

Insects of Indiana for 1936¹

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Since our last report we have experienced extremes of weather during the winter period and during the following summer, which have played an important part in the abundance or scarcity of certain insects and which have given additional data on the effect of such abnormal conditions on insect life. Not only did Indiana experience a summer of high temperatures and low rainfall, but these extremes followed a winter of abnormally low temperature. The severe winter was responsible for the general belief that high insect mortality would result and that insects would be minor factors during the following season. However, in general, this was not the case, for Indiana experienced at least as many and as severe insect problems as during the average years.

The severe winter, with the temperature going as low as -18°F. at Indianapolis and -27°F. in some parts of the state, did result in a high mortality of some species that live exposed during the winter months, as does the San Jose scale, and also among those, such as the Mexican bean beetle, harlequin bug, and bagworm, which are of southern origin but which had extended their northern range as a result of recent mild winters. However, even with the majority of insects which are affected by the winter cold, the winter mortality is less important than the effect of spring and early summer conditions. In other words, insects possess such a remarkable reproductive capacity, that with favorable conditions early in the season, a comparatively few individuals passing the winter successfully may be able to increase to destructive numbers by mid-summer or later. The winter weather may, on the other hand, be responsible for the abundance or scarcity of insects in other ways. Thus, the severe winter of 1935-36 weakened peach trees, which enabled the shot hole borer to increase greatly, since this insect can gain a foothold in stone-fruit trees only after they have been weakened from one cause or another.

The extreme heat and drought of the past summer perhaps played a more significant rôle than did the winter cold, but here again the extremes were favorable to some insects, such as codling moth and chinch bug, although definitely harmful to others, such as European corn borer and Mexican bean beetle. On the other hand, we find that these extreme conditions were also indirectly responsible for insect damage. For example, in many sections of the state, where grasshoppers were abundant in "idle" weedy land, the drought dried up their normal food, and they were forced to migrate to cultivated crops, especially corn, to complete their growth.

¹Contribution from the Department of Entomology of the Purdue University Agricultural Experiment Station, being a continuation of a series of annual summaries begun in 1925, dealing with the major insect problems of Indiana and the relation of weather to abundance or scarcity of different species. The writer expresses his appreciation to the following who have provided records: C. M. Packard, Philip Luginbill, E. V. Walter, W. B. Noble, Curtis Benton, H. R. Painter, L. F. Steiner, A. J. Ackerman, John Amos, H. K. Rippey, G. E. Marshall, G. A. Ficht, G. E. Gould, D. W. LaHue, G. E. Lecker, H. O. Deay and B. E. Montgomery.

The accompanying table (Table I) gives a very good idea of the weather during the winter and following summer of 1936. It will be noted that from March to August, inclusive, the average excess temperature per month was 2.6° F. and that during the six months there was a total of 7.77 inches of rain less than normal.

TABLE I. COMPARATIVE MONTHLY WEATHER DATA FOR INDIANA, 1936

Month		Temperature		Precipitation		Number of Days		
		State Mean	Departure from Normal °F.	State Average Inches	Departure from Normal Inches	Clear	Partly Cloudy	Cloudy
1935								
	Normal	42.4		3.06		11	7	12
November	1935	42.2	-0.2	3.52	+0.46	6	5	19
	Normal	32.1		2.86		9	7	15
December	1935	25.6	-6.5	1.61	-1.25	6	8	17
1936								
	Normal	29.0		3.03		10	7	14
January	1936	22.4	-6.6	1.47	-1.56	9	7	15
	Normal	30.3		2.41		9	7	12
February	1936	22.5	-7.8	2.59	+0.18	10	7	12
	Normal	40.6		3.75		10	8	13
March	1936	44.6	+4.0	2.74	-1.01	12	10	9
	Normal	51.8		3.49		11	9	10
April	1936	47.8	-4.0	3.17	-0.32	10	9	11
	Normal	62.2		4.01		13	9	9
May	1936	65.8	+3.6	2.02	-1.99	19	8	4
	Normal	71.5		3.76		14	10	6
June	1936	71.8	+0.3	1.37	-2.39	18	9	3
	Normal	75.7		3.31		16	10	5
July	1936	81.4	+5.7	1.59	-1.72	17	11	8
	Normal	73.5		3.38		15	10	6
August	1936	79.4	+5.9	3.04	-0.34	18	9	4
	Normal	67.2		3.42		15	7	8
September	1936	70.7	+3.5	4.84	+1.42	13	9	8
	Normal	54.8		2.77		15	7	9
October	1936	55.1	+0.3	4.44	+1.67	14	6	11

Field Crop Insects

The chinch bug (*Blissus leucopterus* Say) continues as a menace to small grain and corn, in spite of the low carry-over and the rather high winter mortality of 50%, as determined in surveys made by the U. S. Bureau of Entomology and Plant Quarantine. In exposed situations the mortality was as high as 98%. The bugs became active in grass clumps, April 14, when the air temperature reached 77° F. Migration to small grain started soon thereafter, and when the first few eggs were found May 19, all bugs had left winter quarters. Spring conditions were favorable to establishment and increase in small grains, resulting in scattered local damage from migrations to corn at grain harvest time, the first migrations being observed about June 27. By July 10 many bugs were mature and flying. Summer heat and drouth

were favorable to early and successful development of the second brood bugs in corn, and by July 20 infestations were recognized as significantly heavy in many regions, especially in the two western tiers of counties from Lake on the north to Greene County on the south. The infestation was not general, but scattered outbreaks causing very noticeable reductions in corn yields occurred. In the area referred to above the bugs are in winter quarters in moderate numbers with prospects of moderate to heavy infestations if winter and spring conditions are favorable to them.

The Hessian fly (*Phytophaga destructor* Say) produced an unusually heavy late fall brood in 1935, in addition to the normal fall brood. Although the late brood suffered a very high winter mortality, because they did not succeed in completing their larval growth before cold weather, there were enough flies surviving from the normal fall brood to produce a very heavy spring infestation in southern and western Indiana. The extreme heat and drought caused a high summer mortality of the puparia, and this, together with the general late sowing of wheat, resulted in a generally light 1936 fall infestation. The rains of late August and early September in northern Indiana, however, were rather favorable to growth of volunteer wheat and fly activity. As a result, in such areas the fall brood of fly is rather abundant in volunteer wheat which may serve as the source of considerable infestation next spring.

C. M. Packard, in charge of the U. S. Cereal and Forage Insect Laboratory at Lafayette, who has made a careful and detailed study of the Hessian fly problem, provides the following figures which illustrate the significance of the Hessian fly problem in Indiana (Table II).

Fungus gnats (*Sciara varians* Joh. det. A. Stone) were exceedingly abundant in wheat fields during April, leading many growers to confuse them with Hessian flies and to consider plowing under wheat.

TABLE II.

Year	Wheat Yield	Loss in Bushels	Loss in Dollars
1929.....	25,909,000	2,015,000	\$2,256,000
1930.....	28,527,000	1,076,000	764,000
1931.....	44,544,000	1,072,000	482,000
1932.....	23,502,000	3,738,000	1,607,000
1933.....	22,905,000	622,000	535,000
1934.....	32,152,000	1,228,000	1,056,000
1935.....	28,618,000	3,672,000	2,790,000
1936.....	27,720,000	2,486,000	2,362,000
Total 8 years.....	223,877,000	15,909,000	11,852,000
Average per year.....	29,233,000	1,989,000	1,482,000

Armyworms (*Cirphis unipuncta* Haw.) were of little importance during the past year.

Corn earworm (*Heliothis obsoleta* Fab.) was generally scarce in corn until late August, although on July 17, seven of 12 ears of sweet corn grown near Lafayette were infested with worms from very small to nearly full grown. Beginning in late August, when eggs became very abundant on corn silks at Lafayette, the infestation increased rapidly, until at harvest time nearly all ears of field corn showed some infestation at Lafayette. Similar increases were noted in many other parts of the state. In the southern half of the state, tomatoes, green beans and peppers were generally infested during the last two weeks in September.

European corn borer (*Pyrausta nubilalis* Hbn.) suffered a decided set-back in 1936, similar to the high mortality resulting from the heat and drought of 1934, the reduction in the infestation in Indiana ranging from 40 to 70%. According to studies made by the federal entomologists, it is likely that the central region of Indiana is a transition zone between the present one-generation area and what will likely become a two-generation area in the southern half of the state. This, together with abnormal seasons in recent years which are unfavorable to corn-borer increase, may explain the slow spread through the transition zone. Scouting in Indiana added but one county, Johnson County, to the infested area.

Grasshoppers (*Melanoplus mexicanus* Sauss, and *M. bivittatus* Say) were destructively abundant in many counties of the state. Damage to field crops, including alfalfa, wheat, soybeans, cowpeas, and corn, was first reported June 14 from St. Joseph, Elkhart, and several adjoining counties, *M. mexicanus* being the predominant species. A little later they became generally common and destructive in several central western counties, including Tippecanoe, Benton, and Vermillion. As the heat and drought dried up succulent vegetation, especially that on idle land where they were abundant, the hoppers migrated to cultivated crops causing scattered damage throughout the state and rather general abundance in some counties. Damage to garden vegetables, including tomatoes, was not uncommon, and one reporter from Cass County reported defoliation of a young apple orchard. Grasshoppers are definitely on the increase and may be expected to be more generally abundant in 1937.

Sod webworms (Crambidae) were reported as damaging corn in several localities in northwestern Indiana the first half of June.

White grubs (*Lachnosterna* spp.) were responsible for scattered damage to grass and corn in the northern third of the state.

Common stalk borer (*Papaipema nitela* Guen.) was noticeably abundant, attacking corn and tomatoes at scattered localities about the middle of June, at which time the borers were quite small, not over one-half inch.

Clover leaf weevil (*Hypera punctatus* Fab.) damaged clover in central and eastern Indiana during the first half of May.

The overflow worm (*Agrotis ypsilon* Rott.) was again destructive to corn in the bottom lands along the Wabash River from Terre Haute south and along the Ohio River near Evansville, during June.

Vegetable Insects

Mexican bean beetle (*Epilachna varivestis* Muls. = *E. corrupta*) following mild winters and favorable seasons, spread and increased to destructive numbers the past two years in most regions throughout northern Indiana. The severe winter following was responsible for a very high mortality. The beetles were first observed at Lafayette, May 27, and during June showed signs of becoming extremely abundant. However, the intense heat in July caused a high mortality from which they did not fully recover, although they became fairly common in late fall. Observations the past ten years indicate that this pest will be a major annual pest in southern Indiana but that it will not be a problem in the northern third of the state, excepting following one or two mild winters and then only when the insects are abundant in the fall in southern Indiana and migrate in numbers to northern Indiana.

Bean leaf beetle (*Cerotoma trifurcata* Forst.) was reported damaging garden beans in many sections of the southern half of Indiana, most reports being received May 11 to 14.

Colorado potato beetle (*Leptinotarsa decemlineata* Say) was normally abundant throughout the state. Adult beetles damaged tomato plantings at Frankfort the last of May.

Potato flea beetle (*Epitrix cucumeris* Harr.) was a potato pest early in June in several localities in southwestern Indiana. Pale-striped flea beetle (*Systema taeniata blanda* Melsh.) was abundant and destructive to tomato plantings throughout the northern half of the state June 8 to 22. This species was also destructive to field and sweet corn in northern Indiana, although one report was from North Vernon in southeastern Indiana. The striped flea beetle (*Phyllotreta vittata* Fab.) was destructive to alfalfa at Winamac June 10.

Blister beetles (*Epicauta marginata*, *E. pennsylvanica*, and *E. vittata*) were abundant in gardens in early July, attacking potato, swiss chard, beets, and other vegetable crops.

Rhubarb curculio (*Lixus concavus* Say) was reported damaging rhubarb during the period May 13 to June 24, from many localities in the northern half of the state, one exception being Bedford in southern Indiana.

Zebra caterpillar (*Mamestra picta* Harr.) was abundant on garden peas at Fort Wayne, June 16, and riddling gladiolus foliage at Greenfield, June 15. In both cases the caterpillars were quite small.

Tomato worms (*Protoparce quinquemaculata* Haw. and *P. sexta* Joh.) became abundant during September, attacking both fruit and foliage of tomato in most regions of the state.

Cabbage worms (*Ascia rapae* L. = *Pieris rapae*) were unusually abundant this fall. The cabbage looper (*Autographa brassicae* Ril.) became abundant and destructive in August and early September, but were later checked by a bacterial disease.

Cabbage maggot (*Hylemyia brassicae* Bouché) was reported damaging cabbage at Indianapolis June 2.

Melon aphid (*Aphis gossypii* Glov.) was abundant in northern Indiana the last of August.

Turnip aphid (*Aphis pseudobrassicae* Davis) was abundant and destructive to turnips in the eastern part of the state during September.

Squash bug (*Anasa tristis* Deg.) was reported damaging squash at Roachdale, July 3.

Onion thrips (*Thrips tabaci* Lind.) was reported damaging onions at Ligonier, June 16.

The leafhopper (*Cicadula divisa* Uhl.) known to spread the causative virus of aster yellows and celery yellows, was found in noticeable numbers at Logansport, resulting in an appreciable amount of celery yellows.

Root-knot nematode (*Heterodera radicola* Greef) is being brought into Indiana in increasing numbers on tomato plants originating in southern states. The problem is one deserving careful study and, therefore, in cooperation with the Botany Department of the Purdue University Agricultural Experiment Station, a study was inaugurated in 1936 to determine the effect of nematode infestation on productiveness, relation of infestation to tomato diseases, varietal resistance, and the ability of the pest to live over winter under Indiana conditions. The preliminary studies conducted in 1937 point to this pest as a factor of significance in tomato production.

Fruit Insects

The periodical cicada (*Magicicada septendecim* L.) appeared as anticipated over the greater part of Indiana, being especially abundant in the southern half, gradually diminishing in numbers towards the northern end of the state. At Orleans on April 10, skunks were observed to be very active in an apple orchard digging for cicada nymphs. Beneath the older trees (25 to 40 years old) 50 to 100 holes made by skunks in search of nymphs were counted, but rarely a hole beneath trees set out since 1919. The skunks, in their search, had dug 4 to 6 inches for the nymphs, which were 4 to 7 or 8 inches below the surface, although they had completed their exit burrows to near the surface. Apparently, the severe winter had no harmful effect on the nymphs. At Orleans the first adults were observed May 20, the first "singing" May 21, and the first egg laying May 26 or 27, and by June 3 broken twigs were conspicuous. At Lafayette the adults were first observed May 23. A fungus disease (*Massospora cicadina* Peck) was not uncommon attacking adults in some localities, although it was not of material value in controlling the cicada.

In southern Indiana many apple trees set out this past spring or the year before were severely damaged, and the egg scars on older trees were not uncommon and will serve as a protection for the San Jose scale against dormant sprays.

Scurfy scale (*Chionaspis furfura* Fitch) was reported from many localities in the state as abundant on apple trees which had not received the dormant spray.

Codling moth (*Carpocapsa pomonella* L.) carried over the winter of 1935-36 in comparatively few numbers, the lightest for several years, due to unfavorable conditions in 1935, and the severe winter which was responsible for a high mortality of those hibernating above the snow line. However, except for a few brief periods, the weather was favor-

able to the development of the codling moth during the 1936 season from the very beginning of spring, resulting in marked increases in codling moth populations. The codling moth carry-over this fall is very high, not only in southern Indiana, but also in regions of northern Indiana, especially where rigid spray schedules were not practiced.

The first overwintering larvae pupated at Elberfeld April 10, and at Bicknell April 13. By April 16, 50% of the overwintering larvae had pupated at Elberfeld and by April 23, 40% had pupated at Bicknell, according to the records of the federal Fruit Insect Laboratory. Emergence of adults began April 30 at Elberfeld; first moths were taken in traps at Bicknell May 4. At Orleans the first record of emergence was May 4, the first moths taken in packing shed May 5, and the first record at bait traps May 7, (May 8 in 1935). Bait trap records showed peaks of emergence at Vincennes and Bicknell May 16-17, and at Orleans May 16-18. In the northern half of the state our first bait trap records were as follows: Lafayette, May 16; Denver, May 16; St. Joe, May 16; LaPorte, May 20; Bristol, May 23. The first larvae were hatching in the Vincennes area May 14, and at Orleans May 21. First larval entries at Vincennes were observed May 19. First larvae left apples at Orleans June 8, and at Bicknell June 10.

By June 22 codling moth infestations were as abundant as for several years, in spite of a subnormal carry over. The first of the series of moth peaks for the second brood came June 21 at Orleans, with successive peaks June 30, July 6, 11, and 14, each being somewhat larger than the previous peak. The first third-brood peak came August 1, with successively larger peaks until the final and largest peak which came August 18.

Oriental fruit worm (*Grapholitha molesta* Busck) became rather conspicuous by the abundance of injured twigs by June 22. However, the absence of fruit in southern Indiana was unfavorable to fall development. In a few regions of northern Indiana where a peach crop developed, the fruit worm increased noticeably and is carrying over the winter in large numbers.

Spring canker worm (*Paleacrita vernata* Peck), appearing the last of May and early June, was more abundant and destructive in northern Indiana than for several years. Unsprayed apple trees were commonly defoliated, and elms especially, among the shade and timber trees, were defoliated in many localities.

Plum curculio (*Conotrachelus nenuphar* Hbst.) was reported by Steiner as more abundant than usual and doing considerable injury. At Vincennes, egg punctures were observed as early as May 5, only a few days after petal fall.

Apple curculio (*Tachypterellus quadrigibbus* Say) was more abundant throughout the state than for many years.

Apple flea weevil (*Orchestes pallicornis* Say) was active in southwestern Indiana as early as March 31, according to Ackerman, the adults being active in apple buds at that time.

Japanese beetle (*Popillia japonica* Newm.) was found in two new localities in Indiana by federal scouts. At Fort Wayne three beetles were taken in the bait traps, and at South Bend two beetles were taken. In

both cases the beetles were taken in the vicinity of railroad yards, indicating introduction by means of rail transportation. Besides these two places and Indianapolis, where beetles have been taken for the past three years, trapping was done in seven other Indiana cities.

Shot hole borer (*Scolytus rugulosus* Ratz.) was destructive to weakened stone-fruit trees, but was not as conspicuous as anticipated, perhaps because many of the peach trees died or were so weakened by the severe winter that they were pulled out.

Apple leaf skeletonizer (*Psorosina hammondi* Ril.) became very conspicuous late in the summer in apple orchards which had been poorly sprayed.

Apple leafhoppers (? *Typhlocyba pomaria* McA.) were abundant the past fall on apple throughout the state. These pests are becoming more of a problem each year, and the evidence this year indicates that they are factors of considerable significance in reducing the size of fruit. In addition to damaging the foliage and, in consequence, the size of the apples, these insects are responsible for considerable spotting of the fruit.

San Jose scale (*Aspidiotus perniciosus* Comst.) suffered a high mortality during the past winter but has increased very noticeably in most sections of the state during the past season.

Black cherry aphid (*Myzus cerasi* Fab.) was very abundant and destructive to sweet cherry in orchards at Bristol, when visited June 19. Reports indicate their abundance in other parts of the state.

Cutworms (*Eriopyga cynica* Gn.) were reported to be attacking apple and peach buds at Bristol on May 15 and causing damage to the extent of \$2000.00 in one orchard investigated.

Red spider (*Tetranychus telarius* L.) was reported damaging blackberry at Mt. Vernon, June 26, and dahlia at Warsaw, September 11.

Shade Tree and Ornamental Shrub Insects

Cottony maple scale (*Pulvinaria vitis* L.) began showing up in conspicuous abundance in the northern half of Indiana during June, the first time for some years that this scale has been conspicuous. Eggs began hatching in northern Indiana June 22. Severe winter apparently had no harmful effect on this insect.

European elf scale (*Gossyparia spuria* Mod.) was also abundant in many sections of northern Indiana. This species, apparently not checked by the winter cold, is increasing in importance as an elm pest. The young were hatching at Jonesboro June 27.

Oyster shell scale (*Lepidosaphes ulmi* L.) is another scale insect which was not affected by the severe winter weather in spite of the fact that it is in a fully exposed situation. At Lafayette the young were hatching May 20, much earlier than usual.

Elm scurfy scale (*Chionaspis americana* John.) and pine leaf scale (*C. pinifoliae* Fitch) were normally abundant, the winter apparently having had no harmful effect.

Arbor vitae scale (*Lecanium fletcherii* Cock.) was reported by Rippey as on the increase and very abundant on arbor vitae in nurseries in northern Indiana.

Elm cockscomb gall (*Colopha ulmicola* Fitch) was reported as abundant from many parts of Indiana.

Elm leaf beetle (*Galerucella xanthomeloea* Schr.) was reported as defoliating large elms near Corydon. This is the first authentic record we have had since we began keeping records of Indiana insects in 1920. This is the third consecutive year of defoliation according to our informant. Later in the year word was received of defoliation of elms by this insect at Richmond.

Elm pine shoot moth (*Rhyacionia buoliana* Schiff. Heinrich det.) was rather common previous to July 20 on Mugho pine plantings at South Bend.

A sawfly (*Neodiprion* sp. Middleton det.) was reported attacking pines, including Scotch pine, at South Bend and Fort Wayne.

Flat-headed borer (*Chrysobothris femorata* Oliv.) was a common pest of maple, apple, and elm in many parts of the state, most of the reports being received during July.

The bagworm (*Thyridopteryx ephemeraeformis* Haw.) and tussock moth (*Emerocampa leucostigma* S. & A.) were normally abundant in southern Indiana. At Terre Haute both species were hatching by May 31, at which time the worms were only a day or two old.

The American bark beetle (*Hylurgopinus rufipes* Eichh.) was taken from an elm log in the vicinity where Dutch elm disease was found in Indianapolis this fall, according to Rippey. Specimens were sent to the Dutch Elm Disease Laboratory where the beetles were used in experiments and successfully established the disease on healthy elms.

Rose sawfly (*Caliroa aethiops* Fab.) was reported abundant on rose in several localities in the state during June and early July.

Lawn and Flower Garden Insects

Larvae of the green June beetle (*Cotinis nitida* L.) were reported damaging lawns in extreme southern localities in Indiana. At Evansville, according to a report received August 25, the parasite (*Scolia dubia*) was conspicuously abundant.

Ants (*Formicidae*) were common in lawns in many localities in the state, especially during May.

White grubs (*Lachnosterna* spp.) were damaging to lawns in isolated locations in northern Indiana.

Bronze cutworm (*Nephelodes emmedonia* Cram.) damaged blue grass lawns at Aurora, according to a report received May 19. However, this cutworm was not observed to attack adjoining plantings.

Household and Annoying Insects

Termites (*Reticulitermes flavipes* Koll.) continue as one of the major destructive insects in Indiana. This past year swarming was first observed in January and was more or less continuous in different locations until April 26.

Although termites must be recognized as a major destroyer of property, exaggerated statements have instilled unwarranted fear in the minds of many home owners. This in turn has provided easy work for racket and itinerant operators. There are reliable and experienced

termite control operators in Indiana, but there are many more who practice termite control who are wholly incompetent. Only persons or firms of known reliability should be employed for protecting homes from termites.

Powder post beetles (*Lyctus* spp.) are very common pests of hickory furniture, log cabins, and timbers in homes and barns throughout the state.

Cluster fly (*Pollenia rudis* Fab.) was frequently reported as annoying in homes in the northern half of Indiana during March and April.

Mosquitoes (Culicidae) were abundant and annoying in many localities in the state the middle of May and also during June.

Bedbugs (*Cimex lectularius* L.) have been reported abundant in homes and poultry houses in many localities in the state.

Other insects commonly reported as annoying or destructive in the home included the following: ants (Formicidae), fleas (*Ctenocephalus felis* Bouché), cockroaches (Blattidae), silverfish (*Lepisma saccharina* L.) clothes moth (*Tinea pellionella* L.), carpet beetles (*Attagenus piceus* Oliv. and *Anthrenus scrophulariae* L.) and boxelder bug (*Leptocoriscus trivittatus* Say).

Stored-Grain Insects

Angoumois grain moth (*Sitotroga cerealella* Oliv.) was frequently reported during May infesting seed corn and popcorn, most of the reports coming from the southern half of the state and in corn held over the second year.

The usual number of inquiries were received regarding the bean weevil (*Mylabris obtectus* Say), granary weevil (*Sitophilus granaria* L.), confused flour beetle (*Tribolium confusum* Duv.), saw-toothed grain beetle (*Oryzaephilus surinamensis* L.) and Indian meal moth (*Plodia interpunctella* Hbn.).