae	Astigmata	Acarus farris Oudeman	grain mite	13
Flou	Acaridae	Astigmata	Tyrophagus longior Hirst	cheese mite	13
Flou & Rice	Acaridae	Astigmata	Tyrophaguse entomophagus Laboulbene	Dried fruit mite	1
Flou	Acaridae	Astigmata	Tyrophagus putrescentiae Schrank	Mold mite	13

From Table No. 1, mites recorded in Libya on stored materials are all from of Astigmata mites, all found in flour but *T. entomophagus* found in rice also. (1, 12)

Table (2) Predatory Mites in Libyan storage Environment

Host	Family	Order	Sc. name	Ref.
Acharidae	Cheyltetidae	Prostegmata	Cheyletus malaccensis oudemans	1
Lepidoptera egg	Ascidae	Mesostigmata	Blattisocius tarsalis Berlese	1،14
Fungus	Tarsonemidae	Prostegmata	Tarsonemus granaries Lindquist	1

From Table No. 2, we find that orders meso-stigmata and pro-stigmata recorded predators of fungi and lepidopteran eggs. (1,13)

Table (3) Insects present in Libyan storage Environment

S, n	Common name	Scin.name	Order&Fam.	Host	Ref	Place
	Order Coleoptera					
1	Bean Weevil	Acanthoscelides obtectus Say.	Col. Bruchidae	Vetches&common bean	2،6،15،26	E. W. L
2	Seed beetle	Bruchidius albosparsus Fahr.	Col. Bruchidae	Seed of Acacia cyanophylla	6،19	W. L.
3	Seed beetle	. Bruchidius Sp.	Col. Bruchidae	Forager	6،19	S. L
4	Seed beetle	. Bruchidius bimoculatus Olivier	Col. Bruchidae	Seeds	4,6,8,10,11,25,26	E . L.
5	Seed beetle	Bruchidius incarnates Boh.	Col. Bruchidae	Broad Bean seeds	26	L.
6	Seed beetle	Bruchidus imbricornis Panz.	Col. Bruchidae	Goate،s Rue seeds	6,11,25,26	E. L.

7	Clover seed beetle	Bruchidus trifolii Motsch	Col. Bruchidae	Clover seed	26	L.
8	Hairy Vetch Bruch	Bruchus brachialis Fahrs	Col. Bruchidae	Clover seed	4,6,8,26	E. L.
9	Lentil weevil	Bruchus lentis Froelich	Col. Bruchidae	Lentil	15	W.L.
10	Chick pea Weevil	Bruchus ornatus Say	Col. Bruchidae	Chick pea	4,6,25,26	E. L.
11	Pea weevil	Bruchus pisorum L.	Col. Bruchidae	Peas	2,6,15,19	E. W. L
12	Broad been weevil	Bruchus rufimonus ,L.	Col. Bruchidae	Broad beans	2,6,11,15,19,20,25,26	E. W. L
13	Pulse beetle	Callosobruchus chinensis L.	Col. Chrysomelidae	Chick pea, Peas Lenticals, Broad beans	2,15	W. L.
14	Cowpea weevil	Callosobruchus maculates F.	Col Chrysomelidae	Peas, Cowpea, chickpeas, kidney beans	2,15	W.
15	Lesser meal worm	Alphitobius diaperinus panzer	Col. Tenebrionidae	Wheat	2,6,11,15,17,26	E. L. W
16	No common name	Alphitobius piceus olivier	Col. Tenebrionidae	Corn	2,6,11,25,26	E. L.
17	Longheaded flour beetle	Latheticus orayzae Water-house	Col. Tenebrionidae	Wheat. Barly. Corn, Oat	2,6,15,19	W. L.
18	Depressed flour beetle	Palorus subdepressus Wollaston	Col. Tenebrionidae	Wheat., Oat, Corn	2, 15	W. L.
19	Meal worm	Tenebrio molitor L.	Col. Tenebrionidae	Wheat, Cereals	5,16,19	W. L.
20	Rust beetles red flour beetle	Tribolium castanium Herbst	Col. Tenebrionidae	Wheat, Barley, Cowpeas, Flour, Coriander, Chocolate, red pepper, Oat, Rye, Soya meal, bran, semolina, Triticale, Milk meal, Corn, Almonds, Chickpeas, Peas, Broad beans,	2,4,6,7.11.15.19.25,26	E. W. S. L.

				Dried fig, Poultry food, Sesame seeds, Rice, Peanuts		
21	Confused flour beetles	Tribolium confusum Jacquelin duval	Col. Tenebrionidae	Wheat, Flour, Macaroni, Oat, Barley, Chickpeas, Raye	2,6,9,11, 15,16,26	E. W. S. L.
22	Broad horned flour beetle	Gnatocerus cornutus Fabbricius	Col. Tenebrionidae	Cereal grains	6,19,22	W. L.
23	Skin beetles	Thorictodes heydeni Reitter	Col. Dermastidae	Wheat	2	W. L.
24	Khapra beetle	Trogoderma granarium Everts	Col. Dermastidae	Wheat, Cereals	2, 6, 15, 19	W. L.
25	Hided beetles	Dermestes mustelinus Erichson	Col. Dermastidae	Dried fish, Cheese,	6,10,11,26	E. L.
26	Hided beetles	Dermestes frischii Kiugelann	Col. Dermastidae	Fish meal	2,6,11, 25,26	E. L.
27	Larder beetle	Dermestes lanarius Illiger	Col. Dermastidae	Meat byproducts	6,9,11, 25,26	E. L.
28	Hide beetle	Dermestes maculates Degeer	Col. Dermastidae	Fish meal	2	W. L.
29	Carpet beetle	Anthernus pimpinellae Fab..	Col. Dermastidae	Wool material	2,15	W. L.
30	Carpet beetle	Anthernus scrophulariae L.	Col. Dermastidae	Wool material	26	L.
31	Variegated Carpet beetle	Anthernus Verbasci L.	Col. Dermastidae	Wool material	4,6,8,11,15,26	E. L.
32	Wardrobe beetle	Attagenus glariosae fabricius	Col. Dermastidae	Corn, Wheat	2,6,15,19	
33	Foreign grain beetle	Ahasverus advena Walti	Col. Cucujidae	Grain	26	L.
34	Grain beetle	Cryptolestes Sp. Ganglbauer	Col. Cucujidae	Cereals	5,6	W, L.

35	Rust-red grain beetle	Cryptolestes ferrugineus Steph.	Col. Cucujidae	Wheat, corn, Oat, Cowpea, Barley, Dried figs, Dates, Pistachio nuts, Milk meal	2,16	W. L.
36	Flat grain beetle	Cryptolestes pusillus Schonherr	Col. Cucujidae	Wheat, corn, Oat, Dried figs, Sweet Sorghum, Rye, Soya meal, Peanuts, Barley, Poultry food	2,15	W. L.
37	Meal beetles	Laemophloeus ater Oliv	Col. Cucujidae	Cereals, Peanuts	6,11,19,25,26	E. W. L.
38	Rusty grain beetle	Laemophloeus frrugineus Steph.	Col. Cucujidae	Grain, Rice	6,11,19,25,26	E. W. L.
39	Flat grain beetle	Laemophloeus minutes Oliv	Col. Cucujidae	Cereals, Peanuts	6,11,19,25,26	W. L.
40	Lined Flat Bark beetle	Laemophloee us testaceus Fabricius	Col. Cucujidae	Grain	26	L.
41	Sawtoothe d grain beetle	Oryzaephilus surinamensis L.	Col. Cucujidae	Wheat, Barley, corn, Oat, figs, Almonds, dates, Rye, milk meal, Peanuts, peas , Poultry food, broad beans	2,4, 6,11,15,19,25,26	W. E. S. L
42		Bruchus signoticornis Gyll	Col. Bostrychidae	Lentil	6,11,19,26	E. W. L.
43	Lesser grain borer	Rizopertha dominica Fabricius	Col. Bostrychidae	Wheat, corn, Oat, Dried figs, Sweet Sorghum, Rye, Cowpea, Barley, Dried figs, Medic, sudan grass seeda, pear millet, Macaroni	2,4,6,11,15,16,19,25,26	E. W. L.
44	Dried fruit beetle	Carpophilus dimidiatus Fab.	Col. Nititulidae	Corn, Wheat, Dates,	2,4,9,11,15,26	E. W. L.

45	Dried fruit beetle	Carpophilus bhemipterus L.	Col. Nititulidae	Corn, Dates, Raisins, Fruit	2,6,9,11,15,19,25,26	E. W. S. L.
46	Dried fruit beetle	Carpophilus humeralis F.	Col. Nititulidae	Corn, Dates	2	W. L.
47	Sigaret beetle	Lasioderma serricorne Fabricius	Col. Anobiidae	Semolina, red peeper, peas, sesame seeds, coriander, curry powder, tobacco	2,4,6,11,15,16,19,25,26	E. W. L.
48	Shiney spider beetle	Mezium affine Boildieu	Col. Anobiidae	Grain, dried fruit	26	L.
49	Drugstore beetle	Segobium paniceum L.	Col. Anobiidae	Chickpeas, Soya beans, Peas, Fenugreek, chocolate, Flour, Curry powder, Coriander, Cumni, Wheat, Rice, Red pepper, Coffee	2,4,6,11,15,25,26	E. W. L.
50	Clown beetle	Carcinops pumilio Stephens	Col. Histeridae	Corn	2	W.
51	Palm seed borer bark beetle	Coccotrypes dactyliperda F.	Col. Curculionidae	Seeds and fruits	15	W. L.
52	Granary weevile	Sitophilus granaries L.	Col. Curculionidae	Wheat, Barley, Chickpeas	2,4,6,15,16,17,19,25,26	E. W. L.
53	Rice weevil	Sitophilus orayza L.	Col. Curculionidae	Wheat, Barley, Chickpeas, peas, oat, broad beans, rice, corn, macaroni, rye, sweet sorgume	2,4,6,7,11,15,16,19,25,26	E. W. S. L.
54	Brown spider beetles	Ptinus hirtellus Sturm	Col. Ptinidae	Cowpeas	2	W. L.
55	Shiny spider beetle	Gibbium psylloides Deczempiski	Col. Ptinidae	Woolens	6,11,25,26	E. L.

56	Merchant grain beete	Oryzaephilus mercator Fauvel	Col. Silvanidae	Peanuts, Almonds, Dates, Raisens, Flour, Semolina, Poultry food	2,15	
57		Monotoma quadricollis Aube	Col. Monotomidae		26	L.
58	Rove beetle	Philonthus sordidus Grovenhorst	Col. Staphylinidae	Predator	26	
59	Rove beetles	Oxytelus sculptus Gravenhorst	Col. Staphylinidae	Flour	2	W. L.
60	Bark gnawing beetles Cadelles	Tenebrioides mauritanicus L.	Col. Ostomatidae	Flour, semolina poultry feeds	2,4,6,8,11,15,19,25,26	E. W. L.
61	Hairy fungus beetle	Typhaea stercorea L.	Col. Mycetophagidae	Corn	2	W. L.
Order Lepidoptera						
1	Carob moth	Ectomyelois ceratoniae Zeller	Lep. Pyralidae	Nuts	25	
2	Dried fruit moth	Ephestia calidella Guenee	Lep. Pyralidae	Dates, Fruit	2,6,15,17,21,23,26	E. W. L.
3	Dried fruit moth	Ephestia cautella Walker	Lep. Pyralidae	Date	2,15	W. E. L.
4	Tobacco moth	Ephestia elutella Hubner	Lep. Pyralidae	Flour	6,15,17,26	E. W. L.
5	Raisin moth	Ephestia figuliella Gregson	Lep. Pyralidae	Raisin	15	W, L.
6	Med Flour moth	Ephestia Kuehniella Zeller	Lep. Pyralidae	Wheat, Dates, Flour Dried fig	2,4,6,15,16,19,23,24,26.	E. W. L.
7	Indian meal moth	Plodia interpunctella Hubner	Lep. Pyralidae	Wheat, Pastichio, nuts, Sesame seeds, Almonds, Dried figs, Peanuts, dates	2,6,15,16,17,19,20,26	E. W. S. L

8	Meal moth	Pyralis farinalis L.	Lep. Pyralidae	foods	4,6,19,21,23,24,26	E. W. L.
9	Angoumois grain moth	Sitotroga cerealella Olivier	Lep. Gelechidae	Wheat, Barley Oats	2,4,6,16,20,23,26	E. W. L.
Order Hymenoptera						
1	Seed chalcid fly	Bruchophagus gibbus Boheman	Hym. Eurytomidae	Clover seeds	26	L.

From Table No. 3, we can see that number of insect species that infect materials stored in Libyan environment is about 71 species belonging to three orders, the largest one is order Coleoptera, 61 species belonging to 16 families, then order Lepidoptera 9 species belonging to two families and order Hymenoptera one species only.

Table (4) Parasite and predator insects in Libyan Warehouse Environment

No.	Order	Family	Sc. Name	Effect	Ref.
1	Hymenoptera	Braconidae	Bracon hebetor Say	Endoparasite	26
2	Hymenoptera	Braconidae	Sigalphus thoracicus Curt	Endoparasite	26
3	Hymenoptera	Bethylidae	Cephalomid tarsalis Ashmed	Parasitoid	25
4	Hymenoptera	Pteromalidae	Dinarmus basalis Rondani	Parasitoid	2
5	Hymenoptera	Ichneumonidae	Idenchthis canescens Grav,	Parasitoid	26
6	Hymenoptera	Perilampidae	Perilampus Sp.	Parasitoid	25
7	Hymenoptera	Chalcidoidea	lariophagus distinguendus Foerst	Ectoparasite	26
8	Hemiptera	Anthocoridae	Xylocaris flavipes Reuter	Predator	2
9	Diptera	Scatopsidae	Swammerdamella brevicarnis Meigen	Parasite	2

Table 4 shows that parasites and predators' insects according to references (2 & 25) were 9 species belonging to 3 orders, 7 species belong to order Hymenoptera, 2 species of them were internal parasites, 1 specie was an external parasite and 4 species were parasitoids, and from the order Hemiptera there is one specie predator, also order Diptera, only one specie parasite.

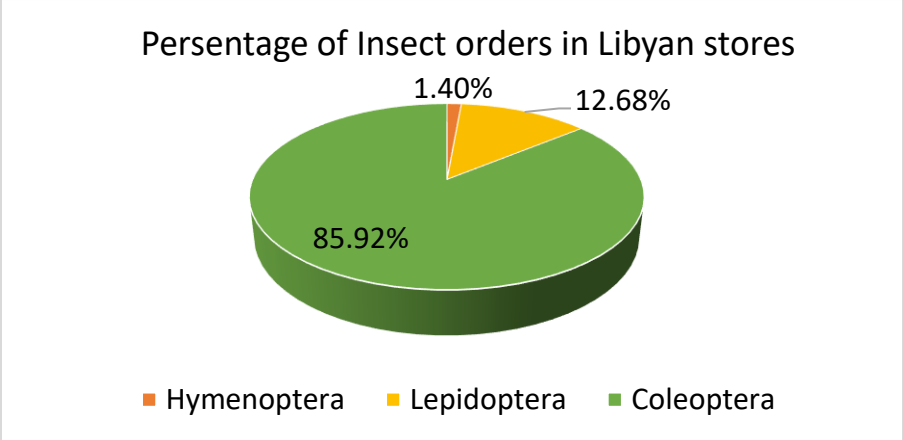

Figure (1) The proportions of insect orders in Libyan warehouses

From Figure 1, we see that insect pests of stored product materials belong to three orders. Coleoptera order is considered to have the highest presence at 85.92%, followed by the Lepidopteran order at 12.68%, and the Hymenoptera order is the least abundant at 1.40%.

Table (5) Percentage of Coleoptera families in Libyan warehouse

No.	Family	%
1	Bruchidae	19.67%
2	Dermastidae	16.39%
3	Cucujidae	14.75%
4	Tenebrionidae	13.115%
5	Curculionidae	4.92%
6	Nititulidae	4.92%
7	Anobiidae	4.92%
8	Chrysomelidae	3.28%
9	Bostrychidae	3.28%
10	Ptinidae	3.28%
11	Staphylinidae	3.28%
12	Silvanidae	1.64%
13	Monotomidae	1.64%
14	Histeridae	1.64%
15	Ostomatidae	1.64%
16	Mycetophagidae	1.64%

From Table 5, family Bruchidae was the most abundant in storage products in 19.67%, followed by family Dermastidae in 16.39%, then family Cucujidae in 14.75%, and family Tenebrionidae in 13.115%, at the end the rest of families came from 4.92% to 1.64%.

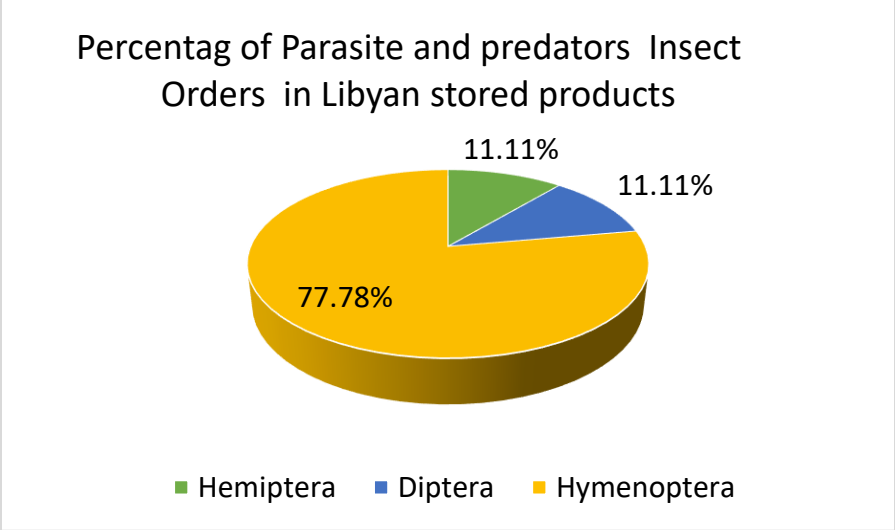

Figure (2) The proportions of parasite and predator insect Orders in Libyan Stored products

From Figure 2, we see that the highest parasitism and predation was came from order Hymenoptera at a rate of 77.78%, while the Hemiptera and Diptera orders had a same rate 11.11% for both.

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