On account of the wide range of subjects in economic entomology requiring attention in California, and the widely separated groups of workers such as at Berkeley, Davis, and Riverside, a meeting of these groups was held during the past year and an organization and division of the work in the state was agreed upon, which as a matter of fact has been in effect since 1914. In administration W. B. Herms, head of the Division of Entomology and Parasitology at Berkeley and Davis, is in charge of the work in agricultural entomology in northern and central California, and is responsible for the work in medical and veterinary entomology throughout the state; H. J. Quayle, head of the Division of Entomology at Riverside and Los Angeles, has general charge of the work in agricultural entomology in southern California, and in so far as the work pertains to citrus over the whole of the state; and H. S. Smith, head of the Division of Beneficial Insect Investigations, has general charge of this work for the entire state.

It is not necessary here to go into detail with reference to further division of the entomological work in northern California. In southern California the research work on subtropical fruit insects is in charge of H. J. Quayle; that of beneficial insect investigations in charge of H. S. Smith; spraying investigations is in charge of R. H. Smith; walnut, deciduous fruit and certain subtropical fruit insects in charge of A. M. Boyce, who will also be in charge of the teaching work at the University of California at Los Angeles; and P. H. Timberlake is in chage of the collection and taxonomic work.

Scientific Notes

Propylene Dichloride as a Fumigating Material. Some years ago in the United States Department of Agriculture Bulletin 1313, experiments with various organic materials were detailed. Among the more efficient ones was propylene dichloride, which at that time was not available because of the high cost. Within the last few years this material has become available and the price very comparable with that of carbon disulphide. Laboratory and field tests with this material against various grain-infesting insects shows that mixtures of this material can be considered as efficient as carbon disulphide for fumigation against grain-infesting insects, without the fire hazard attending the use of the former material.

RAY HUTSON, *Department of Entomology, Michigan State College*

The Gladiolus Thrips, *Taeniothrips Gladioli* M. and S., in California. This thrips, which has recently become a pest of gladioli in many eastern and middle western states (and Canada), has been collected in southern and central California. It was first collected in California on April 30, 1932, by Mr. S. N. LaFollette, county agricultural Inspector, and Dr. Weigel of the Federal Bureau of Entomology, on the property of W. A. Ritto, La Habra Heights (Los Angeles County).

Since the first record of the taking of this thrips in California, it has been collected in about fifty localities in Los Angeles County and in the southern counties of Ventura, San Diego, and Orange. The author collected *T. gladioli* at Davis (Yolo County) on July 16, 1932. All the collections were made from gladioli. Many of the infestations in the south were rather severe. The infestation at Davis was very light and an inspection of the corms has revealed no thrips on them since harvest.

T. gladioli has not as yet been followed through the winter in California but can no doubt readily survive in the field on other hosts.

STANLEY F. BAILEY, *University of California, Davis, California*

Arsenic in Bait-Poisoned Grasshoppers. Frequently the question is raised as to how much arsenic bait-poisoned grasshoppers contain. Following the spreading of some arsenical bait, prepared according to the Standard Government Formula, containing 5 pounds of arsenious oxide per 100 pounds of bran, a number of grasshoppers were collected for analysis. They were sorted approximately according to the three sizes shown in the illustration and analyzed for arsenious oxide according to the official Gutzeit procedure of the A. O. A. C. The results, also shown in the illustration, may be considered as average as the duplicate samples analyzed contained from 100 to 200 grasshoppers each. More arsenious oxide per grasshoppers was found than anticipated, and more than should be necessary to kill. This no doubt must be due to their large feeding capacity. According to the results, it would require 410, 304, and 259 grasshoppers of sizes A, B, and C respectively to yield one grain of arsenious oxide. The quantity of the poison found is somewhat proportional to their size and feeding capacity. The results indicate that the standard bait is quite attractive and palatable to the grasshoppers and that it is an economy to poison grasshoppers while they are young and small.

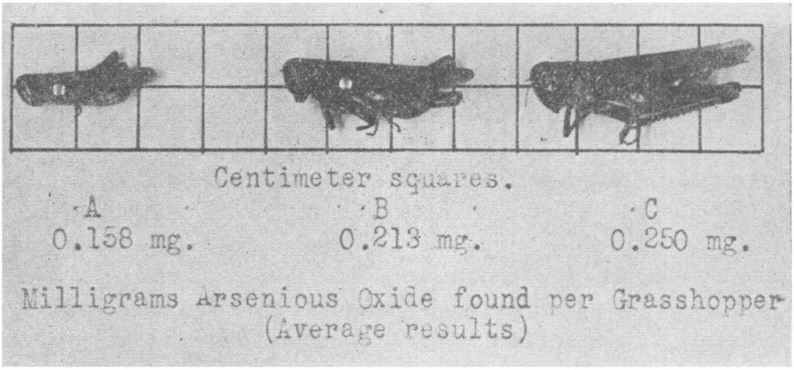

FIG. 25.—Grasshopper bait-poisoning results.

T. H. HOPPER, *Agricultural Chemist, North Dakota Agricultural College*

Parasites from a Bird's Nest. It is of interest to note the varied collection of insects taken from the vacated nest of a pair of purple martins (*Progne subis*), immediately following the past nesting season.

The flea *Ceratophyllus idius* Jordan and Rothschild, which a few years ago had been collected from a similar situation, was particularly numerous. Well over one hundred specimens were found in the nest, together with a few larvae. This flea was originally taken from the tree swallow (*Iridoprocne bicolor*) in British Columbia, a bird having somewhat similar nesting habits to those of the purple martin, and which is a common summer resident in this part of Canada.

The next most numerous insect inhabitant of the nest was a calliphorid fly, *Protocalliphora splendida* MacQ. One hundred and twenty-one pupae of this fly were taken, from which a few adults were reared; 92.74 per cent of the pupae were parasitized by a chalcid, determined as being *Mormoniella vitripennis* (Walk.).

In addition to the three foregoing species, one *Dermestes lardarius* Linn. adult and several larvae, and three psocids, *Troctes divinitoria* Linn., were also taken from the nest.

C. idius was determined by Dr. Carroll Fox, *P. splendida* by Mr. C. H. Curran, *M. vitripennis* by Dr. C. F. W. Meusebeck and *T. divinitoria* by Dr. A. N. Caudell.

W. E. WHITEHEAD, *Macdonald College, P. Q.*

Abia americana **(Cresson) on** *Lonicera*. While this is a well known species of sawfly, there does not seem to be any easily available record of its host plants or life history. On April 12, 1930, my attention was called to a heavy infestation of sawfly larvae on a cultivated climbing honeysuckle (probably *Lonicera japonica*) in a Sacramento yard. No adults were obtained from these larvae as they had all been poisoned. On April 20, 1932, I again had an opportunity to collect larvae of this sawfly, this time on a hedge *Lonicera* of the *nitida* type, also in Sacramento. After feeding this second lot for about ten days, they formed the characteristic brownish sawfly cocoons on the sides of the bottle or the surface of the soil. As no adults had emerged by June 20, one bottle was placed in a refrigerator at about 40–45 degrees F. On November 9, this bottle was removed from the low temperature and adults emerged about November 20, 1932. This would seem to indicate that the species is single brooded and that the larvae require low winter temperatures to prepare them for pupating. I am indebted to Mr. H. H. Ross, Urbana, Illinois, for the determination. For further information on this insect, see Howard's Insect Book, The Hymenoptera of Connecticut, and Insects of Western North America (Essig).

H. H. KEIFER, *California State Department of Agriculture, Sacramento, California*

Rhizopertha dominicana **as a Library Pest.** For several years the books of the library of the School of Tropical Medicine have been infested by a small beetle. Specimens sent to Mr. A. Mutchler of the American Museum of Natural History were identified as *Rhizopertha dominicana* (Bostrichidae). This cosmopolitan form is known as a museum pest according to Miss I. Hawes of the Bureau of Entomology, who kindly consulted the literature pertaining to this species. No record of injury to books was found. Usually the beetles confine their activity to the inner portion of the back, though occasionally small discrete holes not unlike those of isolated termite borings in books could also be noted in the boards. A considerable amount of frass on the shelf beneath the volumes that had not been moved for some time served to indicate the presence of the insect. The binding becomes loose and less durable as a result of invasion.

Approximately a year and a half ago fumigation was resorted to. The library room and a small connecting annex have a volume of 10,320 cu. ft. Five pounds of Cyanogas A dust were spread over newspaper placed on the floor, and sprinkled with water. Doors and windows had been sealed with adhesive paper. After an exposure of 36 hours numerous dead larvae and adults were encountered on the shelves and shaken from the volumes themselves. A few living adults were also found in books. Within a few months they appeared to be as abundant as before.

One year later the operation was repeated in a similar manner except that ten pounds of the fumigant were used. At present, six months after the second fumigation there is no evidence to indicate the presence of this species. To prevent re-infestation by means of volumes not in the library at the time of fumigation, an air tight case suitable for fumigation has been prepared.

W. A. HOFFMAN, *School of Tropical Medicine, San Juan, P. R.*

A Braconid Parasite of a Coccinellid New to Puerto Rico. In March 1931 the writer investigated, in company with Mr. Fernando Chardón of the Insular Experiment Station, reports of a severe outbreak of the yellow cane aphis, *Sipha flava* Forbes, at the East end of the Island. A large field of young plant cane at a Central near Aguadilla was especially badly infested. The common Coccinellid beetle, *Cycloneda sanguinea* L., was exceedingly numerous thruout this planting and it was at first wondered how the outbreak of aphis could have progressed to such an extent in the face of such numbers of its predators. Pupae of the ladybeetle were unusually numerous on the cane leaves but upon examination at least 90% of them proved to be dead, with a neat round hole about the diameter of the lead in a pencil in the body wall of each. Larvae or pupae were found within many of the beetle pupae from which the parasites had not yet emerged. Unfortunately nothing but several small vials of alcohol were available for the preservation of the material so that no adult parasites were reared. A few of the Coccinellid pupae were placed in alcohol however.

Recently several of the parasite pupae and two of the adults which had emerged in the alcohol were sent to Dr. Morrison of the U. S. Bureau of Entomology for determination. Thru his kindness Mr. C. F. W. Muesebeck has been good enough to report that the two adults and one of the pupae are *Homotylus terminalis* Say and that the two remaining pupae evidently represent a Pteromalid. This is apparently the first record of *H. terminalis* from Puerto Rico. *H. obscurus* Howard however was recorded by T. H. Jones as parasitic on *Cycloneda sanguinea* L. and *Megilla innotata* Mulsant at Rio Piedras in 1912 (See Wolcott's "Insectae Portoricensis" Jour. Dept. Agr. P. R. 7 (1): 66, 1923—published 1924).

M. D. LEONARD, *formerly Entomologist, Insular Experiment Station, Rio Piedras, P. R.*

Control of an Infestation of the Cigarette Beetle in a Library by the Use of Heat. Cases frequently arise in which it is not desirable to fumigate a room with poisonous gases in order to eradicate insect pests. The writer was recently asked to advise as to control measures to be taken for an infestation of the cigarette beetle (*Lasioderma serricorne* Fab.) in the library of the U. S. Circuit Court of Appeals in the post office building, New Orleans, La. The building was situated in a congested business section and was continuously occupied so that the use of hydrocyanic acid gas would have been attended with some danger. Accordingly it was decided to try to eradicate the beetles by the use of heat. A gas burner with a capacity of 2½ cubic feet per minute was installed and a temperature of 140–145° F. maintained for six hours. Electric fans were used to secure an even distribution of heat in the room which measured 100 by 21 by 15 feet. The mean outside temperature for the day of treatment was 86° F., minimum 78°F., maximum 94°F. The books were loosened sufficiently to permit the hot air to circulate between the volumes.

Previous to the treatment the beetles were working in the leather bindings of books in all parts of the library, many volumes having been so badly injured as to need rebinding. Three days after treatment, an examination of books from different parts of the library showed many dead larvae, pupae and adults. No live insects could be found. Another inspection made 37 days later also showed no living insects. Since the longest incubation period reported by Runner[1] is 14 days, the absence of any living larvae in the second inspection showed that the eggs also had been killed.

The bookshelves were of steel, but wooden desks and tables were not removed from the room. They were not harmed by the high temperature. The books were bound in sheepskin, and buckram and withstood the heat without injury.

A. W. Cressman, *Associate Entomologist, U. S. Bureau of Entomology, Fruit and Shade Tree Insects Division, New Orleans, La.*

The Flannel Moth in Arizona. The middle of October this year my attention was called to a very unusual prevalence of flannel moth larvae in private grounds near Douglas, Arizona. The insects had inflicted most painful and serious injuries upon a number of persons and had caused the owner of the grounds to resolve to remove his shade trees in order to get rid of the pests.

Upon visiting the grounds I found that the larvae were present in enormous numbers, devouring the foliage of mulberry, apricot, pomegranate, apple and perhaps other trees, though shunning peach foliage. They were forming cocoons in solid masses under the eaves of the stone buildings, on stone walls, in "window corners," under boards on the ground and elsewhere.

As no definite method of control had apparently been worked out for these insects, I began to devise methods of procedure, suggesting that the cocoons be removed from the surfaces to which they were attached and destroyed, that more favorable sites for pupation be provided, such as throwing down additional boards on the ground around trees, and setting up shelf boards on the sides of walls. Apparently attempts had been made to poison the worms by the use of lead arsenate spray, and it was said that the larvae either did not eat the sprayed foliage or were not affected by it.

A workman had thrown an old pair of trousers through a crotch of a tree some two weeks earlier and it was found that about 100 cocoons had been made in and around this garment, which suggested that the trees might be loosely wrapped with sacks or old clothing as a means of collecting large numbers of cocoons.

Instances have been previously reported to me of injury resulting from the poisons of flannel moth larvae in this vicinity. A few trees in the city of Douglas have been found infested sufficiently to do some damage to the trees. Cocoons and larvae sent to the Bureau at Washington were identified by Mr. Heinrich as *Megalopyge bissesa* Dyar (?). Two other species of the Megalopygidae are extremely common in the Sulphur Springs Valley of this County. One of them, belonging to the genus Norape, completely defoliates the mesquite over many acres of ground each autumn. The

[1]Runner, G. A. The Tobacco Beetle, an Important Pest in Tobacco Products. U. S. D. A. Bull. 737, 1919.

other occasionally denudes hackberry trees. The latter two have not been known to inflict injuries on persons handling them. I have gathered a large number of specimens without being in any way affected. It is true also that one could quite easily handle the larvae of the species of Megalopyge above described so long as the insects did not come in contact with the unworn surface of the hand.

WYATT W. JONES, *Douglas, Arizona*

Coleoptera Captured in Japanese Beetle Traps.[1] Many species of insects are captured in Japanese beetle traps either because of the attraction of geraniol and eugenol in the bait or because the traps themselves, through their mechanical construction or color, are attractive. Because of the tremendous numbers of the Japanese beetles present in the trap containers it is usually impracticable, in an area heavily infested by that insect, to ascertain what species are thus captured. During 1932, however, nearly 400 traps were located in a pasture near Woodstown, N. J., and were baited before the Japanese beetle had emerged to any appreciable extent. This pasture was surrounded by a field planted to asparagus on the north, one in corn on the east and south, and by a pasture and potato field on the west. At this time (June 25–30) it was possible to collect from the traps many species which had never been taken previously. Even later in the season, when the Japanese beetle catch was heavy, a few species were found in such numbers as to be noticeable in large quantities of this insect.

The following is a list of Coleoptera taken from the traps. In many cases the number was so large that an accurate count could not be made in the time available and an estimate is made on the basis of one day's collections. It will be noted that the list includes several species of economic importance which were taken in considerable numbers. Species of other orders are not given because the collection and identification of these individuals constituted a task requiring considerable more time than was available.

Scarabaeidae	Number of individuals
Pinotus carolinus (L.)	25
Onthophagus hecate Panz	30
Onthophagus pennsylvanicus Harold	12
Onthophagus nuchicornis (L.)	16
Aphodius fossor (L.)	10
Aphodius haemorrhoidalis (L)	25
Aphodius fimetarius (L.)	45
Ataenius cognatus (Lec.)	11
Serica sp	5
Trox insularis Chev. (trap near dead chicken)	11
Diplotaxis sordida (Say)	1
Phyllophaga ephilida (Say)	200
Phyllophaga futilis Lec.	125
Phyllophaga fervida (Fab.)	15
Phyllophaga hirticula (Knoch)	120
Macrodactylus subspinosus (Fab.)	500
Pachystethus lucicola (Fab.)	13
Pelidnota punctata (L.)	5
Ochrosidia villosa (Burm.)	90
Dyscinetus trachypygus (Burm.)	250
Ligyrus gibbosus (DeG.)	175
Cotinis nitida (L.)	300
Euphoria fulgida (Fab.)	1
Euphoria herbacea (Oliv.)	14

[1]Contribution No. 109 from the Japanese Beetle Laboratory, Moorestown, N. J.

Of other families:

Carabidae	
Lebia grandis Hentz	300
Harpalus pennsylvanicus DeG	150–200
Harpalus faunus Say	150–200
Hydrophilidae	
Sphaeridium scarabaeoides (L.)	750
Sphaeridium bipustulatum Fab.	63
Silphidae	
Silpha americana L.	11
Cantharidae	
Chauliognathus marginatus Fab.	500
Elateridae	
Alaus oculatus (L.)	3
Melanotus sp.	400
Chrysomelidae	
Chrysochus auratus (Fab.)	25
Leptinotarsa decemlineata (Say)	200
Diabrotica duodecimpunctata (Fab.)	23
Diabrotica vittata (Fab.)	41
Curculionidae	
Hypera punctata (Fab.)	18
Other weevils	250

F. W. METZGER and R. J. SIM, *U. S. Bureau of Entomology, Moorestown, N. J.*

A Note on the Hibernation Habits of some Engraver Beetles of the Genus Ips. While it is the general habit of bark beetles to hibernate under the bark of the trees that have served as their larval hosts, such a habit is not universal. For many years it has been known that species of *Phthorophloeus* (*P. liminaris* Harr. and *P. frontalis* Zimm.) usually leave their larval host and bore into the bark of healthy trees of the same species and hibernate near the juncture of the dead and living bark. Several cases are on record in the files of the Division of Forest Insects of species of the genera *Ips*, *Pityogenes*, and *Pityophthorus* leaving their larval host in the fall, entering either dead, dying, or living trees, and hibernating under the bark in closely packed masses. Also in 1927 Watson published an account of the hibernating habits of the bark beetle, *Ips perturbatus* Eichh., showing that the adults leave their galleries in spruce in the fall of the year and descend into the ground to pass the winter. As far as known, this is the first published record of the habit for this genus in North America.

Recently, in studying the seasonal history of the western pine beetle (*Dendroctonus brevicomis* Lec.) infesting ponderosa pine (*Pinus ponderosa*) near Prineville, Oregon, wire cages were attached to the trunks of infested pines in such a way that emerging insects fell into and were caught in collecting jars. These cages, which enclosed about 2 square feet of bark surface, were put in place late in October without disturbing the natural conditions in the bark or the action of normal temperature or moisture.

It was thought that all activity had ceased for the winter, as the weather had turned cold and rainy with intervals of light snows. Despite these unfavorable weather conditions, we were surprised to find a rather heavy emergence of *Ips emarginatus* Lec. and *Ips oregoni* Eichh. during October and through November until after Thanksgiving. Apparently their habit is to leave the bark in the fall of the year, drop straight down to the ground, and then seek shelter at the base of the trees.

The question as to what these emerging beetles were doing became of interest, and a search of the soil at the base of the trees was made. The engrâver beetles were found at the ground level and to a depth of 3 inches below, hibernating in the outer bark flakes and crevices. The usual method was for an adult to select a fairly thick bark flake and bore a slightly curved tunnel into its interior to a depth of about half an inch. In these short tunnels, each containing only one adult, the Ips beetles were found prepared to pass the winter. A little search revealed large numbers of both species concealed in these improvised shelters.

All of the adults do not necessarily descend to the ground to hibernate, for an inspection of the bark showed numerous adults hibernating in the old tunnels. One of the characteristic habits of the bark beetles of this genus is for the hibernating new adults to congregate in large groups under the bark by chewing away the partitions between their pupal chambers. This has been noted for *Ips confusus* Lec. in single-leaf piñon (*Pinus monophylla*), for *Ips radiatae* Hopk. in lodgepole pine (*P. contorta*), and for *Ips vancouveri* Sw. in western white pine (*P. monticola*). This habit, like the ground-hibernation habit just described, is probably characteristic of other members of the genus.

Other secondary insects emerging in large numbers from the bark late in November and probably hibernating in the ground included adults of the staphylinid *Nudobius pugetanus* Csy. (found abundantly in crevices of bark below ground), of the rhizophagid *Rhizophagus sculpturatus* Mann., of the colydiids *Lasconotus complex* Lec., *L. subcostulatus* Kraus, and *Aulonium longum* Lec., and of the tenebrionid *Hypophloeus substriatus* Lec. The most abundant larvae emerging at this time included a small undetermined dipteron (a cecidomyiid) and larvae of the clerid, *Enoclerus lecontei* Wolc. The latter build silk-lined pupal cells under bark flakes at the ground line or below. Some 20 other species of insects commonly found in the bark of trees killed by the western pine beetle were also collected in small numbers. But the emergence of these did not indicate a general exodus for hibernation purposes.

From a total of 16 cages not a single western pine beetle was collected, even though all of the cages were over bark primarily infested by this beetle.

F. P. KEEN, *Entomologist, U. S. Bureau of Entomology*

Notes on a Coccinellid (*Hyperaspis 8-notata* **Casey**) **Predacious on Citrocola Scale** (*Coccus pseudomagnolarium* **Kuwana**) **in Tulare County, California.** The writer has for a number of years been interested in the subject of the biological control of our major insect pests. The following notes deal with a Coccinellid predacious on Citricola scale, (*Coccus pseudomagnolarium* Kuwana), in Tulare County.

The larvae of this Coccinellid was first noticed by Mr. Herman French of the Tulare County Agricultural Commissioner's office, in an abandoned orange grove near Terra Bella, in May 1929. (He brought some into the office for determination because of their superficial resemblance to mealy-bugs.) Adult beetles reared from the specimens he collected and other larvae taken in the same grove were found to be *Hyperaspis 8-notata*, Casey.

This specimen was described by Casey in 1899, from specimens from Arizona. It is rather easily identified by its large size and its broadly rounded and strongly convex shape. It is larger than any of our California species of Hyperaspis, with the exception of *Hyperaspis lateralis* Muls. The elytral ornamentation consists of a humeral marginal elongate spot, a rounded marginal spot behind the middle, a rounded subapical spot and a discal spot shaped like a broad crescent. The larvae are covered with long white waxy filaments such as in some mealy-bugs, which they greatly resemble.

This ladybird is presumably of rather recent introduction into this State. Until 1929 there were but four specimens in the Academy of Science collection in San Francisco, and all of these were from Arizona.

In 1928 the writer took this species in large numbers feeding on Monterey Pine Scale (*Physokermes insignicola* Craw) on Monterey Peninsula. I have also taken them in Sequoia National Park in very limited numbers, the host in this case being unknown.

Repeated collections were made in the orange grove near Terra Bella where this insect was first noticed. Their numbers increased during June, July and August in spite of the very hot weather. This being an abandoned grove, the Citricola scale was very plentiful. During the Fall, however, most of the trees died from lack of water, and the remainder were in such poor condition that they were entirely defoilated and died in the Spring of 1931, thus putting an end to observations in this plot.

In the Spring of 1931 another orange grove was found, near Porterville, in which there were a number of larvae of this beetle. By July the adult population was, in some cases, as high as 200 per tree. Part of this orchard was left unsprayed and it was hoped that some check on the value of this insect in controlling Citricola scale may be obtained, by next Spring.

With the exception of *Chilocorus bivulnerus* var. *orbus*, Casey, which was occasionally taken with the above species this is the only Coccinellid that I have observed or can find any record of feeding on Citricola scale, at least, in the San Joaquin Valley.

F. T. SCOTT, *Visalia, Calif.*

The Toxicity of the Common Castor-Bean Plant in[1] Respect to the Japanese Beetle. The common castor-bean plant (*Ricinus communis* L.) is not considered one of the favored food plants of the Japanese beetle (*Popillia japonica* Newm.) although occasional feeding on its foliage had been noted prior to 1932. During the winter of that year, articles appeared in two trade journals (Charles H. Landreth. "A New Way to Destroy the Japanese Beetle." Horticulture, Vol. X, No. 4, p. 74. Feb., 1932; Burnet Landreth, Jr. "Castor-oil Bean vs. Japanese Beetle." Florists Exchange & Horticultural Trade World, Vol. LXXIX, No. 18, p. 35. April, 1932) to the effect that a large-scale seed grower in the area heavily infested by the beetle reported this insect as being attracted to certain varieties of castor-bean foliage in considerable numbers. It was also stated that these beetles fed extensively and, as a result, were killed. The use of this plant as a killing agent for the beetle was widely advertised and it became evident that many would be planted because of their alleged value in this respect.

A series of tests was conducted during the summer of 1932 to determine the attractiveness and toxicity of the castor-bean plant in relation to the Japanese beetle. Twenty plants of each of six varieties, namely, Cambodgiensis, Panormitanus, Gibsoni, Red Spire, Sanguineus, and Zanzibariensis, were grown at Moorestown, N. J. Leaves of each variety were also used in cages under carefully controlled conditions, and many observations were made on numerous castor-bean plants growing in the area heavily infested by the Japanese beetle.

As a result of these observations and tests, it was evident that beetles fed on the varieties Sanguineus and Zanzibariensis but that the others were practically immune. This feeding was more pronounced after the seed pods had developed, but only in

[1]Contribution No. 110 from the Japanese Beetle Laboratory, Moorestown, N. J.

isolated cases was it of any appreciable extent, the most striking example being where castor-bean plants were located near a bed of Evening primrose (*Oenothera biennis* L.), an outstanding food plant of the beetle. Dead beetles were found under these plants in considerable numbers, but this mortality could not be attributed entirely to the castor-bean, as repeated observations have shown that dead beetles can always be found under plants which are heavily infested by this insect. Under certain field conditions, however, it appears that castor-bean foliage is toxic to the beetle.

In the cage tests, the beetle fed on castor-bean foliage to a limited extent, this being appreciable only on Zanzibariensis. In two tests, 20 per cent of the leaf area was eaten during a three-day period, with a resulting mortality of 17 per cent. In the check cages containing smartweed (*Polygonum pennsylvanicum* L.), a favorite food plant of the beetle, the plants were 75 per cent defoliated, with a mortality of 15 per cent. Cages with both castor-bean and smartweed showed 20 per cent feeding on the former and 75 per cent on the latter, the mortality being 10 per cent. These tests indicated that the castor-bean foliage was practically non-toxic. The data are somewhat contrary to those obtained under field conditions, where, as stated above, some beetles do appear to have died as a result of feeding on castor-bean leaves.

The tests proved conclusively, however, that no tested variety of castor-bean was sufficiently attractive to the beetle to induce the insect to leave favorite food plants in the immediate vicinity. The heaviest infestation on castor-bean plants was noted some time after the height of the beetle season at a period when favorite food plants had been severely injured. On the basis of present information, the castor-bean is of little or no value as a trap plant for the beetle under usual field conditions.

A similar condition is found on certain species of geranium, *Pelargonium* spp. (C. H. Ballou. Journ. Econ. Ent., Vol. 22, No. 2, pp. 289–293. 1929) and on silver-bell tree, *Halesia carolina* L. (H. Fox, unpublished, 1932).

F. W. METZGER, *U. S. Bureau of Entomology, Moorestown, New Jersey*

Outbreak of Grasshoppers in Tennessee During 1932. The past summer witnessed an unusually large increase in the abundance of grasshoppers in Tennessee. So far as the records show, this is the first year that these pests have been of economic importance. From time to time various species have been reported in injurious numbers in different sections of the State, but at the most they were only of minor importance. This year, however, the outbreak was general over the State. Maury County, in Middle Tennessee, suffered the greatest loss.

The most common species, the bird grasshopper (*Schistocera americana* Drury), caused most of the losses, especially in corn and other field crops. The red-legged grasshopper (*Melanoplus femur-rubrum* De Geer) was less abundant and was usually found in pastures and alfalfa fields. Other species were also more abundant than usual, but of little importance compared to the two species mentioned above.

The unusual abundance of the grasshoppers clearly indicated that next year greater loss may occur unless the outbreak is retarded by parasites and unfavorable climatic conditions. It was therefore deemed advisable to perform experiments with poisoned bran mash to determine the best formula for use in Tennessee.

At Columbia, Maury County, on September 16, 1932, a single large experiment under field conditions was conducted with the red-legged grasshopper to determine the best formula for poison bran mash, and the temperatures most favorable for feeding. The formulas used contained, in addition to bran and water, sodium fluosilicate, amyl acetate, and molasses; sodium fluosilicate and molasses; and sodium fluosilicate alone (with only bran and water). Paris green was used in similar combinations. On a basis of 100 pounds of bran, the materials were added as follows: Poison 4 pounds, molasses 2 gallons, amyl acetate 3 fluid ounces, and water 10 gallons. Analysis of the data by methods similar to those used by J. R. Parker (Minn. Agr. Exp. Sta. Bul. 214, p. 8) showed that the formula containing sodium fluosilicate, amyl acetate, and molasses ranked first. Sodium fluosilicate alone ranked second, and Paris green, amyl acetate and molasses ranked third. The remaining formulas were much less efficient. The data also showed that baits containing sodium fluosilicate attracted more grasshoppers than those containing Paris green.

The high toxicity of sodium fluosilicate has been well established (Marcovitch, Bul. 139, Tenn. Agr. Exp. Sta., 1928). Recently Richardson and Haas, working with *M. femur-rubrum* and *M. differentialis* (Jour. Econ. Ent. Vol. 25, 1932, pp. 1078–1088), showed that the M. L. Ds. for sodium arsenites, Paris green, and sodium fluosilicate are approximately the same. Of the poisons used by Richardson and Haas, they found no visible indication of olfactory or gustatory repellence. But when grasshoppers were allowed to feed *ad libitum* on poisoned bait, they found that on the average about twice as much of the baits containing sodium fluosilicate was consumed than of baits containing the sodium arsenites or Paris green.

From these experiments, sodium fluosilicate appears to be fully as effective in poison baits as Paris green. In addition, the sodium fluosilicate is much safer to handle and is less poisonous to man and livestock.

It was found that the addition of amyl acetate to baits containing molasses greatly added to their attractiveness.

Observations showed that for the optimum feeding period soil temperatures ranged from 80°F. to 109°F., air temperatures (not in shade) 12 inches above ground level, from 72°F., to 91°F., and air temperatures 30 inches above ground level, from 72°F., to 88°F.

A parasitic fly was fairly abundant. This fly was tentatively identified by J. M. Aldrich, U. S. N. M., as *Sarcophaga aculeata* Aldrich.

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Why Not Bourgault's Trap for Horse-Flies? Tabanidae have long been recognized as serious pests to live-stock. The injuries caused by these annoying flies are of a diverse nature, the more important of which are:

1. Loss of blood through the bites of the flies and a consequent reduction in the vitality of the animals attacked.
2. Disturbance of normal feeding and resting during the hours of the day when the flies are most active, which in some localities is said to be from 10 a. m. to 5 p. m.
3. Transmission and dissemination of diseases.

These and many others have made the study of Tabanidae, and a possible method of their control, of supreme economic importance, and in this country several investigations have been conducted by the Government and private institutions. Such were the motives for the studies made by Hine in Louisiana in 1903 and 1906, and supplemented in 1922 by Jones and Bradley. The U. S. Department of Agriculture undertook a study of Tabanidae in Antelope Valley (Nevada) in 1915, and the University of Arkansas in that state in 1927–28 with similar ends in view.

As a result of these investigations various remedies were proposed, such as the drainage and clearing of swamps and woods, the collecting of Tabanid egg-masses, the dissemination of egg parasites, and the application of kerosene to the surface of pools which the flies frequent.

But these remedies do not offer the cattle-grower any immediate, practical relief. Draining and clearing are long-term projects; collecting egg-masses is tedious and not convenient in all situations; while kerosene is not applicable to larger bodies of water.

Why not try the fly-trap devised by M. R. L. Bourgault du Cordroy for *Stomoxys* in Mauritius?

The trap is very simple and inexpensive, and the results are said to be excellent and rapid.

The entire trap consists of:

1. A darkened, partitioned building with entrance and exit doors.
2. A brush of leaves and branches.
3. A lighted chamber into which the flies are attracted after they are brushed off the animal, and where they are afterwards destroyed.

Ten minutes are said to be sufficient for a herd of hundred oxen to enter the building, pass through the brushes, and come out the other end of the trap freed of the flies. After the first day, the cattle "go to the trap themselves and sometimes at a gallop."

Instead of taking the entire herd through the trap, one black, preferably tailless animal, is driven through the field, and when a number of flies have collected on its body, it is passed through the brushes.

The great value of the trap as a fly-catcher is testified by the Director of Agriculture of Mauritius, by the Government veterinary surgeon, and by estate managers and planters who saw the device in operation.

Stomoxys are terrific pests here also, at times, and the trap designed especially for these flies elsewhere would prove of real value in reducing their number in this country as well.

The trap can also be adapted for the destruction of Tabanidae on the ranches of our Western cattle-growing sections where they are a serious menace. The difference in the habits of Stomoxys and Tabanidae must be taken into consideration. While Stomoxys frequent barns and stables and at times enter dwellings, Tabanidae are primarily flies of the green field, the swamps, and the wooded area. They very seldom enter buildings, and may not react to the trap in the same way as Stomoxys does. But advantage may be taken of their feeding habits. According to the observations of Webb and Wells (1924) in Antelope Valley, a female completes her full meal of blood in about 10 minutes. During that time the fly is not easily disturbed, and does not withdraw until it feeds to satiety. If the animals can be trained to go through the trap automatically, as testified, the flies would be trapped and brushed off while feeding. A trap constructed conveniently in the pasture would be a real aid in relieving the cattle of these annoying flies.

A detailed description of the device and illustrations of the patented "Trap for Destruction of Cattle-flies," is given in the Journal of the Royal Army Medical Corps, Volume LIV, No. 3, pp. 208–211. London, March, 1930.

BERNARD SEGAL

Comparative Toxicities, with Special Reference to Arsenical and Fluorine-Containing Insecticides. With the increasing complexities of present day civilization mankind is being subjected to an ever expanding number of chemical elements and their compounds. The possibility of acute poisoning and chronic intoxication by these new factors in man's environment is a subject of great importance to the public health. The causes of acute poisoning are more or less easily recognized and measures of treatment and prevention can be adopted relatively early. The insidious nature of *chronic intoxications, and the consequent greater difficulty* of *relating symptoms to the causative agent, make this form of toxicity a subject of greater concern to the public health.*

One of the many avenues through which we are being subjected to possible chronic intoxication is the widespread and increasing use of insecticides. The ideal and perhaps unattainable insecticide is a substance of high acute toxicity to a wide variety of insects and zero or negligible toxicity, both acute and chronic, to man. Because of the lack of such a substance, we are forced into the position of considering the comparative toxicity to man of various insecticides and of selecting the lesser evil.

It is important to review briefly the fundamental points which should be borne in mind when making such comparative studies. Regardless of whether we are concerned with acute poisoning or chronic intoxication, the difficulty of species differences is met with at the outset. Data must be obtained experimentally, on lower animals preferably, on a variety of species, and then tentatively transferred to man on the assumption that the threshold for the development of toxicity in man is no lower than the average threshold in other species.

The procedure for obtaining comparative data in acute toxicity is fairly simple. The substances whose toxicity is to be compared should be administered by the same route, subcutaneously, intramuscularly, intraperitoneally, intravenously, or by inhalation, and the same criteria for judging toxicity must be employed. Usually, a comparison is made of the dosages required to produce death in an arbitrary percentage of the animals, say 50 per cent. Under certain circumstances, it may be more desirable to make comparisons in terms of the effects on pulse rate, blood pressure, respiratory rate, temperature, or motor activity, as indicated by the degree of excitation or depression. Because of species differences, the toxicities of two substances must always be compared for the same species. Lastly, the substances should always be administered in the same form. For example, if the toxicity of a given metallic salt is being compared with the toxicity of bichloride of mercury, it is essential that the same solvent be employed. The toxicity of bichloride of mercury in distilled water is greater than when it is dissolved in sodium chloride solution, and much greater than when it is dissolved in potassium iodide solution. The formation of complex ions, particularly in potassium iodide solution, is responsible for a marked reduction in toxicity. Briefly, a uniformity of all conditions and criteria of judgment is essential for significant comparative data.

The comparison of the ability of two or more substances to produce chronic intoxications is more difficult and less satisfactory. We are not interested in knowing the daily dosage per unit of body weight which will eventually kill the average individual. Instead, we are interested in the daily dosages per unit of body weight which will produce an undesirable deviation from normal without killing an individual. Interference with growth or production of loss in body weight of an adult is often utilized as a basis for judging chronic intoxication. But this may reasonably be considered as an insufficiently delicate criterion. Before lack of growth or loss of body weight occurs, there may be other symptoms sufficient to condemn a substance completely, or to require a decrease in the daily intake, e. g., a loss of hair, change in appearance of teeth, drying of skin, nervous manifestations, insomnia, etc. How are we to compare the ability of two substances to produce chronic intoxication when the undesirable symptom in one case is loss of hair, and in the other case an abnormal whitening of the teeth? Some individuals may prefer loss of hair and some whitening of the teeth. Obviously, that abnormality is least desirable which reflects the most deep-seated harmful disturbance of the organism. Perhaps the loss of hair is a manifestation of a disturbed cysteine metabolism, a disturbance of the role played by the sulphydryl groups in oxidation and reduction; perhaps the abnormal teeth reflect a disturbed calcium metabolism.

There is justification, therefore, in considering chronic intoxicants individually, each on the basis of its own peculiarities and the extent to which it may menace health. But, if comparisons must be made, then uniformity of experimental conditions must be adhered to. Comparisons must be made on the same species, with the same mode of administration, and with the experimental animals under uniform conditions of sanitation and quality of food. The toxic agents should be administered in the form and in the manner in which the living organism would come in contact with the material naturally.

At the present time it is desirable to find a good substitute for lead arsenate as an insecticide. Various fluorine-containing compounds, such as cryolite and barium fluosilicate, are being advocated. Comparative toxicity data have been published showing that the fluorine compounds are less toxic than lead arsenate. Marcovitch[1] has recently stated that a comparison of the amounts of arsenic and fluorine compounds necessary to retard growth of rats shows the fluorine insecticides to be 100,000 times safer than arsenic insecticides, but that in view of the fluorine normally present in foods, the marginal safety factor in 75. Recent investigation has shown that a definite abnormality of teeth may be produced in experimental rats by concentrations of fluoride which do not retard growth. Smyth and Smyth[2] compared the relative toxicity of fluorine and arsenical insecticides by means of feeding experiments conducted on white rats over a period of sixteen weeks. They made use of the tooth abnormality caused by fluorine as one index of toxicity. They concluded that arsenical compounds, such as lead arsenate, are several times more toxic than fluorine insecticides, such as cryolite and barium fluosilicate. This conclusion, based upon well-planned and controlled experiments, is more conservative with regard to the harmlessness of fluorine.

In view of the wide variation in different species in susceptibility to toxicity of a given agent, and in view of the extremely low concentration of fluorine in the drinking water at St. David, Arizona, an endemic area for mottled teeth,[3] it would not be surprising to find eventually that in man the margin of safety for fluorine insecticides is no greater than for arsenical materials.

Until the lowest possible threshold tolerance for fluorine compounds has been established in several species, and until the fullest use has been made of information to be gleaned from areas where mottling of teeth is endemic, the question of the wisdom of substituting fluorine-containing insecticides for lead arsenate must remain an open one.

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[1]Marcovitch, S.—Journal of Economic Entomology, 1932, Vol. 25, page 141.
[2]Smyth, H. F. and Smyth, H. F., Jr.—Journal of Industrial and Engineering Chemistry, 1932, Vol. 24, page 299.
[3]Smith, M. C., E. M. Lantz and H. V. Smith, Arizona Agr. Exp. Station Technical Bulletin 32, (1931).