tuating temperatures of spring and autumn.

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REFERENCES

- COOK, W. (1927) *Jour. econ. Ent.* **20** : 769-782.
 GRANT, G. G. (1971) *Jour. econ. Ent.* **64** : 315-316.
 ITO, Y. and T. ENDO (1970) *Jap. J. Ecol.* **20** : 59-62.
 KAWARABATA, T. and H. UEMATSU (1974) *Proc. Assoc. Pl. Proc. Kyushu* **20** : 44-46.
 MIYASHITA, K. (1971) *Appl. Ent. Zool.* **6** : 105-111.
 MORRIS, R. F. and C. W. BENNETT (1967) *Can. Ent.* **99** : 9-17.
 OGATA, M. (1958) In: *Icones Heterocerorum Japonicorum in Coloribus Naturalibus*: (ESAKI, T. et al. eds.), OSAKA: Hoikusha Pub. Co., Ltd., pp. 140-141.
 UEMATSU, H. (1977) *Proc. Assoc. Pl. Prot. Kyushu* **23** : 137-140.
 WATANABE, N. (1978) *Appl. Ent. Zool.* **13** : 44-46.

Residual Effects of Certain Insecticides against *Lyctus brunneus* STEPHENS (Coleoptera : Lyctidae)¹

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Lyctus brunneus is a cosmopolitan pest insect attacking seasoned sapwood of a hardwood. Chlordane and arsenic and boric compounds, hitherto, were used for control of *L. brunneus*. ITO et al. (1976) and BERRY (1978) demonstrated the utility of a synthetic pyrethroid, permethrin, as a wood protectant. In this paper, residual effects of certain insecticides to *Lyctus brunneus* were examined.

The test insect was reared on the artificial diet as reported by ITO and HIROSE (1979). The insecticides used were fenitrothion (93.4%), permethrin (95.6%), chlordane (tech. grade) and lindane (99.8%), and formulated as an emulsifiable concentrate as follows; an active ingredient 10%, emulsifier 20% (Sorpul® SM 100P, Toho Chem.) and xylene, the balance. Sapwood of a tropical wood, red meranti, containing over 3.0% starch was cut to provide a strip 3×1.5 cm in cross-section and 10 cm in length. The long axis

of the strip was parallel to the grains of wood and the cross sections were sealed with paint. The strip was dipped into a suspension of a test insecticide at a given concentration for 1 min and thereafter placed on a wire netting at 25°C, 50% R.H. Twenty-six months after treatment, four pairs of male and female adults of *L. brunneus* were liberated onto a treated strip which had been placed 7 days before in a plastic box (17×7×4 cm) at 25°C, 70% R. H. Twelve months after liberation of the adults, the number of newly emerged adults on the surface were counted and the remaining strips were severed to examine inner damage.

The results are presented in Table 1. There was no exit hole on the strips treated with permethrin at 0.1%, lindane at 0.1%, chlordane at 2.0% and fenitrothion at 2.0%. In addition, no living larva was observed in the inner parts of strips. These results indicate that the treatment at their respective concentrations were effective to protect wood from attacks of *L. brunneus* for 26 months. The effect of lindane observed in this experiment seems reasonable, since SMITH (1968) reported that lindane at 0.25% perfectly protected wood from *Lyctus powder-post beetle* for over 3 years. He also stated that a concentration lower than 0.25% was adequate for protecting wood during air-drying, because the normal storage period is not longer than 18 months. Therefore, it is expected that permethrin and fenitrothion can be used for the control of *L.*

¹ Appl. Ent. Zool. **15** (3) : 349-350 (1980).

Table 1. RESIDUAL EFFECTS OF THE INSECTICIDES TO PROTECT WOOD FROM
THE ATTACKS OF *Lyctus brunneus*

Insecticide	Concentration %	No. of Strips Used	No. of Strips Damaged	Av. No. of Exit Holes
Permethrin	0.1	3	0	—
	0.01	3	2	8.3
	0.001	3	3	13.7
Lindane	0.1	3	0	—
	0.01	3	2	1.3
	0.001	3	3	5.0
Chlordane	2.0	3	0	—
	0.2	3	2	9.7
	0.02	3	3	17.7
Fenitrothion	2.0	3	0	—
	0.2	3	1	0.7
	0.02	3	3	22.0
Untreated	—	6	6	18.0

brunneus during air-drying of a hardwood in
lumber yards.

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REFERENCES

- BERRY, R. W. (1978) *Pesti. Sci.* **8**: 284–290.
 ITO, T., Y. FUNAKI and C. HIROSE (1976)
Bōtyu-Kagaku **41**: 138–142.
 ITO, T. and C. HIROSE (1979) *Jap. J. appl.*
Ent. Zool. **23**: 188–191.
 SMITH, V. K. (1968) *J. econ. Ent.* **61**: 323–324.