acid formation in the intestine, Rowe and Kahn (5) having shown that the alkaline intestinal and pancreatic secretions and bile exert an inhibitory influence on the rate of calcium absorption.

It is obvious that of the six calcium compounds studied, in albino mice, calcium lactate is the most rapidly and effectively absorbed calcium compound for oral administration. It is reasonable to assume that the same may hold in human subjects.

The authors are indebted to Miss Jessie May Gill for valuable assistance during these studies in which over 900 albino mice were used.

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DRUGS AND BUGS.*

BY ERNST T. STUHR.[1]

The elemental forces which destroy and devour natural resources have long been interesting and fascinating to the curious mind. As the visible forces, such as floods, storms, famines and diseases, destroy progress in civilization, so too, are unnoticed destructive forces. Insects have long been known to be the most destructive of animals. Stored vegetable and animal products are subject to constant menace of invasion by parasites unless proper storing facilities and preventive precautions are observed.

The stock-room of the drug store is, in some instances, a disorderly, neglected and mistreated department of the store. If this is the case, a very untidy situation and atmosphere results, creating a haven for pest invasion of all kinds, including rodents (rats and mice), which are often carriers of bacteria and disease germs.

In general, drugs possessing an abundance of starch, inulin and sugars are most liable to the attack of pests. It should be kept in mind, however, that even in products not infested there is a gradual deterioration which in time renders many products unfit for use. Sanitary storage as a preventive measure is of importance in retarding deterioration.

Every retailer and wholesaler should be vitally interested and should profit by acquiring knowledge of the appearance and habits of the enemies which are harmful and detrimental to drugs in general. An acquaintance with the insect kingdom, as to harmful insect pests, their life cycles and habits and some of the possible preventive and combative means or methods, is essential. The ento-

* Scientific Section, A. PH. A., Washington meeting, 1934.

[1] Department of Pharmacology and Pharmacognosy, School of Pharmacy, Oregon State College.

mological knowledge of the pharmacist need not necessarily be exhaustive, therefore, a synopsis of the extensive class of insects, more numerous in species than all other animals combined, is sufficient.

PHARMACO-ENTOMOLOGICAL DISTINCTION OF INSECTS.[1]

Insects in the adult stage possess well-developed mouth parts. A simple classification or two-group division of insects will be considered according to mouth parts.

A. Mouth parts fitted for chewing.
B. Mouth parts fitted for sucking.

The pharmacist should be interested for the most part in the so-called "biting insects." The "sucking insects" have little opportunity to destroy materials commonly stocked in the drug store, which consists primarily of dry package materials. Certain of the so-called "sucking insects," however, cannot be ignored. Certain young insects have been provided by nature with jaws for biting, which later develop into sucking insects, *e. g.*, certain caterpillars (later become moths or butterflies).

Fig. 1.

Fig. 2.

Fig. 1.—*Sitodrepa panicea* L. (Fam. Anobiidæ) (after Chittenden, U. S. Dept. Agr.).

Fig. 2.—*Silvanus gemellatus* Duv. (Fam. Cucujidæ) (after Chittenden, U. S. Dept. Agr.).

During the past six years extended observations have been conducted on infested stocks with studies of causes of conditions and various possible means of combat for eradication of pests. Monthly, seasonal and yearly checks have been kept, primarily on the so-called "animal parasites" or insects, with enlightening results.

In this paper some of the pests commonly detrimental to stocks and some simple methods found useful in eradicating them are outlined. A list of the more susceptible drugs which are injured by common pests should be most worthy of consideration.

DESTRUCTIVE BEETLES INFESTING CRUDE DRUG STOCK.[2]

Fig. 1. *The Drug Store Beetle.*—A reddish brown insect, 2.4 to 2.7 mm. in length and covered with a short dense pubescence. It is cosmopolitan, being found in homes, stores, warehouses, etc. This beetle infests nearly all sorts of dried plant and animal matter. The eggs are laid on the food, the larvæ working in. Pupation is within a cocoon, and the life cycle is completed in less than two months. Control is by fumigating or by heating to 49° C. Carbon disulphide is the recommended fumigant for grains.

Fig. 2. *The Square-Necked Grain Beetle.*—A reddish brown insect of about 2.5 to 3 mm. in length. This beetle is more abundant in warmer climates, but may be found in heated buildings and warehouses. It eats out the germs of the seed in which it develops. The life cycle is completed in about three weeks. Control as recommended by the U. S. D. A. for grain beetles is similar to that for the drug store beetle.

[1] Sayre, "Organic Materia Medica and Pharmacognosy."

[2] The author is indebted to members of the staff of the Department of Entomology for the identification of the respective beetles.

CRUDE DRUG STOCK FOUND INFESTED.

(*a*) *Infested by the Drug Store Beetle:*

Angelica (rhizome and roots)
Aralia (rhizome and roots)
Asclepias (root)
Aspidium (rhizomes and stipes)
Bryonia (root)
Cichorium (root)
Colchicum (corm)
[1] Euonymus (root-bark)
Glycyrrhiza (rhizome and roots)
Kola (cotyledon)
Lappa (root)
Stillingia (root).

(*b*) *Infested by the Square-Necked Grain Beetle:*

Amygdala Amara (kernel)
Belladonna (root)
Berberis (rhizome and roots)
Calumba (root)
Iris (peeled rhizome)
[1]Iris versicolor (rhizome)
Kava (rhizome and roots)
Rheum (rhizomes and roots)
Sumbul (rhizome and roots)
Zingiber (rhizome).

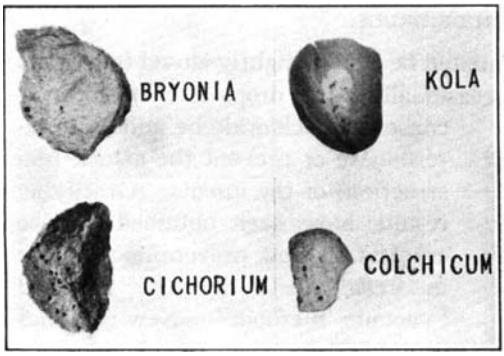

Fig. 3.—Crude drug stock found infested by drug store beetle.

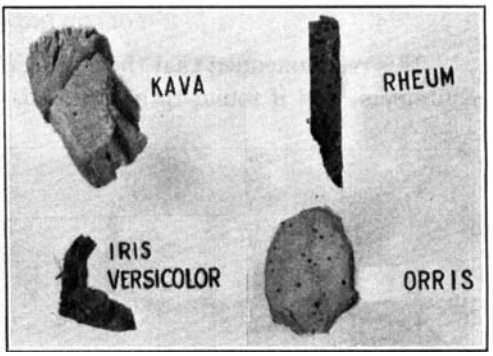

Fig. 4.—Crude drug stock found infested by square-necked grain beetle.

MEASURES FOR DETECTION, PRESERVATION AND EXTERMINATION.

I. Detective Suggestions.—a. Inspection of stock-room, cellars, counters, packages, shelves, containers, laboratories and boxes is essential.

b. Evidences of pest presence: indicated by much powder and broken pieces or bits in bottom of stock containers.

c. Determination of classification of pest—whether beetle, moth, fly, mold, rust, etc. Knowing nature of the pest will assist in determining the proper remedy for effective extermination.

II. Preventive Suggestions.[2]*—a.* Observe sanitation and cleanliness (insect parasites indicate filth).

b. Store only pest-free products.

c. Keep vegetable and animal drugs in a dry, cool atmosphere (preferably in air-tight containers, rooms or bins).

d. Maintain ideal storing temperature—25° C. (77° F.).

III. Combative Suggestions.—Effective methods of extermination.

a. For eggs, larvæ and insects:[3] Expose to temperature of 60° to 65° C. (140° to 149° F.) for about fifteen minutes in case of small amounts of products. For larger quantities of materials the temperature exposures should be from two to three days. Scald and thoroughly dry containers. *Caution:* High temperature with *volatile drugs* is reputed detrimental.

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[1] Infested with both insects.

[2] Dunn, "Insect Friends and Foes," *Am. J. Pharm.*, 104 (October 1932).

[3] Youngken, "Textbook of Pharmacognosy."

b. For insect-infested products.[1] Use of fumigants. Add several drops of carbon tetrachloride or chloroform (about 25 cc. for each 100 cubic feet of drug). Two treatments are advisable, a week or two apart. Either of the above insecticides or preservatives are essential and effective against destruction. Camphor applications are reputed to be useful in the preservation of dried animal drugs.

IV. Requirements of Ideal Pest Exterminators.[2]—*a.* Must arrest growth or destroy parasite.

b. Must be more toxic to pest than host.

c. Must be adherent and maintain activating properties for a certain period of time.

d. Must enter into intimate contact with the parasites or their elements.

V. Vegetable or Mold Parasites[3] (*Spore-Producing Pests*).—Bacteria, fungi, lichens, molds, rusts, mildews and smuts produce fungus diseases. Infest drug stocks exposed to warm, dark, damp atmospheres. This group of pests is thought to deteriorate and decompose the active constituents of products. Moldy drugs result when stocks are stored in damp atmosphere. To prevent destruction keep in dry state.

SUGGESTIONS AND PRECAUTIONS TO BE OBSERVED FOR THE PROPER STORING OF THE FOLLOWING CRUDE DRUGS.

It is recommended that the drugs tabulated be kept in tightly closed (air-tight) containers, and if found to be infested, occasionally a few drops of chloroform or carbon tetrachloride be added to exterminate or prevent the attack (destruction) of the insects. Gratifying results have been obtained for the eradication and prevention of pests in fresh stocks by the so-called "vacuum method." New supplies are placed in a vacuum chamber for several hours and then transferred to air-tight containers for storage.

Fig. 5.—Effective air-tight containers.

This paper is a preliminary report on an investigation being continued in coöperation with the Department of Entomology and the Oregon State Agricultural Experiment Station. The following drugs are tabulated in the report:

Aconite, Aloe, Althea, Bitter and Sweet Almond, Angelica Fruit and Root, Apocynum, Aralia, Arnica, Asclepias, Aspidium, Belladonna Root, Berberis, Bryonia, Calumba, Sweet Flag, Cantharides, Capsicum, Caraway, Chicory, Colchicum Corm, Coriander, Cydonium, Dulcamara, Ergot, Euonymus, Fenugreek, Ginseng, Glycyrrhiza, Hydrastis, Inula, Iris, Jalap, Kava, Kola, Lappa, Linseed, Matricaria, Mezereum, Myristica, Parsley Root and Seed, Phytolacca, Pyrethrum, Pilocarpus, Rhubarb, Sabal, Sarsaparilla, Squill, Senega, Senna, Stillingia, Strophanthus, Sumbul, Tamarind, Trillium, Viburnum, Ginger.

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[1] Kraemer's, "Scientific and Applied Pharmacognosy."

[2] Rusby, Bliss, Ballard, "Properties and Uses of Drugs."

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THE VOLATILE OIL OF HYPTIS MUTABILIS.*[1]

BY HAROLD W. WERNER.[2]

The plant, *Hyptis mutabilis* (L. C. Rich) Briquet, is widely distributed in Florida. It is not, however, generally recognized by the above name, but by the name *H. spicata* (1).

Material for this investigation was collected near Gainesville, Florida. All the plants were apparently of the same race; however, at the time of collection the material was separated into that having green stems and that having reddish stems. The two batches of plant material produced oils which appeared to be identical.

Peckholt (2) and Schimmel & Co. (3) evidently worked with different races of *H. mutabilis* as their oils differed somewhat from the oils produced by the writer. Epling (1) states that several races of the species can be recognized.

RED-STEMMED MATERIAL.

Two hundred and four Kg. of green plant yielded by steam distillation 25 Gm., or 0.012%, of a dark greenish oil with a faint mint-like odor and an after-taste resembling oil of cassia.

The constants of the oil were: 1 volume soluble in 1 to 3 volumes of alcohol, 1 volume insoluble in 4 volumes of alcohol, $d_{25°}^{25°}$ 0.8939, n_D 26° 1.4925, 0% ketones with $NaHSO_3$, 9% ketones with Na_2SO_4, 0% phenols with 4.3% NaOH. $-12^1/_2$° C. did not cause the separation of solid matter. A solution of the oil in CCl_4 was levorotatory.

GREEN-STEMMED MATERIAL.

Two hundred and thirty Kg. of green plant material yielded 46 Gm., or 0.02%, of a dark greenish oil with an odor and taste identical with that of the oil produced from the red-stemmed material.

The constants of the oil were: 1 volume soluble in 1 to 3 volumes of alcohol, 1 volume insoluble in 4 volumes of alcohol, $d_{25°}^{25°}$ 0.8959, n_D 26° 1.4924, acid number negligible, saponification value 7.28, saponification value after acetylation 35.21. $-12^1/_2$° C. did not cause the separation of solid matter. The optical rotation of 4 cc. of oil with 6 cc. of CCl_4 in a 100-mm. tube was −4.18.

Fractionation.—Twenty Gm. of the oil were fractionated four times under atmospheric pressure. Results are shown in the accompanying table.

DATA FOR FRACTIONS.

No.	Boiling Temp. ° C.	$d_{23°}^{23°}$.	n_D 23°.	Gm.
1	160–180	0.8522	1.46874	4.5
2	180–247	0.8800	1.48414	2.5
3	247–263	0.9103	1.49974	6.6
Residue				

* Scientific Section, A. PH. A., Madison meeting, 1933.

[1] From the Department of Pharmacognosy and Pharmacology, University of Florida, Gainesville, Florida.

[2] Professor of Botany and Materia Medica, School of Pharmacy, Duquesne University, Pittsburgh, Pa.