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L. O. HOWARD, ENTOMOLOGIST.

PROCEEDINGS

OF THE

FIFTEENTH ANNUAL MEETING

OF THE

ASSOCIATION OF ECONOMIC ENTOMOLOGISTS.

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LETTER OF TRANSMITTAL.

United States Department of Agriculture,
Division of Entomology,
Washington, D. C., March 29, 1903.

Sir: I have the honor to transmit herewith the manuscript of the Proceedings of the Fifteenth Annual Meeting of the Association of Economic Entomologists, which was held at Washington, D. C., December 26 and 27, 1902. The papers presented at this meeting are of an unusually practical nature, and the discussions bring out facts of considerable importance. I therefore recommend the publication of this report of the Proceedings as Bulletin No. 40 (new series).

The term "new series," applied to these bulletins, will be omitted after this number, as it is no longer necessary to distinguish them from the bulletins of the old series, which included only 33 numbers.

Respectfully,

L. O. Howard, *Entomologist.*

Hon. James Wilson,
Secretary of Agriculture.

The report of the secretary and treasurer was read and referred to an auditing committee appointed by the Chair, as follows: Dr. Henry Skinner and Mr. E. A. Schwarz.

The following names were proposed for membership by Mr. Howard: August Busck, J. Kotinsky, Otto Heideman, R. P. Currie, H. G. Dyar, W. E. Hinds, G. H. Harris, H. G. Barber, H. E. Burke, and J. L. Webb. Mr. Quaintance proposed for active membership Messrs. R. I. Smith and T. B. Symons, of the Maryland Agricultural College. Professor Webster proposed for foreign membership the name of Mr. Joseph Jablonowski, of the Entomological Station, Budapest, Hungary.

Mr. Marlatt inquired if election was necessary in the case of those qualified by their official position.

Mr. Felt thought that according to the constitution it was not, and that the only question was should a committee determine whether their positions qualified them for membership.

On motion of Mr. Osborn, a committee consisting of Messrs. Osborn, Quaintance, and Banks was appointed by the chair to consider the names which had been presented for membership and any others that might be proposed during the sessions.

Mr. Marlatt moved that the chair appoint a programme committee to arrange a programme for succeeding meetings, which was duly carried. The chair named Messrs. Marlatt, Fernald, and Burgess.

Mr. Howard moved that a committee of three be appointed on resolutions, which was carried, and Messrs. Washburn, Busck, and Rumsey were named by the chair.

A paper was next presented by Mr. A. F. Burgess, as follows:

ECONOMIC NOTES ON THE FAMILY COCCINELLIDÆ.

By A. F. Burgess, *Columbus, Ohio.*

Several years ago while located at Malden, Mass., I became interested in the study of the food habits of this family of beetles. Considerable data was collected at that time, and since some additional notes have been obtained; and it seems desirable to place the facts on record, as they may serve as an aid to some future investigator of this subject.

Many of these beetles hibernate during the winter in the adult stage. In Massachusetts it often happens that the most common ladybird, *Adalia bipunctata*, hibernates in dwellings, and sometimes appears during midwinter in rooms which are heated, usually to the disgust of the housewife, who, not recognizing the friendly character of her guest, immediately wages a war of extermination.

The following species have been captured on dates which indicate that they hibernate as adults:

Megilla maculata DeG.—Several hundred examples taken March 31, 1900, at Urbana, Ill. It is a common species in that locality.

Hippodamia glacialis Fab.—Taken at Malden, Mass., November 4, 1897.

Hippodamia parenthesis Say.—Taken at Malden, Mass., November 4, 1897. Taken at Urbana, Ill., April 5, 1900.

Coccinella trifasciata Linn.—Taken at Malden, Mass., April 13, 1898.

Coccinella 9-notata Hbst.—Taken at Malden, Mass., April 12, 1898.

Coccinella sanguinea Linn.—Taken at Malden, Mass., May 1, 1898. Taken at Urbana, Ill., April 15, 1900.

Adalia bipunctata Linn.—The most common species in eastern Massachusetts occurs under loose bark of trees and in sheltered places during the winter.

Harmonia picta Rand.—Taken at Malden, Mass., May 1, 1898.

Mysia pullata Say.—Taken at Malden, Mass., May 2, 1898.

Anatis 15-punctata Oliv.—Taken at Malden, Mass., January 12 and April 10, 1898.

Chilocorus bivulnerus Muls.—Taken at Malden, Mass., April 13, 1898. Taken at Urbana, Ill., April 26, 1900.

Pentilia misella Lec.—Taken at Lakeside, Ohio, October 27, 1900. Large colonies were found under cloth bands, which had been tied around the trunks of plum trees infested with San Jose scale. There were thousands of beetles in this orchard.

Brachyacantha ursina Fab.—Taken at Malden, Mass., May 5, 1898.

Hyperaspis signata Oliv.—Taken at Malden, Mass., May 1, 1898.

Of the 14 species above listed, *Megilla maculata* and *Adalia bipunctata* were the only ones which were found during the winter in colonies. In most cases isolated beetles remain during the winter under the loose bark of trees or under leaves or rubbish, and come forth on the first warm days in spring to search for food.

Early in the spring of 1898 they were first found feeding upon plant-lice eggs. These eggs do not hatch until several days after the beetles appear; hence this habit of the beetles serves to reduce the number of lice considerably.

April 13, 1898, many specimens of *Adalia bipunctata* were found feeding on the eggs of an aphid, which was particularly abundant on the white birch at Malden. A few days later *Anatis 15-punctata*, *Coccinella sanguinea*, *C. 9-notata*, and *Chilocorus bivulnerus*, as well as *Adalia bipunctata* and its variety, *humeralis*, were found busily engaged in feeding on the aphid eggs. Thousands of specimens of Adalia were present, and large numbers of Anatis, the other species occurring in moderate quantities. Three days later both Adalia and Anatis were found mating, and an egg-cluster of the former species was also discovered.

The aphid eggs were found hatching April 18, the young lice at once proceeding to the leaf buds, which were just beginning to burst open. The development of foliage was considerably retarded by the cold and wet weather which characterized the spring of 1898.

Larvæ of Adalia were found May 1. At this time an excellent opportunity was offered to observe the interrelations between several

species of insects. The ladybirds in both adult and larval stages fed greedily on the eggs of the plant-lice and the young lice as soon as they hatched. Accompanying the beetles was also noted several species of predaceous bugs, the most common one being *Podisus serieventris*. Although this species was occasionally found feeding on the plant-lice, it was continually observed preying upon the ladybirds in all their stages. The particular species upon which it was taken in the act of feeding were *Adalia bipunctata* in the egg, larval, and adult stages; *Coccinella trifasciata*, and *Chilocorus bivulnerus*. Four specimens of *Podisus serieventris* were once observed feeding on a single adult *Adalia bipunctata*.

It is a well-known fact that many species of insects will become cannibals if kept in confinement with insufficient food, but *Adalia bipunctata* has been observed repeatedly in the woods feeding upon the eggs of its own species when plenty of other food was available and within easy reach.

By the last part of July scarcely a plant-louse or a ladybird could be found in the locality where they had both been so abundant.

Several species of Coccinellidæ were bred in confinement, and the following table gives their egg-laying records. A pair of beetles was placed in each jar with food, and the record was continued until the female died:

Egg-laying records of several species of ladybirds.

[The asterisk (*) indicates the date on which the experiment was begun.]

Date.	Adalia bipunctata.		A. bipunctata, var. humeralis.		Anatis 15-punctata.			Coccinella sanguinea.	Coccinella 9-notata.	Coccinella trifasciata.
April 6	*									
8		*								
11		29								
13		15	*							
17		29			*					*
18	9	27								
19		9								
20			14							
22					13					
23		2	8		20					
24	8									
28					9					
May 1	13				9		*			
6						*	12	*		
8						14	17	7		
9			15							
10						6	12			
11			12						*	
12			13			12	9			24
13			20		6	20	5			
14						17		12		
16			6							
18			21			26	4			20
19		11	18			27	1			9
20					14	1	10			
21			8			5				18
22			2			8				
23			1							12
24			7	*						
27				10						
28				19						
29							3			
30				23						
June 2				33						

Egg-laying records of several species of ladybirds—Continued.

Date.	Adalia bipunctata.		A. bipunctata, var. humeralis.		Anatis 15-punctata.			Coccinella sanguinea.	Coccinella 9-notata.	Coccinella trifasciata.
June 3										28
4				16						
7									13	
8				12					23	15
9									21	
10				6					60	
11									38	16
12									39	
13				13					15	
14				20					20	
15				20						
16										18
17									2	
19									20	12
21										16
22										20
24				13						
26										25
27										10
28				20						
July 4										15
6										19
8										15
13										18
14										9
15										5
26										12
27										15
28										20
30										19
31										23
Aug. 6										2
7										7
9										4
	30	122	145	205	71	136	73	19	251	426

A pair of *Adalia bipunctata* var. *humeralis* (see column 3) was placed in a jar with food April 13, and eggs were deposited on April 20 and 23. On May 3 the female was isolated, but continued to deposit eggs for three weeks. The eggs, 105 in number, laid from that date until May 20, hatched, but 18 laid subsequent to the 20th did not hatch. In this case the female continued to lay fertile eggs for sixteen days after being isolated.

Several species of ladybirds were reared, and the number of days spent in each stage is given below. In cases where more than one individual of a species was reared the average number of days spent in each stage is given in the table.

Number of days spent in different stages of development by several species of ladybirds.

Species.	Egg.	First larval.	Second larval.	Third larval.	Fourth larval.	Pupa.	Adult to adult.
Adalia bipunctata	6	6	5	5	7	9	38
Adalia bipunctata var. humeralis	5	6	5	6	7	9	38
Anatis 15-punctata	8	6	6	5	12	9	46
Chilocorus bivulnerus	13					8	
Mysia pullata	7	10	5	9	14	7	52
Coccinella sanguinea	7	5	6	5	7	7	36
Coccinella 9-notata	7	6	4	2	6	6	30
Coccinella trifasciata	5	5	6	4	6	8	36

I did not succeed in rearing *Chilocorus bivulnerus*, but secured only the data given in the table.

The length of time spent by these beetles in their different stages varies considerably; it is influenced chiefly by the food supply and weather conditions.

If they are furnished with an abundance of food, and the weather is very warm, the length of time spent in each stage may be considerably reduced.

The next table gives a somewhat incomplete record of the average amount of food consumed daily by the beetles and the amount eaten during each larval stage while they were being reared in captivity. The aphids which served as food were of different species, and would average about the size of half-grown apple aphids. The birch aphid eggs were of the same form and color, but slightly smaller than the eggs of the apple aphis.

Number of aphids consumed daily by ladybirds of several species during different stages.

Species.	First larval stage.	Second larval stage.	Third larval stage.	Fourth larval stage.	Adult stage.
Adalia bipunctata	6	7	23	10	10
Anatis 15-punctata	51	55	107	213	90
Mysia pullata	.....	.....	.....	.....	50
Coccinella sanguinea	10	55	60	.....	.....
Coccinella 9-notata	23	36	.....	.....	100
Coccinella trifasciata	10	30	50	155	50

An adult specimen of *Adalia bipunctata* consumed 100 aphid eggs daily, and an adult of *Chilocorus bivulnerus* ate about one-half as many of these eggs during the same period.

The records given show in a general way something of the economic value of the insects discussed, and gives, it is hoped, more definite data concerning some points in their life history than has been published heretofore.

Mr. Marlatt stated that he had been much interested in this paper, and thought that it threw light on a number of matters about which information was needed. He asked Mr. Kotinsky to give a brief statement on the amount of food which the Asiatic ladybird would eat, since Mr. Kotinsky had been looking after those details. He further stated that the egg records which Mr. Burgess had given were interesting, but he did not consider them of sufficient number to warrant definite conclusions as to the number of eggs deposited by the insects. He thought Mr. Schwarz could give some information on that point. He thought that probably all ladybirds would be found to live for a considerable length of time, the imported *Chilocorus similis* sur-

viving nearly a year, and that egg laying normally extended over a protracted period.

Mr. Kotinsky stated that he had been charged by Mr. Marlatt with the care of the imported Asiatic ladybird ever since it had reached this country, a little over a year ago. He had had occasion to closely watch its food habits until during the summer, when large numbers were available and could safely be confined for close observation. At Mr. Marlatt's suggestion he had once placed three larvæ, one each of the first, second, and third stages, in a jar upon a peach twig covered with young newly hatched peach scales (*Diaspis pentagona*). These had been kept for seventy-two hours, and after making very liberal allowance it was calculated that they had eaten in the course of those three days some 14,000 larvæ, an average rate of 1,500 in the course of twenty-four hours, or a little over one per minute for each beetle larva. Upon a closer observation still he had found that a half-grown larva about the second stage would eat a larva of the scale in the course of about five or six seconds, and would consume about 5 or 6 per minute. He thought the larvæ spent some time wandering about, resting, etc., which accounted for the reduced average when rates per day were considered. Only on one occasion, and that an abnormal one, had he observed one of the larvæ to eat another. This occurred when two full-grown larvæ were confined upon a stick which had no food upon it at all. He was rather surprised to find that the smaller of them had been eaten into by the large fellow immediately back of the head. The beetles themselves are equally voracious. He had not had a chance to count, but they will eat the scale in all stages and plenty of them. It is very interesting to watch them devour an old scale. They do not bore underneath it, but gnaw a hole through the scale close to the exuvium and presumably suck the juices of the scale insect. Time and again he had found the mutilated skin of the adult female adhering closely to the inside of a scale. Once in a while he had seen the beetles chasing each other and enjoying themselves generally upon the twigs. It was also very amusing to see a female sitting over a scale, the ovipositor projected underneath, and herself engaged, in many instances, in calmly devouring the host, which she had apparently withdrawn from beneath its dome. He had never found an egg beneath a scale when it was perforated. Normally the egg is deposited underneath the scale, but he had seen some deposited on the bark, but in no instance had he observed that under these conditions they hatched into larvæ. He had also found some eggs among the bristles of empty pupæ cases.

Mr. Kotinsky further remarked that he had been much interested in the note made by Mr. Burgess on the failure of breeding *Chilocorus bivulnerus*. In spite of all his efforts for over a year now, he had failed absolutely in obtaining the eggs from this species. Mr. Heideman

had once called his attention to a tree on the grounds of the Department of Agriculture thickly covered with the Putnam scale (*Aspidiotus ancylus*), upon which were feeding a number of the twice-stabbed ladybird larvæ. These were the first larvæ of this species which he had noted last summer, as they were unusually scarce. Repeated attempts to obtain the eggs from either the captured adults or other beetles reared in confinement had resulted in disappointment. He expressed a desire to compare eggs of this species with those of *Chilocorus similis*. He was not aware that the egg of any *Chilocorus* had been previously described, which accounted for the difficulty experienced in finding the eggs. There were only two beetles of the Japanese ladybird left in the spring, and the absorbing problem with him had been to find the eggs. Some one had suggested that these might be found in clusters on the surface of the bark, but this did not prove to be the case. He had frequently turned up the scales upon traversed twigs to see whether the scale insects were edible, and in the course of these examinations had discovered underneath the scale something which had at first been taken to be a parasite of the scale insect, but which upon closer examination proved to be the egg of *Chilocorus similis*.

Mr. Howard remarked that he was not aware of other careful observations upon the life history of Coccinellids in this country except the series of Mr. Marlatt and Mr. Kotinsky, and those made by Mr. Coquillet in California, and his recollection was that the total life from egg to adult of *Vedalia cardinalis* in California was much shorter than the life histories which Mr. Burgess had followed in Massachusetts.

Mr. Coquillet stated that his observations on those ladybirds in California had been so long ago that the details had passed from his mind.

Mr. Fiske stated in relation to the life history of *Chilocorus bivulnerus* in Georgia that he considered it a most valuable species from an economic standpoint, and that he had had a good many opportunities to observe its younger stages and to observe it throughout the year. The eggs had been for a long time unknown to him, but last spring he had found them in considerable quantities upon old peach trees infested with the cherry scale, and the eggs were situated under the scales on the bark. At the time they were found they were brown in color instead of yellow, as he had expected. They were not reared to full maturity. He mentioned a very interesting instance which had occurred in Georgia the present year indicating the value of ladybirds. The season had been very long and unusually dry and the plant-lice had had an unusually good opportunity for development; especially was this true of the cotton aphis. Although this insect usually disappears about the first or middle of June, it continued the present year up until the 1st of July and threatened to do considerable damage.

About the middle of July letters began to come in to the Department concerning a so-called new insect occurring on cotton. The prevalence of the Colorado potato beetle in Georgia at the present time led many of the cotton growers to think that this plant was being attacked by the Colorado potato beetle. Upon receiving specimens of the insect injuring cotton, it proved to be *Hippodamia convergens*, the specimens received being mostly in the larval and pupal conditions. For some time something over twenty letters a day were received from cotton growers concerning this insect. He had made two or three trips to the cotton fields to observe this species and found that it occurred in very extraordinary numbers; thousands of them on the cotton plants. There would be as many as a dozen or fifteen or even twenty larvæ and pupæ of this ladybird on one tip of the plant, perhaps no more than 3 inches long. There were also present larvæ of certain lace-winged flies, but he considered this ladybird beetle the principal agent in checking the outbreak of the cotton aphis.

Mr. Fiske further stated that both he and Mr. Scott had been giving considerable attention to the ladybirds as found in Georgia and hoped soon to be able to publish a paper on them. One species, an *Exocomus*, had been reported as feeding on scale insects, and he was informed, he thought by Mr. Schwarz, that this genus was one that fed almost exclusively on scale insects. He had observed this species frequently, and so far it had occurred largely on plant-lice and only occasionally on scale insects.

Mr. Burgess remarked in reference to *Chilocorus bivulnerus* that he had attempted to rear it a number of times, but had been unable to do so. This species appeared to feed on plant-lice, and when plant-lice eggs were offered the beetles early in the spring they were devoured quite greedily. In his own experiments he had been able to obtain only two or three eggs of this species, and they had been deposited on a twig placed in a jar. Only one of these eggs had hatched, and this was how he had obtained the record indicated, of the length of the egg stage.

The next paper, presented by Mr. F. L. Washburn, was as follows:

DISTRIBUTION OF THE CHINCH BUG IN MINNESOTA.

By F. L. Washburn, *St. Anthony Park, Minn.*

From observations made last summer, from reports of correspondents, and from press articles it is evident that the chinch bug has been this season confined to the southeastern, south central, and southern portions of the State. Careful examination of Professor Lugger's past reports indicates that this is not a condition of affairs