Effect of Oleoresins and Powders of Some Dried Fruits and Rhizomes on the Residual Toxicity of Pyrethrins. S. M. AHMED, M. RAVINDRANATH GUPTA and S. K. MAJUMDER (Central Food Technological Research Institute, Mysore-570013, India.) Received May 7, 1976. *Botyu-Kagaku*, 41, 135, 1976.

23. ピレトリンの残効性に及ぼすオレオレジンおよび乾果，乾燥根茎粉末の影響

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種々の植物のオレオレジンおよび乾果，乾燥根茎の粉末をピレトリン残効性の安定剤として利用することを，コクヌストモドキを使って調べた．テストした植物のうちショウガのオレオレジンが，ピレトリン効力増強に卓効を有していた．コバンノキの1種の乾果の粉末は，ゴマ油と共に，あるいは単独で，ピレトリンの安定剤として有望であることがわかった．

Introduction

Inspite of all the advances made in the field of synthetic insecticides, pyrethrum an insecticide of botanical origin, still rules supreme due to its low mammalian toxicity and high insecticidal activity. The greatest disadvantage of pyrethrins is that the residues undergo quick oxidation, decomposition and loss of insecticidal potency in the presence of light, moisture and air. Hence, several synergists both synthetic compounds and vegetable oils were screened and used in combination to enhance the toxicity. Hiromichi and Tanimura[3] reported that two constituents of pepper and oleoresin exhibited synergistic effect with pyrethrins against household insects. The oleoresins of certain plant rhizomes like Arrow root, *Curcuma angustifolia* and Kachura, *Kaempferia galanga* were found to be synergistic to some chlorinated insecticides against house flies[5]. While the powders of Cumin, *Cuminum cyminum*, Turmeric, *Curcuma longa*, pepper, *Piper nigrum*, Ginger, *Zingiber officinale* and Kachura were observed to be repellent against *Tribolium castaneum*[2,4]

Although synergistic properties of oleoresins of some rhizomes and the repellent action of powders of few dried fruits and rhizomes have been reported in the literature, their role in combination with pyrethrins was not studied, except the work of Hiromichi and Tanimura[3] who have concentrated only on pepper oleoresin. Therefore, in the present investigation an effort has been made to study the role of oleoresins and powders of some dried fruits and rhizomes grown in the tropics on the residual toxicity of pyrethrins against adults of *T. castaneum*, an important pest of stored commodities.

Materials and Methods

To study the effects of various oleoresins and powders of dried rhizomes and fruits in combination with pyrethrins, one week old *Tribolium castaneum* (Herbst) adults were used as test insects. The insects were reared on wheat flour at 30±1°C and 65 to 70 per cent RH.

The powders of dried fruits like Amla, *Emblica officinalis* and Halda, *Chloroxylon swietenia* and rhizomes like Ginger, *Zingiber officinale*, Turmeric, *Curcuma longa*, Kachura, *Kaempferia galanga* and Arrow root, *Curcuma angustifolia* were prepared by grinding them to 100-mesh size. The oleoresins of kachura, arrow root, ginger, black pepper, *Pipper nigrum* and red chillies, *Capsicum annum*, were prepared from the powders by extracting with ethylene dichloride (84°c) in cold, and the extract was concentrated by evaporation.

Pyrethrum extract (containing 20 per cent pyrethrins, supplied by M/s Bombay Chemicals Pvt Ltd., Bombay) was dissolved in trichloroethylene for stock solution. Various oleoresins were dissolved in the same solvent and mixed with pyrethrum solution such that 1m*l* of the mixture contained 200 μg of pyrethrins and oleoresins in 1 : 10 and 1 : 20 ratios. The powders of fruits and rhizomes were weighed and added directly to the pyrethrum solution such that 1m*l* contained 200μg of pyrethrins and 10mg of powder. In an another experiment to study the combined

effect of powders and sesame oil with pyrethrins, test mixtures were prepared containing 200μg of pyrethrins, 2 mg of sesame oil and 10mg of powder per m*l*. In all the experiments, 1 m*l* of each mixture was applied on a petridish (63.3 sq. cm) for testing.

Bioassay of the residues was carried out by releasing 25 *T. castaneum* adults into each dried, treated petridish. There were 4 replicates for each treatment. After 24 hours of exposure to the insecticidal deposits, the data on percentage knockdown and mortality of insects were collected. The same dishes were kept under normal laboratory conditions for further testing of the residual toxicity at weekly intervals. The data of control dishes (containing all the ingredients except pyrethrins) were taken to calculate the corrected percentages of knockdown, and mortality using Abbott's formula[1]. The whole data were subjected to Analysis of variance after transforming the values as angles= Arc Sin$\sqrt{\text{percent}}$.

Results and Discussion

The effect of various oleoresins on the residual toxicity of pyrethrins has been presented in Table 1. All the treatments were found superior to control. In general, the effect of high concentrations of oleoresins were not consistently superior to that of lower concentrations. Among the oleoresins tested, only ginger was found effective in prolonging the toxicity of the deposits. The turmeric and arrow root showed only 16 to 20 per cent knockdown and no mortality and black pepper and red chillies at 1 : 20 ratio showed 47 to 58 percent knockdown and 21 to 24 percent mortality after 7 days. With regard to knockdown there was no significant difference between ginger and kachura, but the per cent mortality on 7th day due to ginger at both ratios and kachura at 1 : 20 ratio was equal and significantly superior to other treatments. However, only ginger oleoresin enhanced the toxicity of pyrethrins by bringing about 45 per cent mortality in 14 days and 20 per cent at the end of the test period (21 days). Though Hiromichi and Tanimura[3] reported better synergistic action of pepper oleoresin with pyrethrins on mosquito larvae, but it was not promising against *T. castaneum* adults. The oleoresin of kachura was found to be better repellent than ginger[2]. However, in the present study ginger, in combination with pyrethrins, was more effective than kachura.

The data on the residual toxicity of pyrethrins in combination with various powders have been given in Table 2. All the treatments were found better than control. The amla powder brought about 49.8 per cent knockdown and 28.1 per cent mortality at the end of 14 days. The powders of halda, kachura and turmeric were significantly inferior to amla and ginger with regard to the per cent knockdown. Though ginger showed 81 per cent knockdown and 38.4 percent mortality in 7 days, it did not exhibit any further effect.

The combined effect of the powders and sesame oil in enhancing the pyrethrins toxicity is presented in Table 3. In general, the residual toxicity of pyrethrins was enhanced by the

Table 2. Residual toxicity of pyrethrins in combination with powders of dried fruits and rhizomes against *Tribolium castaneum*

Treatments	Toxicity of deposits at intervals of 7 days				14 days			
	% knockdown		% mortality		% knockdown		% mortality	
	Corr.	Trans.	Corr.	Trans.	Corr.	Trans.	Corr.	Trans.
Pyrethrins (Control)	—	—	—	—	—	—	—	—
Py+Amla (*Emblica officinalis*)	85.5	67.6	22.1	28.0	58.4	49.8	22.2	28.1
Py+Ginger (*Zingiber officinale*)	97.6	81.0	38.7	38.4	—	—	—	—
Py+Halda (*Chloroxylon swietenia*)	15.7	23.3	—	—	—	—	—	—
Py+Turmeric (*Curcuma longa*)	10.4	18.8	—	—	—	—	—	—
Py+Kachura (*Kaempferia galanga*)	7.7	16.1	—	—	—	—	—	—
CD at 5% level		15.5						

Table 1. Effect of oleoresins on the residual toxicity of pyrethrins to *Tribolium castaneum* adults

Treatments		Toxicity of deposits at intervals of 7 days % knockdown Corr.	7 days % knockdown Trans.	7 days % mortality Corr.	7 days % mortality Trans.	14 days % knockdown Corr.	14 days % knockdown Trans.	14 days % mortality Corr.	14 days % mortality Trans.	21 days % knockdown Corr.	21 days % knockdown Trans.	21 days % mortality Corr.	21 days % mortality Trans.
Pyrethrins (Control)		—	—	—	—	—	—	—	—	—	—	—	—
Py+Ginger	A	100.0	90.0	52.0	46.2	100.0	90.0	50.7	45.4	22.1	28.0	9.3	17.8
(*Zingiber officinale*)	B	100.0	90.0	48.0	43.8	100.0	90.0	49.3	44.6	35.7	36.7	12.4	20.5
Py+Kachura	A	100.0	90.0	21.1	27.4	—	—	—	—	—	—	—	—
(*Kaempferia galanga*)	B	95.9	78.3	32.0	34.4	—	—	—	—	—	—	—	—
Py+Black pepper	A	—	—	—	—	—	—	—	—	—	—	—	—
(*Piper nigrum*)	B	53.4	46.9	12.5	20.7	—	—	—	—	—	—	—	—
Py+Red Chillies	A	—	—	—	—	—	—	—	—	—	—	—	—
(*Capsicum annum*)	B	71.8	57.9	16.6	24.0	—	—	—	—	—	—	—	—
Py+Arrow root	A	12.4	20.6	—	—	—	—	—	—	—	—	—	—
(*Curcuma angustifolia*)	B	9.2	17.7	—	—	—	—	—	—	—	—	—	—
Py+Turmeric	A	—	—	—	—	—	—	—	—	—	—	—	—
(*Curcuma longa*)	B	8.0	16.4	—	—	—	—	—	—	—	—	—	—
CD at 5% level			18.9		14.3								

A : Pyrethrins (200μg)+Oleoresin (1 : 10) per dish
B : Pyrethrins (200μg)+Oleoresin (1 : 20) per dish

Table 3. Combined effect of sesame oil and powders on the residual toxicity of pyrethrins against *Tribolium castaneum* adults

Treatments	Toxicity of deposits at intervals of 7 days % knockdown Corr.	7 days % knockdown Trans.	7 days % mortality Corr.	7 days % mortality Trans.	14 days % knockdown Corr.	14 days % knockdown Trans.	14 days % mortality Corr.	14 days % mortality Trans.	21 days % knockdown Corr.	21 days % knockdown Trans.	21 days % mortality Corr.	21 days % mortality Trans.
Py+Sesame Oil (Control)	100.0	90.0	68.0	55.4	25.0	30.0	—	—	—	—	—	—
Py+Sesame Oil+Amla	100.0	90.0	100.0	90.0	100.0	90.0	69.3	56.4	94.6	76.5	26.4	30.9
Py+Sesame Oil+Ginger	100.0	90.0	100.0	90.0	100.0	90.0	84.1	66.5	29.7	33.0	3.3	10.6
Py+Sesame Oil+Turmeric	100.0	90.0	96.6	79.4	93.8	75.5	28.0	31.9	14.3	22.2	2.7	9.4
Py+Sesame Oil+Halda	100.0	90.0	50.7	45.4	46.6	43.1	5.2	13.2	—	—	—	—
Py+Sesame Oil+Kachura	100.0	90.0	86.4	68.4	23.0	28.7	—	—	—	—	—	—
C.D. at 5% level		—		13.0		17.6		12.0		11.6		14.2

powders in the presence of sesame oil. The knockdown data showed that all the treatments were highly effective in 7 days and after 14 days the powders of amla, ginger and turmeric were significantly superior over control, halda and kachura. But at the end of 21 days amla showed superiority over the other treatments by bringing about 76.5 per cent knockdown. The mortality data indicated that amla, ginger, turmeric and kachura were equally effective in 7 days and there was no significant difference between turmeric and kachura, kachura and control and between control and halda. At the end of 14 days amla and ginger were significantly superior over others. The amla powder showed upto 30.9 per cent mortality and was significantly superior to ginger and turmeric at the end of the test period.

Thus it was observed that ginger as an oleoresin and as a powder with sesame oil when incorporated with pyrethrins has helped in enhancing the residual toxicity. The amla powder with or without sesame oil was found superior in prolonging the tenacity of pyrethrins. Though turmeric as an oleoresin or powder did not show much effect on pyrethrins activity, it brought about stability of residues in the presence of sesame oil to a certain extent. The soluble fractions of the powders might have been responsible for the stability of pyrethrins. Besides, this effect could also be due to the finer particles which might have retained the molecules of pyrethrins without exposing them completely for quick decomposition.

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Efficacy of Insecticides against Lyctus Powder-Post Beetle, *Lyctus brunneus* (Steph.). Takaaki Ito, Yoko Funaki and Chuji Hirose (Research Department, Pesticides Division, Sumitomo Chemical Co. Ltd., 4-2-1 Takatsukasa, Takarazuka, Hyogo 665, Japan) Received May 11, 1976. *Botyu-Kagaku*, 41, ○, 1976.

24. 数種殺虫剤のヒラタキクイムシ，*Lyctus brunneus* (Steph.)，に対する効力 伊藤高明，舩木容子，広瀬忠爾（住友化学工業株式会社生物科学研究所農薬事業部研究部） 51. 5. 11 受理

ヒラタキクイムシ幼虫に対するパーメスリン，フェニトロチオン，クロールデンの殺虫効果を，(1) 薬剤をラワン，メランチ類の板上に塗布後，幼虫を接触させる，(2) 薬剤を人工飼料中に混合後，幼虫に摂食させる，の2方法を用いて調べた．板上での接触試験ではパーメスリンが最も高い殺虫効果を有し，効力発現速度も最も速いことが認められた．薬剤処理人工飼料の摂食試験では，パーメスリンの本幼虫に対する食毒作用はフェニトロチオンに比較すると劣ることが認められた．クロールデンは両試験のいずれにおいても3薬剤中最も低い効力を示した．

一方薬剤処理後，3カ月を経過したラワン，メランチ類の辺材に，ヒラタキクイムシ成虫を放飼することによって被害防止効果を調べた．3薬剤とも，0.1%液処理区では全く被害は認められなかった．しかし0.01%処理区においてはフェニトロチオン，クロールデンの処理辺材の一部に被害が認められたのに対し，パーメスリン処理辺材では全く被害が認められなかった．

以上の結果から本害虫に対して，パーメスリンが3薬剤中最も高い防除効果を有するものと考えられた．

Lyctus powder-post beetle, *Lyctus brunneus* (Steph.), attacks the sapwoods of hardwood products, and causes extensive damage of the internal part of the woods. The female adults of the beetle lay eggs in the vessels of the woods and the new hatched larvae burrow along the