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ECOLOGICAL STUDIES ON THE POWDER-POST BEETLE *LYCTUS AFRICANUS* LESNE

Y. EL-SEBAY AND HODA. HELAL

Plant Protection Research Institute, Agricultural Research Centre, Dokki, Egypt.

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Abstract

The present investigation was carried out to study some ecological aspects of the powder-post beetle *L. africanus* such as the effect of initial sex ratio on infestation, response to colour effect, and effect of light on adult beetle activity.

Increasing of males proportional to females, increased the female progeny and vice versa. Females were more sensitive than males to colour effect. Orange colour is the most effective on female activity followed by green, white, red and blue. Darkness had strong effect on the adult beetles, giving higher progeny and shorter duration.

INTRODUCTION

The post powder beetle *Lyctus africanus* Lesne is considered one of the most serious borers attacking either raw or working wood all over the country.

Helal (1981 a, b) studied some biological aspects of *L. africanus* and its biological behaviour.

The present study was carried out to clarify the effect of initial sex ratio of beetles on infestation. The investigation included the effect of colour response and light on adult activity.

MATERIALS AND METHODS

The present study was conducted at the Plant Protection Research Institute, Wood-Boring Dept., during 1989-1991.

In order to study the effect of sex ratio on initial infestation and progeny of beetles, 19 ratios of males and females were tried comprizing one male to one, two, three ..ten females and one female to one, two, three ...ten males. Ten replicates were prepared for each ratio. Each replicate contained a piece of dry poinciana wood (5 X 3 X 1cm) placed in a glass jar. Newly emerged beetles of *L. africanus* at the specified ratio under laboratory conditions were released in each jar.

Daily inspections were carried out during each generation and the number of emerged beetles from each replicate was counted and recorded. Progeny was detected for each ratio in proportional to the number of exit holes on the wood surface.

To study the effect of different colours on adult beetles, an artificial diet was prepared according to Nour and Helal (1971). The diet was stained with blue (methylene blue), green (green florescent), orange (orange florescent) and red (Eosin). A diet without staining was used as an untreated control. As a facultative choice, two pieces of diet stained with a colour were placed in a metallic container. A Petri dish containing 1000 newly emerged adults was placed in the center of each container and left for 36h. Pieces of diets were carefully transferred separately to glass jars. The experiment was repeated ten times. Numbers of attracted beetles to each colour were recorded, identified into males and females, then left to form the next generation. At the end of each generation the number of emerged beetles from each colour was recorded.

To study the effect of light on the biological aspects of *L. africanus* beetles, 20 cuttings of seasoned *Poinciana* wood were prepared (5 X 3 X 2 cm) and placed separately in glass jars. Ten jars were painted with black color, while the last ten jars were left normally. Ten males and ten females of newly emerged beetles were released in each jar. Adult longevity, progeny, life cycle, and length of emergence period were recorded.

RESULTS AND DISCUSSION

Effect of sex ratio at initial infestation on the progeny

Data presented in Table 1 show that at the sex ratio 1:1 the sex of the emerged beetles (progeny) was almost the same. Increasing famale numbers to one male only, the resulting progeny showed higher number of males than females. On the other hand, the present data revealed that although the progeny increased in number, yet the number of progeny/female (fecundity) decreased.

In contrary, when one female was placed to any number of males, the resulting progeny produced more females than males.

The total number of progeny and number of beetles/female had increased when male ratio increased proportional to female. This showed that female needs to copulate with more than one male to give a higher number of progeny (38.7 individuals/female).

The results also showed that the number of exit holes in the infested wood was similar to the number of emerged beetles indicating that each exit hole was produced by one emerged beetle.

Effect of colour on adult activity

Stained artificial diet with five different colours showed variable response of adult beetles.

Table 1. Infestation ratio of males to females of *L. africanus* beetles and number of emerged progeny related to number of exit holes.

Initial Infestation Ratio Male : Female			Number of emerged beetles				Number of exit holes.
			Male	Female	Total	Total/ female	
1	:	1	12.0	10.6	22.6	22.6	22.6
1	:	2	15.9	13.4	29.3	14.6	29.3
1	:	3	24.0	19.9	43.9	14.6	43.9
1	:	4	25.0	21.4	46.4	11.6	48.0
1	:	5	26.3	25.3	51.6	10.3	53.0
1	:	6	27.5	24.0	51.5	8.5	52.0
1	:	7	28.4	25.3	53.7	7.7	55.0
1	:	8	32.5	25.1	57.6	7.2	28.0
1	:	9	36.2	24.8	61.0	6.8	63.0
1	:	10	36.1	25.3	61.4	6.1	63.0
2	:	1	14.1	15.0	29.1	29.1	29.0
3	:	1	14.2	15.4	29.6	29.6	30.0
4	:	1	13.8	16.2	30.0	30.0	32.0
5	:	1	14.5	17.5	32.0	32.0	34.0
6	:	1	14.2	19.3	33.3	33.3	34.0
7	:	1	13.9	22.1	36.0	36.0	36.0
8	:	1	13.7	24.5	38.2	38.2	39.0
9	:	1	13.8	24.9	38.7	38.7	39.0
10	:	1	14.1	25.1	38.2	38.2	39.0

Table 2. Number of attracted beetles of *L. africanus* to different colours during 36 h.

Replicate	Colour														
	Blue			Green			Orange			Red			Normal (control)		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
1	3	1	4	58	71	129	102	211	313	8	10	18	49	54	103
2	4	0	4	70	78	148	110	241	351	11	9	20	38	31	69
3	2	1	3	78	100	178	90	121	211	18	3	21	51	54	65
4	0	1	1	62	114	176	98	138	236	9	7	16	28	38	66
5	3	0	3	69	98	167	100	251	351	13	3	16	61	55	116
6	2	0	2	73	116	189	116	163	279	11	5	16	55	46	101
7	3	1	4	70	110	180	108	210	318	15	9	21	63	58	121
8	0	2	2	69	72	141	97	215	312	12	4	16	48	60	108
9	0	1	1	70	83	153	94	193	287	7	7	14	47	50	97
10	1	1	2	64	90	154	83	160	243	10	2	12	60	49	109
Total	18	8	26	683	932	1615	998	1903	2901	114	59	173	500	495	995

Table 2 shows that the orange colour was the most favorable color selected by the adult beetles, followed by green, red and blue. The choice of the insect was expressed biologically by the number of the initially attracted beetles to its favorable colour. Out of 5670 beetles released, 2901 were attracted to orange colour (51%), 1615 beetles were attracted to green colour (28%), 995 to normal diet (17%), 173 to red colour (3%) and 26 to blue colour (0.5%)

Data in Table 2 showed that colours affected mainly adult female behaviour rather than males, for orange colour, 1903 females were attracted at a ratio of 1 male : 2 females followed by green colour (1:1.4), red and blue (1:0.5). The normal colour represented the normal ratio 1:1.

Table 3 shows the number of emerged beetles from the infested coloured diet.

Orange colour produced 14350 beetles as a progeny representing 45% of the total emerged beetles of the whole experiment. Green and normal diets produced nearly the same number of emerged beetles (26 and 24%), followed by 1321 beetles for red (4%) and 111 beetles for blue diet (0.4%). The produced sex ratio from the different colours almost ranged between the normal ratio (1:0.9-1:1.1).

Effect of light and darkness on adult activity

Table 4 demonstrates the effect of light and darkness on adult activity and behaviour of *L. africanus* beetles as detected by the following four biological responses :

a. Adult longevity

Longevity of adult beetles exposed to light averaged 20.7 days (12-25 days) for males and 17.3 days (12-25) for females. While in darkness, males longevity averaged 9.4 days (5-15) and 9.2 days (7-16) for females.

b. Number of emerged beetles (progeny)

As shown in Table 4, the progeny beetles reared under darkness was larger in

Table 3. Number of *L. africanus* emerged beetles from different coloured diets for one generation.

Replicate	Colour														
	Blue			Green			Orange			Red			Normal (control)		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
1	19	5	24	317	320	637	730	810	1540	126	138	264	510	488	998
2	0	0	0	431	510	941	670	720	1390	100	87	187	320	410	730
3	16	14	30	520	488	1008	560	520	1080	61	53	114	415	422	837
4	0	0	0	360	352	712	615	633	1248	60	73	133	311	329	640
5	0	0	0	320	300	620	814	855	1669	32	31	63	330	415	745
6	0	0	0	410	450	860	427	410	837	46	54	100	410	437	847
7	12	15	27	367	340	707	815	819	1634	69	80	149	500	488	988
8	0	0	0	451	502	953	911	838	1749	40	59	99	417	525	942
9	0	0	0	355	411	766	800	873	1673	94	71	165	343	512	855
10	13	17	30	216	300	516	710	820	1530	22	25	47	402	398	800
Total	60	51	111	3747	3973	7720	7052	7298	14350	650	671	1321	3958	4424	8382

Table 4. Effect of light and darkness on *L. africanus* activity.

Replicate	Light condition					
	Adult longevity		Progeny		Life cycle in days	Emergence period in days
	Male	Female	Male	Female		
1	12	24	28	28	42	34
2	29	24	31	15	56	48
3	18	18	12	27	44	56
4	25	25	18	23	48	32
5	21	19	29	17	60	24
6	19	20	33	25	52	38
7	24	23	22	28	54	39
8	18	17	24	31	50	44
9	20	12	36	32	44	47
10	21	14	14	17	48	50
Av.	20.7	17.3	24.7	24.3	49.8	41.2
Dark condition						
1	7	16	40	29	58	82
2	7	7	29	26	58	83
3	12	8	46	46	31	80
4	12	7	55	41	58	83
5	10	7	37	33	58	83
6	15	9	26	26	58	83
7	7	7	19	13	58	83
8	9	14	76	67	58	83
9	10	10	60	65	58	83
10	5	7	27	26	61	80
Av.	9.4	9.2	41.5	35.7	58.6	82.3

number than that reared under light condition.

Under darkness, the number of emerged males averaged 41.5 individuals (19-76) and females 35.7 (13-67), while under light condition, the progeny averaged 24.7 males (12-36) and 24.3 for females (15-31).

Male production under darkness was slightly more than females, whereas the ratio was normal under light condition (1:1).

c. Life cycle

The life cycle of beetles reared under light was shorter than those reared under darkness. The average life cycle under light was 29.8 days (42-60 days) while under darkness the average was 58.6 days (58-61 days).

d. Period length of adult emergence

Under light condition the period length of adult emergence extended to 41.2 days (24-56 days), while it almost doubled to 82.3 days (80-83 days) under darkness.

Darkness was more suitable for *L. africanus* survival. This was expressed by shorter longevity, higher number of beetles, longer life cycle and longer period of adult emergence.

It could be concluded that wood painted with orange colour is more susceptible to infestation by *L. africanus* , while wood painted with blue or red becomes less susceptible. In all cases however, wood should not be kept under darkness.

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دراسات بيئيه علي خنافس ليكتس الساحقه

يسري السباعى ، هدي هلال

معهد بحوث وقاية النباتات – مركز البحوث الزراعيه – الدقي.

أجريت الدراسات البيئيه علي خنافس ليكتس الساحقه للخشب بقصد كشف الغموض عن بعض جوانب سلوكياتها مثل تأثير النسبه الجنسيه الأوليه للحشره علي بداية الإصابه للخشب ، تأثير الألوان المختلفه علي جذب الحشره للإصابه وأيضاً تأثير الضوء والإظلام علي نشاط الحشره.

أوضحت النتائج أن زيادة نسبة الذكور إلي الإناث عند بداية العدوي يزيد من النسل الناتج والعكس صحيح مما يثبت أن أنثي الحشره تحتاج إلي أكثر من ذكر لتزيد من نسبة إنتاجها. أوضحت التجربه أيضاً أن إناث الحشره تتأثر بالألوان في حين لا تتأثر بها الذكور ويعتبر اللون البرتقالي من أفضل الألوان لها ويليه الأخضر ثم اللون العادي (الكنترول) ثم الأحمر وأخيراً اللون الأزرق.

كما وجد أن هذه الحشره تفضل حالة الإظلام عن الضوء فتزيد نسبة نسلها وتقل دورة حياتها ومدة خروج الخنافس من الخشب.