

THS



LIBRARY Michigan State University



RETURNING MATERIALS:
Place in book drop to remove this checkout from your record. FINES will be charged if book is returned after the date stamped below.

N.S. Degree.

The Economic Importance

of

Insects Hibernating in Rubbish.

There (

Contents.	D
Introduction	rage 3
Collections or lots	4
Economic importance of orders considered	i 16
Comparative list	17
Summary of orders	18
Observations	22
Summation	25

THE ECONOMIC IMPORTANCE

OF

INSECTS HIBERNATING IN RUBBISH.

William T. Shaw.

Introduction.

and the economic importance of insects hibernating in neglected corners of the farm, orchard, or garden as compared with the number of those hibernating in cleanly cultivated localities, and to ascertain the best time for and means of destroying injurious insects, should they be found in such places. It has long been known that some of the most troublesome insects pass the winter as adults, ready to do injury immediately upon the first sign of plant growth.

Where or in what numbers, perhaps, has not been so clearly understood

By taking about the same amount of material from various places around the farm, garden and orchard, during the winter, and examining it closely for insects, some very satisfectory results were obtained and interesting observations made. The quantity of material taken in each case was as much as could be packed neatly in a vesicula, or collecting can used by botanists, or roughly speaking about a peck. This would be, then, a very small proportion of the litter sometimes found scattered over an acre of ground, and the number of insects in each lot would depend not upon a difference in the amount of material examined but upon the more or less favorable conditions offered for hibernating.

Considerable variation was noticed in the number of insects, where a series of collections was made from the same spot at various dates and different temperatures, and in early spring when the first warm days came, the numbers taken were much less than in winter.

Some points not thought of at first developed as the search progressed and added interest to the work. For instance, certain kinds of leaves seemed more favorable for protection than others. The number of insects varied with the amount of moisture in the rubbish, and like points which will be taken up more fully under subsequent heads.

In all thirty-six collections were made, representing as far as practicable many different locations, proximity to different crops, and even spots remote from cultivation.

About 1475 insects were collected, 27% of which are known to be injurious. Unless otherwise indicated, only adults were considered.

Lot I, Feb. 8, 1900. Tem. 43°

The material from which the insects found in Lot I were taken, was made up largely of hard maple leaves, a few oak, and leaves of the spruce, which were piled several inches deep. The location from which it was taken was sheltered on two sides by a mixed spruce and maple hedge, with an exposure towards the south east, presenting an ideal situation for insect hibernation.

There was no snow on the ground, and the day was damp and rainy, the leaves were without frost but very wet. Although much severe weather had been experienced previous to this date, the insects were apparently uninjured, and though sluggish, soon became active when brought into a warm room. Very few dead specimens were found. The leaves on account of their wet condition were quite closely held together, many being reflexed in such a way as to form a loop along

the midrib, into which the insects had crawled.

The adjacent garden patch had had a crop of asparagus on it the summer before. The old stocks had been taken off and the ground was fairly clear of rubbish. There were no insects found among the spruce needles under the hedge.

The total number of insects found in this locality was 255. Note.

Thysanura, sow-bugs, mites, spiders, larvae and pupae were also found, as was the case to a greater or less extent throughout all the collections made.

Lot 2, Feb. 9, 1900. Tem. 18°

Rubbish was taken from the south side of the same windbreak from which Lot I was selected but the material was collected from among some gooseberry bushes. It was composed chiefly of maple leaves, which were piled thick and deep and afforded good shelter. There were also a few pear and apple leaves. The location although more exposed than Lot I, was a very good situation, being well protected from the north wind. There were many dead insects found here. The ground was lightly covered with snow.

In all 73 insects were found, among which were those injurious to the pear.

Lot 3, Feb. 12, 1900. Cloudy, Tem. 43°

The leaves in this Lot were taken from under a barberry hedge which extended between two fields, corn and meadow. The corn field had been kept perfectly clean, the previous year, and the meadow had been mown the summer before and now had a sod of the ordinary appearance for the season. There was no grass under the hedge on the east side, next the cornfield, from which side the material was taken, consequently the shelter was not good. The ground was free from snow. But 9 insects wefe found.

Lot 4, Feb. 12, 1900. Tem. 439

The spot from which the material in Lot 4 was taken was located near the south end of a deciduous woods. The leaves were taken from under a pile of oak branches which had retained their foliage, having been cut while in leaf during the previous summer. This appeared to be a good location. There was no snow on the ground. The field which had buckwheat for its previous crop, was clean and had but very little rubbish left.

Oak leaves and grass made up the bulk of the material. A careful search showed more insects in the dead grass than in the oak
leaves. The latter seemed to be rather harsh and unpliant to form
good hibernating material.

The total number of insects found was 30.

Lot 5. Feb. 12, 1900. Tem. 43°

This location was near Lot 4, but in the woods about four rods.

The situation was not especially sheltered except by the forest trees, being in a space between the large trunks.

The material was chiefly made up of oak leaves, with a few bass wood and maple among them. Those taken from the underside next the ground were much decayed, and were damp. No snow.

The insects found numbered 45.

Lot 6, Feb. 15, 1900. Tem. 17.

The material was taken from a pile of wheat straw which lay at the edge of a buckwheat field. When the straw became thawed it was very wet, and was entirely free from insects. There was from four to five inches of snow on the ground.

Lot 7. March 26, 1900. Tem. 40°

The leaves forming the material taken were gathered from the south side of a clump of bushes on the campus. They were chiefly oal

with spiraea, tulip tree, elm, and various kinds of leaves from shade trees and shrubs. The position was high, and appeared to be favorable for hibernation.

Only 14 insects were found.

Lot 8, March 28, 1900. Tem. 419

Stems of sweet clover which had been left piled in small heaps in a cleanly cultivated field were examined. The situation was an exposed one and the signs of insects were few. There was no snow.

Only one insect was found.

Lot 9, March 30, 1900. Tem. 379

This lot was also taken from an exposed spot in an open field, but where the land was not nearly so clean. A row of maple trees ran along the side of the field and consequently leaves from this tree and also a few from the oak were gathered together in a patch of millet. The millet had not been cut the previous fall, and now the old stalks were standing about a foot high and somewhat scattering, but thick enough to gather leaves and later snow which might be blown into them. The leaves where the sample was taken were piled about a foot deep, and were on a slight elevation which was rather dryer than the surrounding land which though wet was not submerged. The snow had just gone, but the frost was still in the ground.

The insects found numbered 25.

Lot 10. March 30, 1900. Tem. 37.

Some grass with leaves of sycamore, elm, beech, and stems of scouring rush were taken from the low lands of a river bottom which were quite remote from a cultivated crop. High water had evidently covered the spot as the rubbish looked muddy, and was still quite damp. Otherwise the location was quite desirable, being on the east

side of a low tangled grassy thicket.

Twenty insects were found.

Lot 11. April 2, 1900. Tem 46°

A well cultivated strawberry patch was selected from which to take the rubbish examined in this Lot. It was made up principally of the old leaves of the strawberry plants. The patch was free from grass and weed stalks.

Nineteen insects were found, among which were insects injurious to the strawberry.

Lot 12. April 2, 1900. Tem. 46?

In this case the material which was made up of a few partially decayed clover stalks but chiefly of maple leaves, was taken from a timothy and clover meadow. The position was moderately exposed. There was no snow on the ground.

Twenty-eight insects were found.

Lot 13, April 2, 1900. Tem 46?

In Lot 13 the vines and leaves were taken from a place where squashes had been grown the previous year. They were the leaves and vines of this plant, and were evenly scattered over the ground. In no case did they afford abundant protection, but were thick enough in places to make a network sufficient to collect the snow in winter.

Twenty-two insects were found.

Lot 14. April 3, 1900. Tem. 42.°

The grass and a few maple leaves which were collected in this

Lot were taken from the edge of a cleanly cultivated cornfield, near

the posts of a wire fence. The position was not particularly shelter

ed, but the dead grass was somewhat long and afforded fairly good

shelter.

Principally Calcoptera were found, to the number of nine.

Lot 15, April 3, 1900. Tem. 42°

The material was taken from a field upon which beans had been grown the previous year. The cultivation had been fairly clean, a few weeds were showing. The rubbish consisted entirely of bean stocks which were piled in heaps. There was still some ice under the heaps and the position was exposed. The insects taken numbered 31.

Lot 16, April 3, 1900. Tem. 42°

The grass with a very few leaves which were taken collected from a piece of sod in the center of a plum orchard which was cleanly cultivated. The grass was rather long and afforded fairly good shelter. Twenty-eight were found.

Lot 17, April 3, 1900. Tem. 40°

This Lot was taken from the same place as that from which Lot 15 was taken, the object being to see if the bean stocks, standing as they grew, - as they were left in part of the field, - would harbor insects. If not it was thought it would be better to leave the old stocks standing rather than to pull them and leave them in heaps not burned. Some of the stocks were lying on the ground where they had been pressed by the weight of the snow. Here as in Lot 15, the insects found were very small and could find shelter where larger ones could not. Twenty-two were found here, and thirty-one in Lot 15.

Lot 18, April 3, 1900. Tem. 38.

The material was taken from the end of the field from which Lots 15 and 17 were taken to see what proportion of the insects, which might have been in the field, migrated to better shelter. The rubbish was taken from a copse on the river bank above high water m mark, and was made up of grass from one spot, and leaves of apple or

	-			
		•		
*				

thorn from another place a few paces distant. Principally Coleoptera was found, numbering 42.

Lot 19. April 3, 1900. Tem. 38°

The rubbish was taken from the same spot as that from which Lot I was taken, the object being to determine if possible the time when the insects begin to leave their winter quarters. By this it is hoped to find the best time for spring burning. As nearly as possible the same amount and kind of material was taken in both instances.

The result was that about fifty insects were found dead. The living ones found were quite inactive, and showed little signs of l leaving, except that they showed preference for the wet leaves and had quite deserted the dry leaves of the top. The leaves were still too wet to burn. See also Lots 27 and 36. The insects found in this collection numbered 291.

Lot 20. April 4, 1900. Tem 46°

For this Lot the tops of mangolds were taken from piles where they had been left in the field which was cleanly cultivated. They were quite wet and partially decayed. There was ice in the bottom of the piles. The insects taken numbered 32.

Lot 21. April 5, 1900. Tem. 48.º

Lot 21, was taken from the same place and was composed of the same material as Lot 6. It was taken to verify the results found in Lot 6. There was still some frost in the pile. Only three insects were found, which would indicate that good, clean straw was not a favorable shelter.

Lot 22. April 5, 1900. Tem. 48°

Some oak leaves among which were leaves of elm and blue beech were taken from the east side of a woods bordering an oat field.

The location was fine and warm and had previously been well covered

Lot 23, April 5, 1900. Tem. 53°

Potato tops were taken from a cleanly cultivated patch, where they had been left the previous autumn. They were not in piles but were left scattered about as they had been dropped, consequently the shelt r which they afforded was not good.

Forty-three insects were taken.

with snow, traces of which still remained in the fence corners.

The "Bugs" found were very active. Probably the Jassids were on the wing as few were found. The collection numbered 49 insects.

Lot 22, April 5, 1900. Tem. 53.°

Potatoe tops were taken from a cleanly cultivated patch, where they had been left the previous autumn. They were not in piles but were scattered about as they had been dropped, consequently the shelter which they afforded was not good. Forty-three insects were taken.

Lot 24. April 5, 1900. Tem. 53°

The north side of a clump of spruce trees was selected as the location from which leaves of oak, maple, elm and spruce were taken. The bulk of the leaves were oak. There was still some ice under the rubbish. Fifty-two insects were found.

Lot 25. April 5, 1900. Tem. 53.

The material for this Lot was taken from the north side of a plum orchard. The land was in good condition and had no crop upon it. The rubbish taken consisted of leaves; oak, elm and a few beech. It was taken from the south side of the fence in a spot well exposed to the sun. Twenty-two insects were found.

. Lot. 26. April 7, 1900. Tem 50°

Material composed almost entirely of oak leaves was taken from a clump of lilac bushes on the campus, from a spot where the grass had been mowed and kept short the previous year. The location was fairly well protected and was well covered with snow during February and March.

The leaves were dry almost to the ground, and few insects were found. This was the date upon which the leaves were being raked upon lawns for the purpose of burning. Only six insects were found.

Lot 27. April 7, 1900. Tem. 50°

For this Lot the same material was taken, and the same locality chosen as in the case of Lot 1 and 19 and later 36. The material was partly dried and a heap of it was raked together and burned. It did not burn readily but by frequent stirring it was finally burned completely.

A sample was examined for insects. Those found were all active. Jassids and lacewings were seen flying about. Sowbugs, millipeds and angle-worms were numerous, the latter no doubt having come up from the ground. The insects will remaining in the leaves numbered llô, showing a marked decrease.

Lot 28. April 7, 1900. Tem. 67°

Lot 28 was taken from the same place as was lot 2. The leaves were now dry almost to the bottom of the layers. But thirty-three insects were found, showing a decrease here also.

Lot 29. April 7, 1900. Tem 67°

The material, chiefly hard maple leaves, similar to that in Lot 2, was taken from under some current bushes about ten feet from the hedge near Lot 2. The leaves were dry excepting those near the ground which were still quite wet. Twenty-four insects were found.

Lot 30. April 7, 1900. Tem. 709

Some maple leaves were taken from the roots of blackberry bushes. They had been flooded during the winter and were covered with sediment, but were now partly dry. Only three insects were found.

Lot 31. April 7, 1900. Tem. 68°

Apple and hard maple leaves were taken from an old apple archard grown over with sod. The leaves were partly dry and were piled deep between the tussocks of grass. But eleven insects were found.

Lot 32. April 7, 1900. Tem. 376

The material was taken from the same orchard, but from a part of it where the orchard was cultivated. The rubbish was made up purely of apple leaves, which do not seem to be suitable as material for hibernating as they lie so flat when wet and are so hard and unbending. Leaves were wet in the lower layers only. Twelve insects were found.

Lot 33. April 9, 1900. Tem. 43°

Some oak leaves were taken from a pile of rubbish which had been raked up and left standing for about two days. The object of taking this Lot was to ascertain if insects remained in the rubbish after it had been raked up. Only four insects were found which would suggest that they had deserted the disturbed leaves.

Lot 34. April 10. 1900. Tem. 40.º

The material in this lot was made up of leaves from the pine and spruce, and was taken from the north side of a clump of these trees. There was also a little dead grass mixed in with the leaves.

Evergreen leaves do not afford good shelter for insects, apparently, as therewas not a sign of an insect in the material examined.

Lot 35. April 10, 1900. Tem. 40.

In this case the material was taken from the compost heap, and was composed of leaves, chiefly oak, which were taken from the campus two days before.

It was thought that the insects might be smothered by being buried in the heap, but no dead ones were found. Eleven insects were taken.

Lot 36. November 24, 1900. Tem. 32?

Material was taken from the same place as Lots 1, 19 and 27.

There had been some cold weather with about four inches of snow a week or so before this, sufficient cold to drive the insects to shelter.

The summer's crop was asparagus again.

The collection was made to ascertain the proper time to burn as the leaves were sufficiently dry at this time. Providing the insects had taken shelter for the winter this plan of destroying insects might be practical.

The results showed a total of 104, many of which were injurious Heteroptera and Homoptera. All were sluggish.

Economic Importance of the Orders Under Consideration.

The first order considered is the Order Orthoptera to which belong the grasshoppers, crickets and cockroaches, very many of which are injurious. As will be noticed, not many of these insects were found.

The two following orders Heteroptera and Homoptera contain insects commonly known as "Bugs", most of which are very injurious especially to young and growing vegetation from which they <u>suck</u> the sap. On account of this habit of piercing the tissues of the plants and obtaining their food from below the surface, they are difficult to control, avoiding as they do the poisens of the spray pump, and being killed only by some form of contact spray as kerosene or to-bacco. To these orders belong the Chinch-bug, Tarnished Plant-bug, Jassids and Psylla.

The Neuroptera contains chiefly beneficial insects as Aphislions (Chrysopa), insects which do much good by killing plant-lice.

The Lepidoptera, the order to which belong the Butterflies and Moths although containing adult insects of great beauty, contains _ forms which are very destructive in the young or larval stage.

Diptera or two winged insects, flies, contain very serious enemies although some as the Syrphus flies are very beneficial as their larvae feed pargely on plant lice. Others are important as scavengers.

Among the Coleoptera or Beetles are found both forms, beneficial and injurious. Of the former the Carabidae or Ground-beetles, the Staphylinidae or Rove-beetles are important as destroyers of other insects. The Coccinellidae or Lady-bug family like the Aphis-lions are very destructive to the plant lice. Of the latter, many such as those belonging to the families Chrysomelidae, Scarabaeidae and Elateridae are destructive to vegetation.

Of the Order Hymenoptera much good may be said. Here are found such families as Chalcididae, Ichneumonidae, Proctotrupidae and Brachonidae, containing little wasp-like insects which destroy great numbers of larvae destructive to crops.

List Showing the Relative Number of Insects Hibernating in

Good and Poor Localities.

Poor.					Good.		
Lot 3	Ó	insects	:	Lot 1	255 insects		
" 4	30	11	•	" 2	73 "		
" 6	0	11	<u>.</u>	" 5	45 "		
m 8	í	**	•	" 7	14 "		
" 10	20	. 11	•	n ģ	25 "		
" 11	19	#	<u>.</u>	" 16	2 8 "		
		**	•				
- L	28	**	• -	1 ()	₹ &		
" 13	22		•	" 19	E J I		
" 14	9	91	•	" 22	49 "		
" 15	31	11	:	" 27	116 "		
" 17	22	11	:	" 2 8	33 "		
* 20	32	Ħ	:	" 29	24 "		
" 21	3	Ħ	•	" 31	ĩi "		
* 23	43	11	•	" 3 6	104 "		
" 24	52	Ħ	•	00	104		
" 25		11					
	22	11					
# 26	6						
* 30	3	11					
" 32	12	n					
m 34	0	11					
Total	364	insects.		Total	1109 insects		

SUMMARY OF ORDERS, FAMILIES, ETC.

Orthoptera,

```
Blattidae,
                 Pyconoscelus (?) 4
         Acrididae,
                 Chortophaga (†), (\S) \frac{1}{4}
                 Tettigidea, + +
                  Tettix, 乳。
Heteroptera,
         Reduviidae, (5) 5
         Nabidae,
                 Coriscus (*) = \frac{8}{7}, \frac{8}{7}, \frac{2}{7}, \frac{1}{7}, \frac{3}{12}, \frac{1}{18}, \frac{3}{19}, \frac{3}{19}, \frac{2}{25}, \frac{1}{33}, \frac{3}{32}
         Tingitidae,
                 Piesma (†) cinerea, \frac{3}{7}, \frac{3}{2}, \frac{1}{2},
         Acanthiidae
                  Triphleps (?) (*) ½
         Capsidae,
                 Lygaeidae,
                 Cymus (?) 12
                 Peliopelta, 🛂 .
                 Peritrechus, \frac{1}{17} Trapezonotus, \frac{1}{17}, \frac{1}{17}, \frac{1}{17}, \frac{1}{17}, \frac{1}{17}, \frac{1}{12}, \frac{1}{17}, \frac{1}{12}, \frac{1}{12}, \frac{1}{12}
         Coreidae,
                 Corizus, \(\frac{1}{2}, \frac{1}{16}, \frac{1}{22}, \frac{2}{29}\).
         Pentatomidae,
                 Brochymena (†) 4-pustulata, \frac{1}{2}, \frac{1}{3}. Euchistus (†) ictericus, \frac{1}{2}
                 Euchistus (†) tristigmus
                 Peribalus limbolarius, 4. 23
```

```
Homoptera

Jassidae ($), $\frac{1}{10}, \frac{1}{10}, \fra
```

• į Neuroptera,

```
Chrysopidae,
                                                                         Chrysopa plorabunda (*), \frac{6}{1}, \frac{29}{2}, \frac{2}{23}, \frac{1}{27}, \frac{1}{28}, \frac{1}{36}.
                                     Hemerobiidae,
                                                                        Micromus posticus (x) \frac{2}{7}, \frac{3}{2}, \frac{1}{19}, \frac{2}{27}.
 Lepidoptera.
                                     Noctuidae,
                                                                         Monestra trifolia,
                                                                         Scopelosoma (+), +
Diptera,
                                       Tipulidae (†), 36
                                      Cecidomyiidae (+), 24
                                     Phoridae,
                                                                         Phora, 主, 支, 方, 立y, 28, 36
                                    Muscidae, 3, 4, 18, 19, 21, 22, 30, 35, 36
 Coleoptera,
                                     Carabidae,
                                                                      Agonoderus (†), \frac{7}{18}, \frac{1}{29}

Bembidium (†), \frac{3}{1}, \frac{11}{2}, \frac{1}{20}, \frac{1}{20}, \frac{1}{20}, \frac{1}{20}, \frac{1}{20}, \frac{1}{20}, \frac{1}{20}, \frac{1}{20}, \frac{1}{20}, \frac{1}{20}.

Bradycellus (*), \frac{1}{12}.

Dyschirius (*) \frac{1}{19}.
                                                                      Platynus (X), \frac{1}{22}
Pterostichus (X), \frac{1}{2}, \frac{1}{2}
                                                                         Stenolophus (x), 1, 1/19 20 26.
                                                                         Tachys (★), }
                                                                         Tetragonoderus (**), 🚣
                                    Mydrophilidae,
                                                                         Cercyon, 1/2
                                     Silphidae,
                                                                        Clambus, 1
                                     Pselaphidae,
                                                                         Ctenistes, 4. 4.
                                       Staphylinidae,
                                                                         Actobius (X), 20
                                                                         Alerocharini (tribe) (*) 3-
                                                                      Falagra (*) \frac{1}{7}, \frac{1}{7}
                                                                       Oxytelus (*), 1, 1, 1, 2,
                                                                        Paederus (*),
                                                                       Scopaeus (*), \vdots, \vdots, \vdots, \vdots, \vdots, \vdots, \vdots
                                                                     Scopaeus (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,), (,),
```

, •

```
Trichopterygidae,
                                Ptenidium, 5,-
                                 Truchopteryx, $ 22' 27' 36
   Phalacridae,
                                Litochrus, 4-
                               Olibrus, \frac{3}{4}. \frac{1}{10}, \frac{1}{12}, \frac{1}{10}, \frac{4}{16}, \frac{5}{17}. \frac{1}{18}. \frac{1}{27}. Phalacrus, \frac{7}{5}. \frac{1}{47}. \frac{1}{32}.
   Corylophidae,
                                 Corylophus truncatus, 5
                                Orthoperus, 7, 73
                                Sericoderus, 4-
  Coccinellidae,
                                Coccinella (*) \frac{1}{2}, \frac{1}{3}.
                               Hippodamia (*), \frac{1}{7}, \frac{1}{7}, \frac{1}{7}, \frac{1}{7}, \frac{1}{2}, \frac{1}{2}, \frac{1}{2}?

Psyllobora (*), \frac{1}{7}, \frac{1}{7}?
                                  Scynnus (X), 2
  Cryptophagidae,
                                Tomarus, 19
 Mycetophagidae,
                                Litargus, +.
 Dermestidae,
                                 Anthrenus (\frac{1}{7}), \frac{1}{19}, \frac{1}{24}
 Nitidulidae,
                                Euparia, 2 30 19 27
                               Nitidula, 1, 19, 27, 31.
 Trogostidae,
                                Nemosoma, j.
 Lathridiidae.
                                Corticaria (+), 4, \(\frac{1}{2}\), \(\frac{1}\), \(\frac{1}{2}\), \(\frac{1}{2}\), \(\frac{1}{2}\), \(\frac
Dascyllidae,
                                                                                                                                                                                                       Cyphon (?) \frac{1}{7}, \frac{1}{4}, \frac{2}{27}, \frac{1}{33}
Elateridae,
                                Crypto hypnus (†) obliquatulus 20.
 Scarabaeidae,
                               Aphodius (†), 1, 1/2, 1/20, 1/23, 1/35
 Chrysomelidae,
                               Crepidodera (†) atriventris,
                               Crepidodera (†) sp., 16
                             Phyllotreta (†), 3/3/2 "
Phylliodes (†) punctulata, 5/3/2
Tenebrionidae,
                               Paratenetus, +
Anthicidae,
                               Notoxus, \frac{148}{7}, \frac{1}{7}, \frac{1}{7},
                                Smicronyx, +
Scolytidae,
                               Hylesinus (\uparrow), \frac{1}{3}.
```

£ t. •

```
Hymenoptera,
Ichneumonidae,
Pezomachus (*) ½
Pterocomus (?), (*) ½
Braconidae,
Ganychorus (*), ½
Chalcididae,
Merisus (*);
Proctotrupidae
Paramesius (*), ½
Polygnathus (?), (*), ⅓
Thoron (?) (*), ($), ⅓
Myrmicidae,
Cremastogaster (?), ⅓
```

- (?) Identification doubtful.
- (大) Beneficial. (†) Injurious.
- (S) Immature.

Note. The fraction to the right of the genus or species is meant to represent the number of specimens found and the locality in which they were taken, the numerator or upper figure referring to the number of insects and the denominator the locality for example, Lygus pratensis 4/1, would mean that four insects of this kind were collected from Lot I.

Observations.

It may be of interest to note the relative number of insects found classified as injurious, beneficial and indifferent. Twenty-seven per cent of the insects collected are known to belong to injurious genera. Nineteen per cent are known to be beneficial, while the remainder, fifty-four per cent are indifferent. Forty-eight per cent of the injurious insects were Heteroptera and Homoptera insects known to be very injurious and as previously explained hard to check by artificial means. Of these seventy-five per cent were found hibernating in places of best shelter, seeming to avoid clean, open localities, a fact which should be significant.

In estimating these percentages only those genera known to be injurious were considered with the exception of the Diptera or flies in which the family Phoridae was regarded as indifferent, the families Cecimomylidae, and Tipulidae as injurious and the Muscidae on account of the injurious and beneficial members contained, and for the reason that they were not traced to genera were not considered in reckoning the percentages. In the beneficial list were included all the Neuroptera or Aphis lions, all the Hymenopter or Wasps but the Ants, all the Staphylinidae or Roveobeetles, all the Coceinellidae or Lady-bug, and all the Carabidae or Ground-beetles, except those genera known to be injurious. These percentages might be considered as average inasmuch as the previous summer was not marked by anyespecial outbrake of insects in the locality from which the collections were made.

Some of the more common-insects found were: Tarnished Plant-bug (Lygus pratensis). Spittle insects (Agallia). Jassids (Typhlocyba). Psylla, (Psylla) Bemdibium, and Corticario. The last named genus although very common is represented by small insects which probably are never very injurious.

By a careful examination of the list showing the relative number of insects hibernating in good and poor locations it will be seen that in almost every case where the conditions had been left more favorable, there the greatest number of insects were found. In the majority of cases in the list representing the localities with the least insects neat farming had been practical the year before.

It was found that some materials were more favorable for hibernatination than others. Hard maple leaves appeared to be among the
best and wherever they were found the number of insects was greater
See Lot 12. Apple and oak leaves were poor, probably on account of
their being hard and unpliant, while the maple either crumpled or
folded in such a way as to form small openings into which the insects
crawled. See also Lots 4 and 32. The leaves of spruce were almost
destitute of insects as was also the wheat straw examined, A fact
which shows the importance of using good, clean straw rather than
leaves as a covering for strawberries or other plants needing protection in the winter. See Lots 6 and 21.

In regard to the time at which the insects began to leave winter quarters it might be best shown by an examination of Lots 1 19, 27 and 36 which in brief is this:- as the weather became warm and the topmost leaves dry, the insects began to leave, even before the rubbish was dry enough to burn well. Few insects were found wher the leaves were dry, and those insects which fly readily as Jassids and many of the "Bugs", which are usually injurious left the rubbish soon after the warm days arrived. This was also true of the Lacewing, which are beneficial insects. It would seem from this that spring burning would not be completely successful when we attempted to destroy noxious insects. On the other hand by examining Lot 36 it will be seen that sufficient cold weather and low temperature

A .

N.

-

;

existed to drive insects to winter quarters.

Already Heteroptera and Homoptera, - generally injurious - were found in numbers and were sufficiently sluggish to render their destruction by fire successful. As stated in Lot 36 snow had fallen previously but had melted and the leaves had been dried by frost and wind until they were in good condition for burning. Indeed there were times when burning could have been done for several days following.

It was noticed in the spring that the insects left their winter quarters after the leaves were raked up, the temperature being higher and the insects more active, they were enabled in many instances to fly on being disturbed. See Lot 33.

Special attention was given to the searching for insects known to be troublesome on certain plants. In a few cases insects were found near the plant upon which they had fed, for example, Pear Psylla. Paria a genus containing enemies of the strawberry, and Jassids of the oak. In direct contradiction to this was an instance (Lot 5) where Paria was found well in the woods, certainly remote from the tame strawberry plants at least. In locations where this insect is troublesome it might be well to choose for strawberries, a field remote from the woods.

As many insects were found in the harvested fields the importance of fall plowing would be evident, turning under completely all stubble or weeds which serve to harbor insects in whatever form they might pass the winter.

That insects seek shelter in the fall and choose protected spots is shown in Lots 15, 17 and 18 where the number in Lot 18, the most sheltered spot, is much larger than in the other Lots.

In Lot 7 although the location was good, the scarcity of insects might be accounted for by the fact that the surroundings had been

	-	

kept especially neat and no field crop had been near by.

A very marked decrease was shown in the number of insects found in Lots 19 and 27, the leaves being dryer and the weather warmer on the date of the latter collection.

Summation.

First. It is important that all rubbish be raked out of corners and burned at the proper time, and that fence and hedge rows be kept neat as a means against injurious insects.

Second. As shown by a study of the activity of the insects during different temperatures it is important that burning should be done on cold days. As an illustration for this see Lot 27 and 36 where the temperatures were respectively 50° and 32°

Third. Burning in tate fall and during winter would seem preferable to spring burning.

Fourth. Fall plowing would be recommended as means of destroying insects and getting rid of their winter protection.

Fifth. As is shown by an examination of Lots 6 and 21, the use of good clean straw is preferable to the use of leaves when employ ed as a covering or protection for tender plants and shrubs.

Sixth. As insects were found wintering near the trees or plants upon which they had fed during summer it is important that extreme care be taken to burn all the rubbish found in the neighborhood of vegetation to be protected or freed from insect attack.

İ

..

H

**

y

..

```
Trichopterygidae,
                     Ptenidium, 5,-
                     Trichopteryx, 5 22 27 57
   Phalacridae,
                     Litochrus, 4-
                     Olibrus, 3. 10, 1/2, 15- 14, 15- 18 17
                    Phalacrus, 3, 1/37, 32.
   Corylophidae,
                     Corylophus truncatus, +
                    Orthoperus, 7/2 /13
                    Sericoderus, 4-
  Coccinellidae,
                    Coccinella (*) + ½3, ¾2.
                    Hippodamia (*), \frac{1}{7}, \frac{3}{72}, \frac{1}{19}, \frac{1}{23}, \frac{1}{27}, \frac{1}{27}, \frac{1}{27}
                     Scymnus (*), 3
  Cryptophagidae,
                    Tomarus, 19.
 Mycetophagidae,
                    Litargus, +.
  Dermestidae,
                    Anthrenus (\dagger), \frac{1}{19}, \frac{1}{24}.
  Nitidulidae,
                    Euparia, 7. 30 19 27
                   Nitidula, 1, 19, 27, 31.
  Trogostidae,
                   Nemosoma, is-
 Dascyllidae, Cyphon (?) \frac{1}{7}, \frac{2}{3}, \frac{2}{23}, \frac{1}{23}.
                                                                                                                           Elateridae,
                   CryptoChypnus (†) obliquatulus 29.
 Scarabaeidae, Aphodius (\dagger), \frac{1}{7}, \frac{1}{12}, \frac{1}{12}, \frac{1}{12}, \frac{1}{12}
 Chrysomelidae,
                   Crepidodera (†) atriventris,
                   Crepidodera (†) sp., 16
                   Glyptina cerina, ;
                   Paria (†) 4-notata, 4. 4. 7.
                   Phyllotreta (†), 3/3/2 "
Phylliodes (†) punctulata, 3/3/2
 Tenebrionidae,
                   Paratenetus, :
 Anthicidae,
                   Notoxus, \frac{148}{2}, \frac{1}{7},                    Smicronyx, 4
Scolytidae,
                  Hylesinus (†), \frac{1}{3}.
```

```
Hymenoptera,
       Ichneumonidae,
             Pezomachus (*) 122
             Pterocomus (?), (*),
       Braconidae,
             Ganychorus (*), =
       Chalcididae,
             Merisus (*) ;
       Proctotrupidae
             Paramesius (X), 19. 36
             Polygnathus (?), (*), 16. Thoron (?), (*), (%), (%).
       Myrmicidae,
             Cremastogaster (?), :
```

- (?) Identification doubtful.
- (*) Beneficial. (†) Injurious.
 (%) Immature.

The fraction to the right of the genus or species is Note. meant to represent the number of specimens found and the locality in which they were taken, the numerator or upper figure referring to the number of insects and the denominator the locality for example, Lygus pratensis 4/1, would mean that four insects of this kind were collected from Lot I.

Observations.

It may be of interest to note the relative number of insects found classified as injurious, beneficial and indifferent. Twenty-seven per cent of the insects collected are known to belong to injurious genera. Nineteen per cent are known to be beneficial, while the remainder, fifty-four per cent are indifferent. Forty-eight per cent of the injurious insects were Heteroptera and Homoptera insects known to be very injurious and as previously explained hard to check by artificial means. Of these weventy-five per cent were found hibernating in places of best shelter, seeming to avoid clean, open localities, a fact which should be significant.

In estimating these percentages only those genera known to be injurious were considered with the exception of the Diptera or flies in which the family Phoridae was regarded as indifferent, the families Ceci complidae, and Tipulidae as injurious and the Muscidae on account of the injurious and beneficial members contained, and for the reason that they were not traced to genera were not considered in reckoning the percentages. In the beneficial list were included all the Neuroptera or Aphis lions, all the Hymenopter or Wasps but the Ants, all the Staphylinidae or Roveobeetles, all the Coceinellidae or Lady-bug, and all the Carabidae or Ground-beetles, except those genera known to be injurious. These percentages might be considered as average inasmuch as the previous summer was not marked by anyespecial outbrake of insects in the locality from which the collections were made.

Some of the more common-insects found were: Tarnished Plant-bug (Lygus pratensis). Spittle insects (Agallia). Jassids (Typhlocyba). Psylla, (Psylla) Bemdibium, and Corticario. The last named genus although very common is represented by small insects which probably are never very injurious.

By a careful examination of the list showing the relative number of insects hibernating in good and poor locations it will be seen that in almost every case where the conditions had been left more favorable, there the greatest number of insects were found. In the majority of cases in the list representing the localities with the least insects neat farming had been practical the year before.

It was found that some materials were more favorable for hibernatination than others. Hard maple leaves appeared to be among the
best and wherever they were found the number of insects was greater
See Lot 12. Apple and oak leaves were poor, probably on account of
their being hard and unpliant, while the maple either crumpled or
folded in such a way as to form small openings into which the insects
crawled. See also Lots 4 and 32. The leaves of spruce were almost
destitute of insects as was also the wheat straw examined, A fact
which shows the importance of using good, clean straw rather than
leaves as a covering for strawberries or other plants needing protection in the winter. See Lots 6 and 21.

In regard to the time at which the insects began to leave winter quarters it might be best shown by an examination of Lots 1 19, 27 and 36 which in brief is this:- as the weather became warm and the topmost leaves dry, the insects began to leave, even before the rubbish was dry enough to burn well. Few insects were found wher the leaves were dry, and those insects which fly readily as Jassids and many of the "Bugs", which are usually injurious left the rubbish soon after the warm days arrived. This was also true of the Lacewings which are beneficial insects. It would seem from this that spring burning would not be completely successful when we attempted to destroy noxious insects. On the other hand by examining Lot 36 it will be seen that sufficient cold weather and low temperature

existed to drive insects to winter quarters.

Already Heteroptera and Homoptera, - generally injurious-were found in numbers and were sufficiently sluggish to render their destruction by fire successful. As stated in Lot 36 snow had fallen previously but had melted and the leaves had been dried by frost and wind until they were in good condition for burning. Indeed there were times when burning could have been done for several days following.

It was noticed in the spring that the insects left their winter quarters after the leaves were raked up, the temperature being higher and the insects more active, they were enabled in many instances to fly on being disturbed. See Lot 33.

Special attention was given to the searching for insects known to be troublesome on certain plants. In a few cases insects were found near the plant upon which they had fed, for example, Pear Psylla. Paria a genus containing enemies of the strawberry, and Jassids of the oak. In direct contradiction to this was an instance (Lot 5) where Paria was found well in the woods, certainly remote from the tame strawberry plants at least. In locations where this insect is troublesome it might be well to choose for strawberries, a field remote from the woods.

As many insects were found in the harvested fields the importance of fall plowing would be evident, turning under completely all stubble or weeds which serve to harbor insects in whatever form they might pass the winter.

That insects seek shelter in the fall and choose protected spots is shown in Lots 15, 17 and 18 where the number in Lot 18, the most sheltered spot, is much larger than in the other Lots.

In Lot 7 although the location was good, the scarcity of insects might be accounted for by the fact that the surroundings had been

kept especially neat and no field crop had been near by.

A very marked decrease was shown in the number of insects found in Lots 19 and 27, the leaves being dryer and the weather warmer on the date of the latter collection.

Summation.

First. It is important that all rubbish be raked out of corners and burned at the proper time, and that fence and hedge rows be kept neat as a means against injurious insects.

Second. As shown by a study of the activity of the insects during different temperatures it is important that burning should be done on cold days. As an illustration for this see Lot 27 and 36 where the temperatures were respectively 50° and 32°

Third. Burning in tate fall and during winter would seem preferable to spring burning.

Fourth. Fall plowing would be recommended as means of destroying insects and getting rid of their winter protection.

Fifth. As is shown by an examination of Lots 6 and 21, the use of good clean straw is preferable to the use of leaves when employ ed as a covering or protection for tender plants and shrubs.

Sixth. As insects were found wintering near the trees or plants upon which they had fed during summer it is important that extreme care be taken to burn all the rubbish found in the neighborhood of vegetation to be protected or freed from insect attack.

