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WOOD-BORERS AND WOODEN TREES RELATIONSHIP

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Abstract

Studies were carried out to investigate the factors affecting the wood borer's attack and its relationship with wooden trees. Physical structure of the wood, mode of attack and feeding habits were also studied. Chemical component of wood in relation to biological activity was considered.

The results showed that the four tested borers prefere wood characterized by a thin layer of bark and large paranchymal cells. Data indicated that *B. reichei, D. bifoveolatus, E. obtusedentatus* and *L. africanus* prefer hosts containing large quintities of starch, free amino acids, crude fibers and carbohydrates.

INTRODUCTION

Because of the serious role of wood borers attacking wooden trees, several investigations have been carried out to study their biology, ecology and control.

Chamberlin (1960) stated that wood borers are influenced by moisture content and texture of bark. Taher (1966) mentioned that high inflestation of peach trees by different scolytids were attributed to its large size and thin bark. Helal (1969) proved that the rate of infestation by *Sinoxylon sudanicum* (Bostrychidae) to

Poinciana wood was negatively correlated with crude fibers but positively related to ash, protein and carbohydrates. Wigglessworth (1972) mentioned three types of wood borer's feeding : 1) larvae able to feed on cell content and perhaps part of polysaccharides intermidiate between starch and the hemicelluloses, i. e. Lyctidae and Bostrychidae. 2) Larvae using the cell contents and the carbohydrates of the cell wall as far as the hemicelluloses, i. e. Scolytidae. 3) Larvae able to use all the carbohydrates of the cell wall including cellulose, i. e. Anobiidae and most Cerambycidae.

Abdallah (1978) reported that 31% moisture content is enough for olive tree infestation by *Scolytus amygdali* (Scolytidae). Helal and El-Sebay (1980) determined the optimum moisture content of eucalyptus wood (45-37%) for infestation by *Phoracantha semipunctata* and the effect of the host on the biological activity of borer. Helal (1982), Helal and El-Sebay (1985) and Helal *et al.* (1986) studied the relationship between the chemical components of *Poinciana* wood and the rate of infestation by *L. africanus* all over the year. The same authors studied the effect of different hosts on the biological activity of *Bostrychopsis reichei, Dinoderus bifoveolatus* and *Ennaedesmus obtusedentatus* beetles.

The aim of the present study is to study the relationship between wood borers and wooden trees. The investigation included physical structure of wooden trees and chemical components in relation to the biological activity of the borers; *Ennaedesmus obtusedentatus, Bostrychopsis reichei, Dinoderus bifoveolatus* (Bostrychidae) *and Lyctus africanus* (Lyctidae).

MATERIALS AND METHODS

The present work was carried out at the Wood-Boring Insects Dept., Plant Protection Research Institute, during 1989-1992.

To study the physical structure of wood, 15 wooden trees and shrubs were chosen as common and widely distributed in Egypt. These were : *Acacia arabica* (acacia), *Bambosa arundinacea* (bamboo), *Casuarina equistifolia* (casuarina), *Casia nedosa* (cacia), *Dalbergia sisso* (sisso), *Delonix regia* (royal poinciana), *Eucalyptus* *rostrata* (eucalyptus), *Eugina jambolana* (bamboosa), *Morus alba* (mulberry), *Populus Nivea* (poplar), *Ricinus communis* (caster oil), *Salix babylonica* (weeping willow), *Schinus molle* (schinus), *Sesbania aculata* (sesban), and *Tamarix articulata* (athel).

Two years old branches of the forementioned hosts were taken, and proper cross sections were made in each host and examined microscopically to study the different layers and sort of cells width of each layer and cells density per millimeter in addition to cell diameter.

Chemical components of 15 hosts in addition to cotton stalks had been determined. Cuttings from each host were prepared and each was divided into three layers i. e. bark, sapwood, and heart wood (Fig. 1).

Each layer was finely ground using a grinding machine and analysis was carried out as follows :

Determination of moisture content, dry matter, ash, crude fibers, and phenols was carried out by applying the methods of A. O. A. C. (1959). Cellulose and legnine were determined according to Allain's method (1924). Total carbohydrates was determined according to the modified Harding method described by King and Wootton (1959). Determination of fats was carried out following the method described by Joseph *et al.* (1972). Total protein and amino acids were determined using Somogi methods described by Offord (1969) and Georg and Lederer (1974).

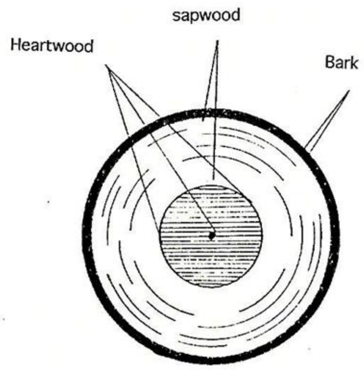

Fig. 1. The three main layers of wood.

In order to study the effect of the different hosts on the biological activity of borers, ten cuttings from each host were prepared and placed separately in glass jars for each borer. Ten males and ten females from the laboratory culture of *Bostrychopsis reichei, Dinoderus bifoveolatus, Ennaedesmus obtusedentatus* and *Lyctus africanus,* were released in each jar. Daily observations were carried out to determine adult longevity, length period of emergence, number of emerged beetles (progeny/female), and duration of generation.

RESULTS AND DISCUSSION

Physical structure of host plants

Diagrams of 15 wooden hosts are illustrated in (Fig. 2) showing the different cells of each layer in cross section.

Microscopic examination clarified the epidermis, periderm, sapwood and heartwood layers, their width, and sort of cells.

Table 1 showed that the widest bark layer was found in *A. arabica* and *E. rostrata* (28 u), while the thinner was in *R. communis* (4 u) followed by *M. alba* and *S. aculata* (5 and 6 u, respectively). On the other hand, phleom, cambium and paranchyma cells varied in width. The wider layer was found in *D. sisso* and *M. alba* (126 u), while the thinner was in *B. arundinacea* (9 u).

Diameter of xylem vessels was wider in *D. sisso* (31 u), while thinner in *T. articulata* (1 u).

Regarding the cells density per millimeter square, *T. articulat*a contained 200 cells/mm^2, and 13/mm^2 in *B. arundinacea.*

Chemical components of host plants

Data in Table 2 show the chemical components of the analized 16 host plants.

Table 1. Measurements of different zones of 16 wooden hosts.

Host	Epiderm and periderm in micron	Cortex width in micron	Sapwood fibers in micron	Heartwood fibers in micron	No. of fibers/ mm^2
A. arabica	28	12	13	8	17
B. arundinacea	18	9	8	7	13
C. equistifolia	21	91	6	3	80
C. nedosa	25	14	25	14	20
D. sisso	14	126	31	11	25
D. regia	8	77	22	15	14
E. rostrata	28	49	6	6	54
E. jambolana	14	13	11	4	58
Gossypium spp.	-	-	-	-	-
M. alba	5	126	7	4	40
P. nevea	9	59	4	4	70
R. communis	4	98	8	6	20
S. babylonica	10	112	7	4	95
S. molle	14	91	4	2	50
S. aculata	6	91	11	6	16
T. articulata	14	70	2	1	200

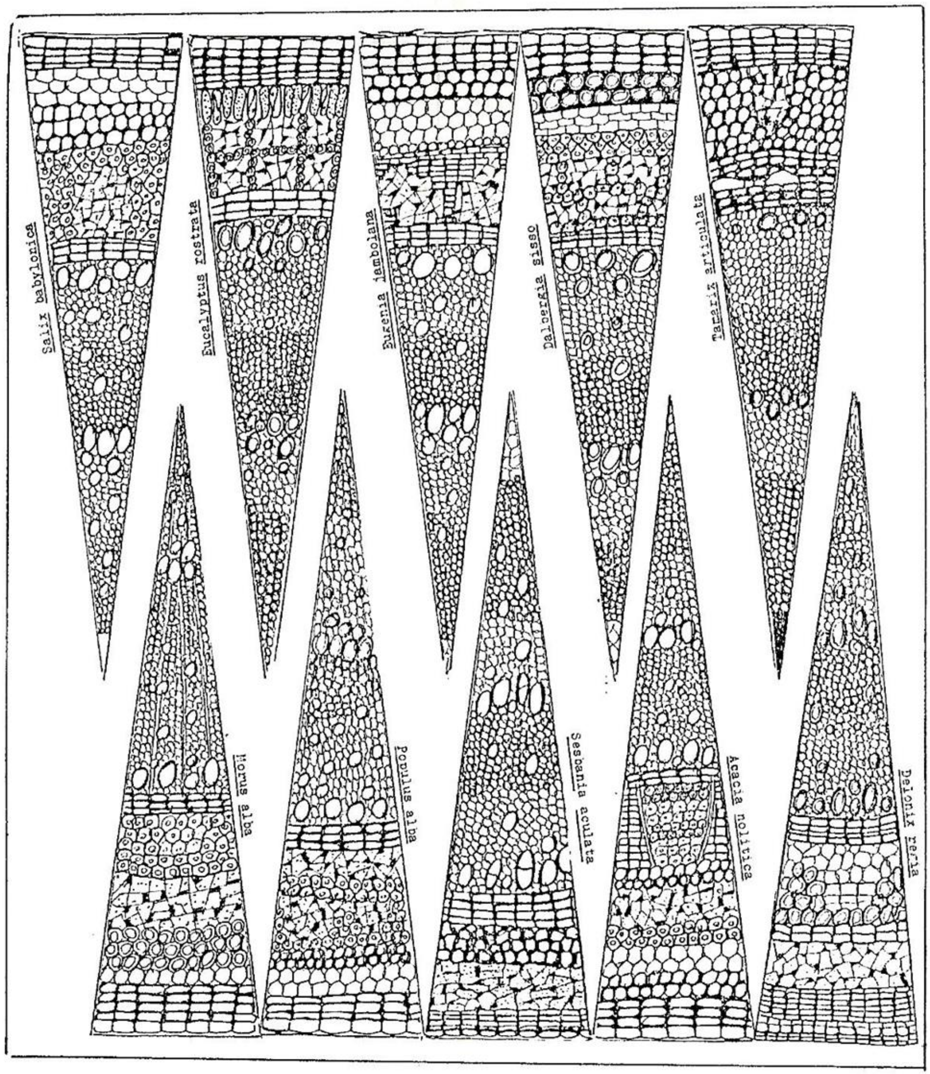

Fig. 2-a. A diagram of examined cross sections of 15 wooden hosts.

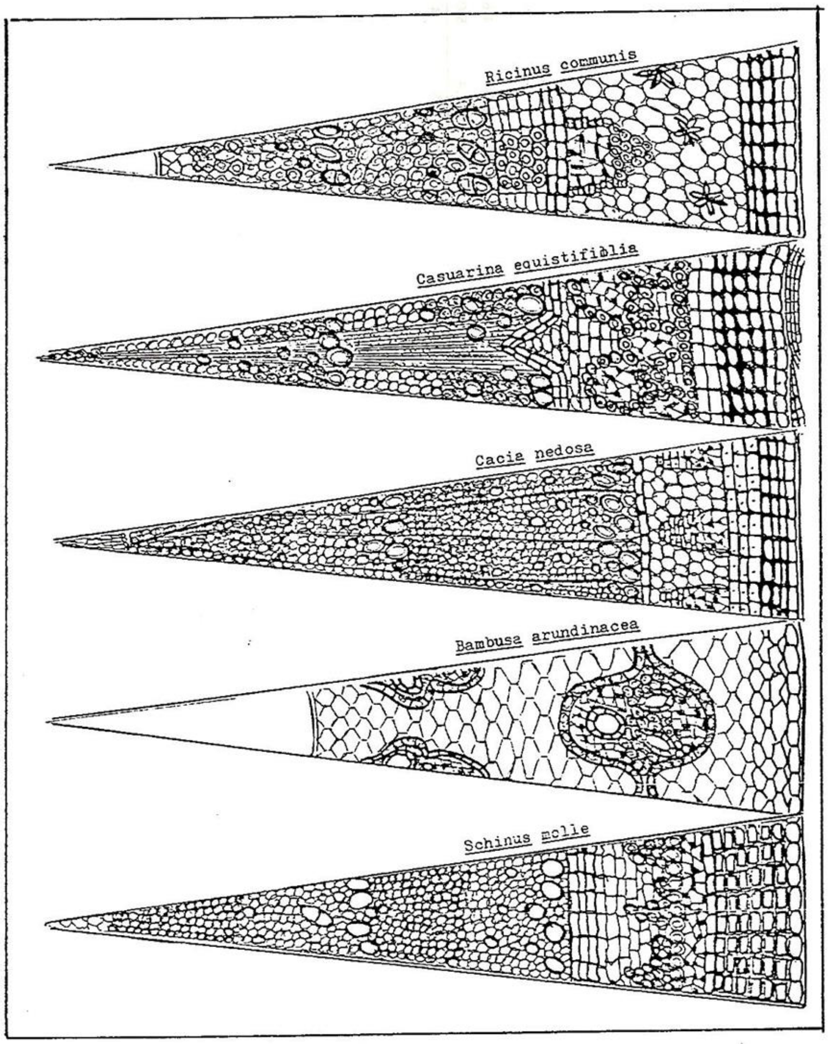

Fig. 2-b. A diagram of examined cross sections of 15 wooden hosts.

Table 2 . Chemical components of 16 wooden hosts through three zones of wood.

Hosts	Zone of wood	Moisture content %	Dry matter %	% Ash Tot.	% Ash Sol.	% Ash Insol.	Legnine %	Cellulos 2 %	Fats %	Phenols %	Starch %	Protein %	F.A.A %	Crude fiber %	Carbo-hydrate %
A.arabic	bark	11.9	88.1	7.6	3.9	3.7	23.5	22.4	0.6	1.4	5.5	6.0	0.12	7.2	13.8
	sap	11.7	88.2	1.6	0.7	0.9	21.5	38.5	0.5	1.0	4.0	5.0	0.12	11.3	4.8
	heart	11.5	88.3	1.0	0.2	0.1	20.9	20.6	0.5	1.2	5.6	7.8	0.22	10.4	10.3
B.arundinacea	bark	12.3	87.7	4.2	3.2	1.0	12.1	20.7	0.9	1.2	2.1	8.8	0.33	15.2	22.2
	sap	11.5	88.5	2.0	0.4	1.6	16.8	27.9	0.5	1.1	2.9	6.5	0.09	23.6	8.2
	heart	11.2	88.8	2.9	1.3	1.6	18.4	16.7	0.4	1.8	4.6	5.2	0.12	10.2	28.5
C. equistifolia	bark	10.6	89.4	10.0	9.1	0.9	1.58	21.9	4.9	2.2	4.0	4.9	0.02	4.7	20.9
	sap	11.3	88.7	2.2	1.5	0.7	31.2	23.2	4.8	1.7	3.9	7.8	0.03	9.3	4.6
	heart	11.1	88.9	1.3	1.0	0.3	38.9	22.7	4.5	0.9	1.4	4.0	0.14	10.4	5.0
C. nedosa	bark	8.1	91.9	4.2	3.22	1.0	2.1	30.6	3.6	2.0	2.2	8.5	0.10	5.3	14.3
	sap	11.7	88.3	0.8	0.3	0.5	2.3	32.5	3.6	1.2	2.5	5.6	0.19	7.3	12.8
	heart	11.3	88.7	0.6	0.2	0.4	35.2	25.3	3.5	1.2	4.4	4.7	0.07	11.2	2.5
D. sisso	bark	9.8	91.2	10	9.2	0.8	5.6	20.2	2.3	1.9	6.7	10.5	0.13	8.2	25.7
	sap	7.6	91.4	0.5	0.3	0.2	35.1	29.4	3.5	0.4	2.9	5.9	0.21	9.2	4.3
	heart	10.0	90.0	0.2	0.1	0.1	36.9	22.3	2.4	0.4	4.7	4.8	0.03	8.3	10.0
D.regie	bark	11.7	88.3	7.8	4.1	3.7	9.7	11.6	1.9	2.0	16.9	7.5	0.01	9.2	21.7
	sap	8.4	91.6	0.9	0.6	0.3	15.8	32.2	1.6	0.9	9.4	6.9	1.28	12.3	10.3
	heart	8.3	91.7	2.4	0.1	0.3	16.5	34.9	1.9	0.6	12.6	8.1	0.25	10.8	5.7
E. rostrata	bark	10.2	89.8	3.7	2.7	1.0	10.0	18.1	1.5	3.5	8.0	9.9	0.69	12.5	24.1
	sap	11.3	88.7	2.88	1.9	0.9	10.8	80.8	11.9	0.9	3.3	4.3	0.08	17.3	2.5
	heart	10.1	89.9	0.2	0.0	0.2	15.5	34.9	3.8	0.5	3.6	6.8	0.6	20.2	4.3

Table 2 . (cont).

Hosts	Zone of wood	Moisture content %	Dry matter %	% Ash Tot.	% Ash Sol.	% Ash Insol.	Legnine %	Cellulos 2 %	Fats %	Phenols %	Starch %	Protein %	F.A.A %	Crude fiber %	Carbo-hydrate %
E. jambolana	bark	12.6	87.4	7.5	3.6	3.9	2.1	13.2	1.6	3.6	3.2	4.9	0.04	14.3	33.9
	sap	11.3	88.7	0.6	0.3	0.1	22.3	27.3	0.5	1.7	5.1	5.5	0.39	10.9	14.6
	heart	11.4	88.6	0.4	0.3	0.1	4.4	22.4	0.4	1.0	3.3	6.2	0.20	15.2	5.1
G. jossypium	bark	10.4	89.6	4.3	2.5	1.8	5.7	15.9	0.5	2.9	7.4	6.5	0.35	20.3	46.0
	sap	10.1	89.9	1.1	0.6	0.5	11.5	32.0	1.5	1.5	5.1	9.7	0.35	18.5	27.2
	heart	12.2	87.8	1.4	0.9	0.5	15.1	35.8	0.5	1.8	8.3	4.2	0.29	8.9	1.5
M.alba	bark	8.9	91.1	7.3	3.9	3.4	14.6	16.2	3.3	1.4	5.8	8.6	0.16	10.2	23.5
	sap	8.2	91.8	0.4	0.3	0.1	36.21	25.1	1.6	0.5	2.9	4.3	0.00	13.5	7.3
	heart	10.3	89.7	0.4	0.2	0.2	38.7	22.4	2.3	0.6	0.9	7.5	0.01	8.3	8.6
P.nevea	bark	12.8	87.2	7.6	3.8	3.8	3.0	20.3	1.5	2.6	4.9	7.5	0.01	17.3	22.5
	sap	8.3	91.7	0.3	0.1	0.2	24.8	26.5	1.9	0.8	6.1	9.4	0.05	9.5	12.4
	heart	8.6	91.4	0.5	0.1	0.4	30.2	17.0	3.6	0.8	3.9	11.4	0.01	3.9	20.1
R. communis	bark	12.4	87.6	13.4	9.3	4.1	9.9	25.9	1.0	1.5	3.4	5.4	0.23	14.3	12.6
	sap	13.3	86.7	5.0	0.6	4.4	14.7	39.5	10.4	1.0	2.7	4.5	0.22	5.2	3.5
	heart	10.9	89.1	3.0	0.4	2.6	6.9	30.7	6.6	0.6	5.6	8.9	0.26	15.4	11.1
S.babylonica	bark	11.5	88.5	6.7	1.7	5.0	8.3	20.4	1.9	1.4	3.5	6.2	1.11	10.1	28.4
	sap	10.9	89.1	0.9	0.1	0.8	18.8	29.4	0.8	0.6	4.5	9.9	0.25	11.6	12.4
	heart	10.7	89.3	0.6	0.1	0.5	28.8	34.7	0.4	0.4	6.1	4.6	0.18	10.0	3.5
s.molle	bark	10.0	90.0	3.4	0.4	3.0	14.5	24.8	2.4	1.5	3.2	3.8	0.04	9.4	27.1
	sap	11.4	88.6	0.9	0.2	0.7	30.2	23.3	1.8	6.0	1.8	4.9	0.01	12.2	2.5
	heart	11.3	88.7	0.2	0.1	0.1	38.9	21.6	3.6	1.1	1.4	4.9	0.03	10.1	6.7
S. aculata	bark	10.9	89.1	8.6	3.5	5.1	10.6	20.1	2.0	2.7	3.7	5.1	0.23	12.2	23.9
	sap	11.7	88.3	0.7	0.4	0.3	32.1	34.0	1.0	0.6	2.9	7.8	0.25	11.6	4.6
	heart	12.7	87.3	0.4	0.1	0.3	36.2	32.4	0.3	0.9	2.6	3.4	0.00	3.2	7.9
T. articulata	bark	7.8	92.2	10.2	10.0	0.2	3.7	20.5	5.6	1.1	2.9	5.5	0.01	10.3	28.8
	sap	11.0	88.0	0.2	0.1	0.1	31.8	30.9	2.4	0.2	2.2	4.3	0.00	12.4	3.6
	heart	11.0	88.0	0.6	0.2	0.4	28.6	21.4	3.5	0.5	2.1	5.8	0.00	9.5	16.0

Table3. Effect of wooden hosts on the biological activies of four wood borers.

wooden hosts	*E. obtunedentatus* Adult longevevity in days	*E. obtunedentatus* period of emergenc in days	*E. obtunedentatus* Progeny/femals	*E. obtunedentatus* Duration of generation in days	*D.bifoveolatue* Adult longevevity in days	*D.bifoveolatue* period of emergence in days	*D.bifoveolatue* Progeny/female	*D.bifoveolatue* Duration of generation in days
A.arabic	7.5 ± 0.7	45.7±3.2	11.2 ± 0.8	53.4 ± 2.1	7.1± 0.8	0.0	0.0	0.0
B.arundinacea	17.6± 1.3	16.3 ± 0.9	35.2 ± 1.3	30.8 ± 1.6	28.4 ± 2.2	43.4 ± 3.1	26.0 ± 0.50.0	83.2 ± 3.1
C. equistifolia	4.8± 0.5	0.0	0.0	0.0	6.1 ± 1.3	0.0	0.0	0.0
C. nedosa	4.3±0.3	18.1± 0.5	3.8 ± 0.5	63.8 ± 2.8	7.1 ± 0.5	0.0	0.0	0.0
D. sisso	4.1 ± 0.5	20.2 ± 0.7	3.4 ± 0.7	62.1 ± 3.2	12.5 ± 0.9	30.2 ± 1.2	13.2 ± 0.8	116.2 ± 3.2
D.regie	26.3 ± 0.4	29.3 ± 0.6	18.3 ± 0.8	30.1 ± 2.2	28.5 ± 1.3	34.2 ± 1.3	20.2 ± 0.5	73.2 ± 2.2
B. rostrata	18.3 ± 0.8	5.2 ± 1.1	5.2 ± 1.1	52.1 ± 2.1	4.6 ± 0.4	0.0	0.0	0.0
E. jambolana	4.1± 0.5	0.0	0.0	0.0	5.7 ± 0.2	0.0	0.0	0.0
G. jossypium	18.5 ± 0.8	31.2 ± 1.1	49.3 ± 2.1	28.2 ± 1.3	8.9 ± 0.6	0.0	0.0	0.0
M.alba	12.3 ± 1.1	15.2 ± 1.3	13.2 ± 0.9	48.2 ± 1.8	5.1 ± 0.3	0.0	0.0	0.0
P.nevea	3.8 ± 0.7	0.0	0.0	0.0	5.9 ± 0.2	0.0	0.0	0.0
R. communis	17.5 ± 1.3	18.4 ± 1.8	24.3 ± 1.4	30.4 ± 1.7	9.8 ± 0.2	0.0	0.0	0.0
S.babylonica	4.1 ± 0.5	0.0	0.0	0.0	5.6 ± 0.4	0.0	0.0	0.0
s.molle	3.8 ± 0.3	0.0	0.0	0.0	5.9 ± 0.2	0.0	0.0	0.0
S. aculata	5.2 ± 0.6	0.0	0.0	0.0	5.3 ± 0.4	0.0	0.0	0.0
T. articulata	4.3 ± 0.4	0.0	0.0	0.0	6.3 ± 0.2	0.0	0.0	0.0

Table3. (cont).

wooden hosts	*B. reichei* Adult longevivity in days	*B. reichei* period of emergence in days	*B. reichei* Progeny/female	*B. reichei* Duration of generation in days	*L. efricenus* Adult longevivity in days	*L. efricenus* period of emergence in days	*L. efricenus* Progeny/female	*L. efricenus* Duration of generation in days
A.arabic	6.9 ± 1.2	32.1 ± 2.1	7.1 ± 1.1	126.4 ± 1.3	15.4 ± 0.9	15.2 ± 1.2	8.3 ± 0.9	54.2 ± 1.9
B.arundinacea	13.1 ± 0.9	32.5 ± 0.2	8.3 ± 0.4	116.2 ± 1.2	17.1 ± 0.9	20.3 ± 0.9	17.5 ± 0.6	39.4 ± 0.6
C. equistifolia	6.1 ± 0.3	0.0	0.0	0.0	6.3 ± 0.3	0.0	0.0	0.0
C. nedosa	5.9 ± 0.4	0.0	0.0	0.0	5.7 ± 0.2	0.0	0.0	0.0
D. sisso	15.4 ± 0.9	35.4 ± 1.3	10.7 ± 0.6	109.5 ± 2.2	16.3 ± 0.8	16.7 ± 0.8	15.3 ± 0.7	32.3 ± 1.1
D.regie	12.5 ± 0.9	40.3 ± 0.8	11.8 ± 0.6	101.4 ± 1.1	25.2 ± 0.5	32.5 ± 0.7	40.2 ± 1.1	34.2 ± 0.8
B. rostrata	5.2 ± 0.4	0.0	0.0	0.0	4.6 ±0.5	0.0	0.0	0.0
E. jambolana	5.9 ± 0.5	0.0	0.0	0.0	4.7 ± 0.2	0.0	0.0	0.0
G. jossypium	17.3 ± 1.1	62.4 ± 3.2	19.4 ± 1.1	91.2 ± 0.5	15.3 ± 1.3	11.3 ± 1.3	9.3 ± 0.4	41.2 ± 0.9
M.alba	21.3 ± 0.9	53.2 ± 0.7	9.2 ± 9.9	13.4 ± 2.5	15.7 ± 0.9	17.3 ± 0.8	13.1 ± 0.4	43.2 ± 0.9
P.nevea	5.9 ± 1.0	0.0	0.0	0.0	5.2 ± 0.2	0.0	0.0	0.0
R. communis	13.2 ± 1.1	53.2 ± 1.2	6.7 ± 0.7	98.3 ± 0.9	5.4 ± 0.3	0.0	0.0	0.0
S.babylonica	6.4 ± 0.5	0.0	0.0	0.0	6.3 ± 0.4	0.0	0.0	0.0
s.molle	5.9 ± 0.8	0.0	0.0	0.0	5.3 ± 0.4	0.0	0.0	0.0
S. aculata	6.6 ± 0.5	0.0	0.0	0.0	5.7 ± 0.5	0.0	0.0	0.0
T. articulata	6.3 ± 0.4	0.0	0.0	0.0	5.6 ± 0.3	0.0	0.0	0.0

The largest content of dry matter was found in the bark of *T. articulata* (92.2%), while the lowest was in the bark of *R. communis* (87.6%).

The largest amount of ash was found in the bark of *R. communis* (13.4%), while the least was found in the heartwood of *E. rostrata, D. sisso* and *S. molle* (0.2%).

The crude fibers were concentrated in the bark of cotton stalks (20.3%). The least content was in the heartwood of *S. babylonica* (3.2%).

The largest quantity of legnine was localized in the heart wood of *Casuarina* (38.9%), while the bark of *B. arundinacea* had the least content (2.1%).

Sapwood of caster oil plant had the largest quantity of cellulose (39.5%), while the bark of *M. alba* had the least content (10.3%).

Eucalyptus wood contained the largest amount of fats (11.9%) in the sapwood layer, while the lowest fat was found in cotton stalks bark (0.5%).

Phenols were found concentrated in the bark of *E. jambolana* (3.6%), while the wood of *T. articulata* contained the least amount (0.2%).

Poinciana had the largest amount of starch (16.9%), while the heartwood of *M.alba* had the least content (0.9%).

Heartwood of poplar had the largest amount of protein (11.4%), while the heartwood of salix contained the least (3.4%).

Poinciana had the largest quantity of free amino acids (1.3%), while in *T. articulate* it reached 0.001%.

The largest percent of total carbohydrates was found in cotton stalks (46%), and the least amount was found in bamboo (28.5%).

Effect of host on the biological activity of the four borers

Data in Table 3 show the effect of host on the biological activity of the four borers.

The longest longevity of *E. obtusedentatus* beetles was 18.5 ± 0.8 days on *R. communis*, which has a thin bark layer (4 u) with wooden vessels found in bundles alternated by the phleom and cambium. The higher progeny/female (24 individuals) and the lowest duration of generation (30 days) occured on that host.

D. bifoveolatus beetles attack the large parenchymal cells that existed in *D. regia* (77 u). The bark of *B. arundinaces* (18 u) gave a higher progeny on *B. arundinaces* (26 individuals / female) and the shortest duration of generation was achieved on *D. regia* (73 days).

B. reichei gave a satisfactory progeny on *D. regia* (11.8 individuals/female), followed by *D. sisso* (11 individuals/female). The shortest duration of generation (91 days) was found on *Gossypium.*

L. africanus beetles, gave higher progeny (40 individuals/female) on *D. regia* which is chracterized by a large paranchymal cells in the sapwood region and no infestation occured in the heartwood region where the cells are very condensed.

Chemical components relationship

Data in Tables 2 and 3 show the chemical components of the different hosts and their effect on the biological activity of the tested borers.

The longest longevity of *B. reichei* adults lasted 17.0 ± 1.3 days. The higher progeny (19.4 ± 1.1 / female), and the shortest duration of generation (19.2 ± 0.5) were observed on cotton stalks which contain high contents of crude fibers, carbohydrates, and the lowest content of fats.

The longest longevity of *D. bifoveolatus* adults was found on bamboo and poinciana (29 days). The higher progeny/female was 26 and 20, respectively, and the shortest duration of generation was 73 and 83 days, respectively.

Bamboo showed the lowest amount of lignin and carbohydrates, while *Poinciana* had the largest contents of starch and free amino acids. These components were belived to be favourable to this beetles for attacking the two hosts.

Adult beetles of *E. obtusedentatus* survived longer on Poinciana (26 days) which contains the largest amounts of starch and free amino acids. When reared on cotton stalks, the beetles produced a large progeny (49 individuals/female) and the duration of generation lasted 28 days.

From the forementioned findings it could be concluded that the essential food requirements of *E. obtusedentatus* are sufficient crude fiber, starch, free amino acids and carbohydrates which exist in cotton stalks.

L. africanus beetles lived longer on *Poinciana* (25 days), showing a higher progeny (40 individuals/female) and the shortest generation duration which lasted 34 days.

The uninfested hosts by the four borers (casuarina, bambosia, poplar, willow, schinus, sessban and athl) were characterized by higher quantities of dry matter, legnin, fats and phenols, whereas they contained lower quantities of ash, crude fibers, cellulose, starch, free amino acids and carbohydrates.

General Discussion

From the previous data it could be seen that the wood borers' behaviour in attracking wooden trees depends on certain factors : mode of entry and attack of wood, and the preferable layer of wood (Fig. 3).

Borers attacking healthy trees, need thin layer of bark and wide zone of sapwood containing paranchymal cells, such as Buprestides Scolytids, Cerambycids and Curculionoids. Some of the Cerambycids go through heartwood zone (Chamberlin 1960).

Chemically, the susceptible tree should not contain much phenols in the bark due to its repellant effect. (Chapman and Bernays 1977). Sapwood has enough quantity of total carbohyrates, cellulose, fats, protein and amino acids. The stored nutrients in sapwood, controls borer's duration and progeny to survive in. Eucalyptus borer *Phoracantha semipunctata* needs 3 months to complete one generation due to its boring behaviour into the enrished layer (phloem + cambium) (Helal and El-Sebay 1980b). While the other cerambycid borer suchc as *Macrotoma palmata* needs from 3-7 years to complete one generation since it survives in the heartwood where less nutrients are available (Mostafa 1976). On the other hand, borers such as *Scolytus amygdali* produced 5 generations per year due to its feeding on the enrished layer under bark (Abdallah 1984).

However, there are certain chemical substances in the trees which give rise to new substances resulting from the reaction between the borers and the trees. In the bark of hickory tree, "juglone", the substance (5-hydroxy-1, 4 naphthoquinone) is responsible for the attraction of *Scolytus quadrispinosus* which attacks hickory, but it is considered as a deterrent for *Scolytus multistiatus* beetles. Scolytid beetles of *Dendroctomus brevicornis*, feeds on bark of *Pinus pondrosa* and produces a pheromone (frontaline) through its frasses which attracts all the other males and females in order to attack the same tree (aggregation pheromone) (Wigglesworth, 1972).

Physical structure is not only just the sort or the size of cells but also certain chemicals occur in these cells. Monophagous borers seek a specific substance in the tree, such as eucalyptus borer which attacks the trees in a certain time of the year during the flowering period (March and October), where an attractive substance is released from the flowers (El-Sebay 1978). In olives, the bark beetle *P. scarabaeoides* attacks only olive trees, while in polyphagous borers, such as M. palmata or *S. amygdali*, they need hosts with a similar texture of bark and sapwood in order to obtain their food requirements (Taher, 1966).

On the other hand, some borers attack wood with no bark (seasoned wood) such as lyctids, bostrychids, and some of cerambycids. Those borers attack sapwood region depending on the kind and size of cells, in addition to the chemical components inside the cells like starch, carbohydrates, protein and amino acids; or they might need cells that fit egg deposition as in bostrychids.

Subterranean termites usually attack any cellulose material whether dead or alive. Its attacking behaviour is mainly on the surfaces to aviod the sapstream of

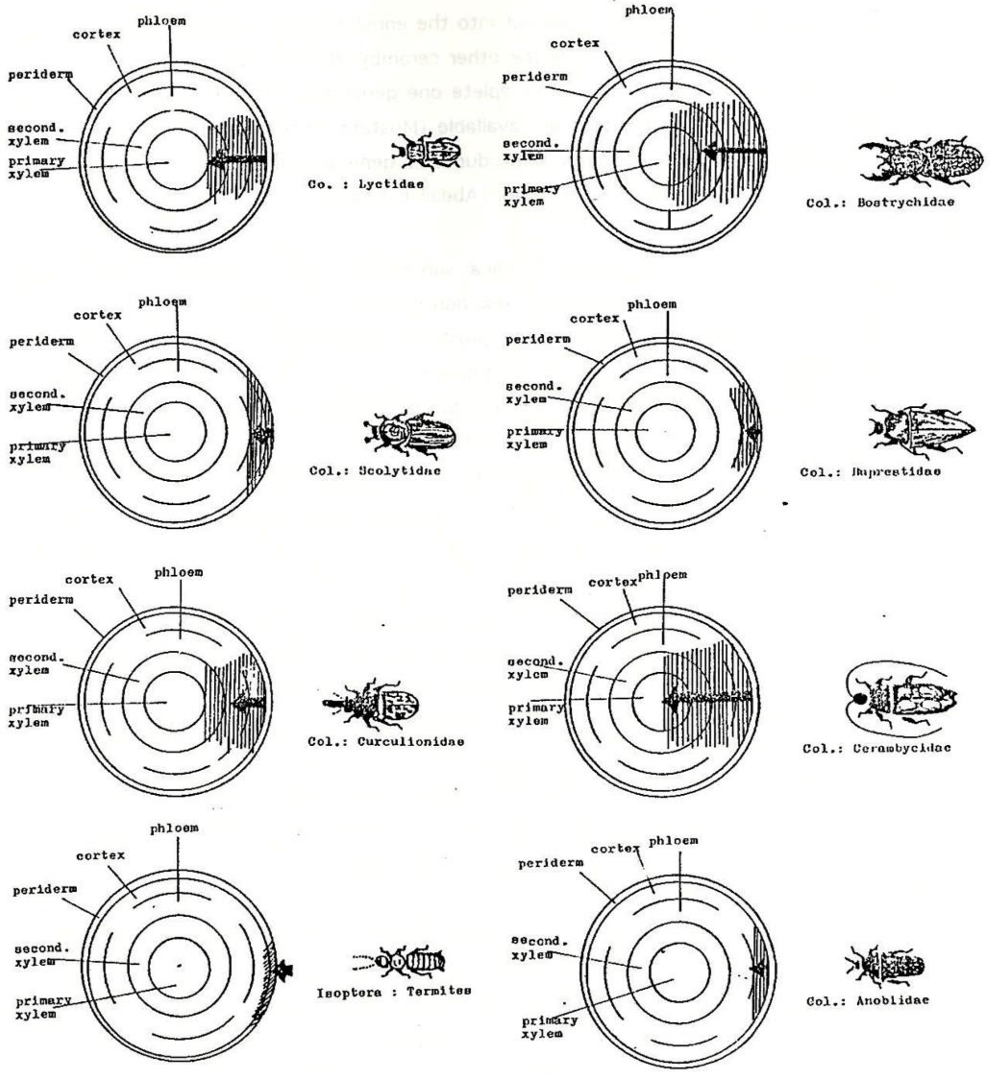

Fig. 3. Mode of attacking behaviour of different wood - borers.

alive trees. Dry wood termites survive and feed inside the wood just like anobiids by the aid of certain microorganisms which occur inside the insects (Chapman, 1977).

Other borers are controlled by moisture content of wood; some attack healthy trees containing 55 - 45 % moisture content like *M. palmata* and *Zeuzera pyrina*, whereas other attack trees containing 35 - 25 % moisture content (eucalyptus borer and shot hole borer). Some attack seasoned wood containing 15-10% moisture content (*B. reichei, E. obtusedentatus, L. africanus* and *Stromatum falvum)* while some others attack old decayed wood such as anobiids.

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العلاقه بين ناخرات الأخشاب والأشجار الخشبيه

يسرى السباعى ، هدى هلال

معهد بحوث وقاية النباتات – مركز البحوث الزراعيه – الدقى .

أجرى هذا البحث بغرض إيجاد علاقه بين ناخرات الأخشاب والأشجار الخشبيه حيث تم عمل قطاعات عرضيه فى ١٥ عائل خشبى وتم فحصها بالميكروسكوب وتم رسمها مع التركيز على أنواع الخلايا والمناطق المختلفه فى كل قطاع.

أيضاً تم عمل تحليل كيماوى لمعرفة المكونات الكيماويه المختلفه لثلاث مناطق هامه فى كل قطاع تمثل طبقة القلف والخشب العصيرى والخشب القلب وإيجاد أهم أنواع المواد المسئولة عن جذب أو طرد الناخرات.

بالإضافه إلى إجراء عدوى صناعيه لعدد ١٦ عائل خشبى لمعرفه تأثير العائل ومدى قابلية العوائل للإصابه وكذلك تأثر الناخرات بهذه العوائل من حيث مدة حياة الحشره ، مدة خروج الحشرات ، النسل الناتج بالنسبه للأنثى الواحده ثم مدة الجيل كله على كل عائل.

كما تمت مناقشة هذه النتائج من أجل العلاقات المختلفه من شكل مورفولوجى ومكونات كيميائيه ، ومدى تأثير ذلك على بيولوجية الحشرة الناخره.

ومن أهم النتائج المتحصل عليها أن الناخرات لها علاقه وثيقه بنوع الخلايا فى الخشب وحجمها حيث تفضل حشرات يوستريكيدى الخلايا البرانشيميه الكبيرة الحجم وتضع البيض فيها. كما تهاجم طبقة الخشب العصيرى الخارجى. كما وجد أن الناخرات تفضل الخشب المحتوى على ألياف خام ، نشا ، أحماض أمينيه ويعمل الفينول على طرد الحشرات وموت النسل الناتج.