Technical Report No. 50

SAMPLING INSECT POPULATIONS BY SWEEP NET ON THE PAWNEE SITE

GRASSLANDS BIOME

U. S. International Biological Program

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ABSTRACT

Insect samples collected by sweep net on the Pawnee Site were influenced by weather at the time of sampling as well as by population changes. Consideration of these effects allows a better understanding of insect behavior and reduces the sampling required.

METHODS

The Study Area

The main study area is located within the Pawnee Grassland in Weld County, Greeley, Colorado. It is a U. S. D. A. grassland experiment station which is approximately seven miles north of Nunn, Colorado.

The Pawnee grassland experiment field is divided into several sections and this report is written from work done only in T 10 N, R 65 W Section 20. This section has a dense growth of *Melilotus officinalis* (L.) Lam. with an understory of western wheatgrass (*Agropyron smithii*), sagebrush (*Artemisia frigida*), white clover (*Melilotus alba*), thistle (*Circium arvense*), prickly pear (*Opuntia*), buffalo grass (*Buchloe dactyloides*), and sunflower (*Helianthus*). These plants were classified with the help of botanists at Colorado State University using Harrington's book, *Plants of Colorado*. The density of *Melilotus officinalis* L. in the area sampled was about 92% and other plants constituted 8%.

This study area was chosen because of its homogeneity and so that it would be possible to sample only the *Melilotus* without the probability of picking up too many insects that would not normally be found on *Melilotus*.

Sampling Technique

The section was sampled twice a week at the beginning of the season and the frequency was gradually reduced as the number of insects caught declined. Counts were begun on *Melilotus* at approximately 2:30 p.m. every sampling date from June 21 through October 15, 1968. Prior to sampling, the date, time of day, plant stage, and the approximate weather conditions were recorded in a field notebook.

The area was sampled by sweeping with a standard sweep net. Two methods of estimating pest populations were used, the sweep net method and visual plant observation. To avoid undue variation in the environmental factors during the interval, 10 plants were examined then the sweeps were made and 10 more plants were examined. Ten sweeps were made on *Melilotus* and each sweep was equal to a swing through 180° around a point in a horizontal plane. The contents of each 10 sweeps were killed and put into an empty vial. This was one sample. The number of samples taken each day varied from 10 to 23 depending on the density of the species sampled, the frequency of occurrence of the species, and the total insect yield (Table 1). Random sampling was not actually taken into account.

The visual observation was conducted mainly to determine the portion of the plant fed on by the different species, the type of damage they do and the density of each species per plant. Stems with puncture wounds and entrance holes were cut and brought back into the laboratory for further examination. Galls were also brought back for identification. Nymphs and larvae were brought back and, if possible, identified. Those that could not be identified directly, were reared and identified by means of the adults. During the seeding stage of the plant, seeds were brought back at different intervals and examined for eggs and seed-feeding insects.

All the samples were brought back into the laboratory and counts were made of all the insects caught according to species, where possible. Sometimes only the genus or family names could be recorded because of problems in identification. Specimens of each species were pinned and labeled for a more accurate identification at a later time.

There are other possible methods that could have been used to sample the area. These two methods were chosen considering the amount of funds allocated to the project during that time.

INSECT BEHAVIOR

Several of the species collections were greatly influenced by weather. Comparisons to the previous nights minimum temperature were particularly valuable for *Hydnocera subfasciata* Lec. (Fig. 1). Other species had strong cyclic trends which obscured the effects of weather. When the population trends were expressed as a function of the cosine and sine of the collection date, however, the weather effects became apparent and a useful relationship could be expressed (Fig. 2). Still other species showed population trends but did not show particular responses to weather (Fig. 3).

SAMPLING EFFICIENCY

The variances for the sweep net samples were generally larger than the mean (Table 2). When the regression equations including temperature, cosine, and sine were applied, however, the residual variances were generally less than the means. On the average, the residual variance was 0.7 that of the total variance. Use of regression equations correcting sample numbers for weather and population cycles can be expected to require required sample numbers to 85% of that required without such corrections.

Table 1. Populations of 24 taxa of insects. Average number of specimens per ten sweeps (12" net) on 18 sampling dates from June to September 1968.

TAXA	JUNE 11	JUNE 18	JUNE 21	JUNE 25	JUNE 28	JULY 2	JULY 6	JULY 9	JULY 16
COLEOPTERA, Tenebrionidae									
Bothrotes canaliculatus (Say)	0.5	0.25	0	0.25	0	1.1	1.0	1.6	2.0
Eleodes hispilabris (Say)	0	0	0	0	0	0	0	0	0
Cleridae									
Hydnocera subfasciata Lec.	0	0	0.9	0	0.7	0.7	0.8	0.25	0
Coccinellidae									
Hippodamia convergens Guen.	0	0	1.8	0	0.6	0.4	0.2	0.2	0
Curculionidae									
Sitona flavescens Marsh	0	0	2.6	0	0.4	0.5	1.1	0.5	0
Collops bipunctatus Say	1.25	1.0	0	2.0	0	2.0	0.2	3.0	3.0
Mordellidae									
Mordella marginata Melsh.	1.25	1.0	ND	1.0	ND	3.0	ND	3.0	0.25
Mordellistena aethiops Smith	0	0	0	0	0.3	0.2	3.4	4.55	0
Mylabridae									
Mylabris fraterculus Horn	5.0	9.0	ND	10.0	ND	14.5	ND	9.0	2.0
DIPTERA, Bombyliidae									
Phthiria sulphurea Loew	ND	ND	0	0	0	0	0.1	0.6	ND
Chloropidae									
Eribolus nanus (Zett.)	ND	ND	4.0	ND	2.6	14.3	17.5	1.2	0
Scenopinidae									
Scenopinus sp.	0	0	0	0	0.5	4.0	10.1	12.4	0
Trypetidae									
Euarestoides abstersus (Loew)	ND	ND	2.4	0.2	0.2	1.3	1.5	0.1	ND
HEMIPTERA, Lygaeidae									
Nysius angustatus Uhl.	ND	ND	0.4	ND	2.9	2.5	5.8	2.5	ND
Miridae									
Adelphocoris rapidus Say	ND	ND	4.2	ND	6.8	1.8	2.4	4.4	ND
Liocoris desertus (Knight)	4.0	4.0	6.0	8.0	4.6	10.0	10.7	12.2	7.0
Nabidae									
Nabis alternatus Pshly.	ND	ND	4.9	ND	5.8	2.0	1.0	1.2	ND
HOMOPTERA, Aphidae									
Misc. aphids	1.25	2.0	ND	2.0	ND	2.0	ND	1.6	1.0
Cicadellidae									
Cuerna costalis (F.)	ND	ND	2.0	ND	0.8	0.7	0.4	0.2	ND
Fulgoridae									
Bruchomorpha oculata Newn.	ND	ND	0.8	ND	2.4	0.3	0.2	0.3	ND
LEPIDOPTERA, Arctiidae									
Estigmene acraea (Drury)	0.25	1.25	0.3	2.0	2.1	7.0	8.1	8.5	4.0
HYMENOPTERA, Braconidae									
Apanteles sp.	ND	ND	0	0	0	0.6	2.1	1.0	ND
Halictidae									
Halictus confusus Smith	ND	ND	2.4	ND	0.2	0.3	0.2	0.4	ND
ORTHOPTERA, Acrididae									
Melanoplus sp.	ND	ND	10.1	ND	10.2	5.4	8.2	3.3	ND

Table 1. (continued)

TAXA	JULY					AUGUST			SEPT.
	19	23	26	30	31	2	6	13	6
COLEOPTERA, Tenebrionidae									
Bothrotes canaliculatus (Say)	0.8	2.0	3.6	3.0	2.1	0.3	0	0.2	0.1
Eleodes hispilabris (Say)	0	0.2	0.5	0	1.0	2.1	1.5	2.4	1.0
Cleridae									
Hydnocera subfasciata Lec.	0.25	0.2	0.4	0	0.2	0.2	0.3	0.3	0
Coccinellidae									
Hippodamia convergens Guen.	0.1	0	0	0	0	0	0	0	0
Curculionidae									
Sitona flavescens Marsh	1.0	1.9	2.1	0	0.2	0.5	0.6	0	0.2
Collops bipunctatus Say	0.4	1.0	0.6	1.0	0.1	0.2	0.6	0.6	0
Mordellidae									
Mordella marginata Melsh.	ND	1.0	ND	0.6	ND	ND	0.6	0.7	ND
Mordellistena aethiops Smith	0.2	2.8	3.6	0	1.0	0.2	0	0	0
Mylabridae									
Mylabris fraterculus Horn	ND	3.0	ND	1.0	ND	ND	0.6	1.0	ND
DIPTERA, Bombyliidae									
Phthiria sulphurea Loew	1.2	2.6	3.1	ND	1.1	0.4	0.2	1.5	0.1
Chloropidae									
Eribolus nanus (Zett.)	1.2	2.5	0.5	0	1.1	0.2	0.5	0	0.5
Scenopinidae									
Scenopinus sp.	0.2	9.2	2.5	0	0.3	4.4	4.8	1.5	0.2
Trypetidae									
Euarestoides abstersus (Loew)	0.2	1.0	0	0	0	0	0	0	0
HEMIPTERA, Lygaeidae									
Nysius angustatus Uhl.	2.6	4.7	2.2	ND	0.2	0	0.2	0.6	0.5
Miridae									
Adelphocoris rapidus Say	1.3	3.3	0.2	ND	0.3	0.2	0.5	0	0.5
Liocoris desertus (Knight)	11.8	13.1	1.5	5.0	0.3	0.4	0.2	0.6	0
Nabidae									
Nabis alternatus Pshly.	0.7	1.0	0.5	ND	0	0.1	0	0	0
HOMOPTERA, Aphidae									
Misc. aphids	ND	0	ND	0.25	ND	ND	0.25	0.25	0.25
Cicadellidae									
Cuerna costalis (F.)	1.4	2.6	1.7	ND	0.2	4.0	0.8	0.5	0.2
Fulgoridae									
Bruchomorpha oculata Newn.	5.1	5.2	0.6	ND	0.4	1.0	0.5	0.3	0
LEPIDOPTERA, Arctiidae									
Estigmene acraea (Drury)	5.2	6.0	5.8	4.0	3.8	2.4	2.0	1.2	0.4
HYMENOPTERA, Braconidae									
Apanteles sp.	5.1	2.0	1.0	ND	0	0	0.1	0.2	0
Halictidae									
Halictus confusus Smith	2.7	0.5	0.2	ND	0	0.2	0	0	0
ORTHOPTERA, Acrididae									
Melanoplus sp.	16.3	14.2	11.1	ND	7.9	7.2	3.8	3.7	0.7

Table 2. Means and variances of insect sweep net samples.

Insect Taxa	Samples	Mean	Total SS.	Total Variances	Residual Variance	Ratio of Variances
Bothrotes canaliculatus (Say)	18	1.04	20.66	1.22	.94	.77
Eleodes hispilabris (Say)	18	.48	10.50	.62	.38	.61
Hydnocera subfasciata Lec.	18	.29	1.51	.09	.04	.44
Hippodamia convergens Guen.	18	.18	3.24	.19	.13	.68
Sitona flavescens Marsh	18	.64	10.86	.64	.42	.66
Collops bipunctatus Say	18	.94	15.93	.94	.54	.57
Mordella marginata Melsh.	10	1.24	8.46	.94	1.05	1.12
Mordellistena aethiops Smith	18	.90	39.60	2.33	2.30	.99
Mylabris fraterculus Horn	10	5.51	209.01	23.25	13.89	.60
Phthiria sulphurea Loew	14	.78	13.36	1.05	.78	.74
Eribolus nanus (Zett.)	15	3.02	402.95	28.90	23.04	.80
Scenopinus sp.	18	2.78	268.28	15.80	15.26	.96
Euarestoides abstersus (Loew)	15	.46	7.66	.55	.27	.49
Nysius angustatus Uhl.	13	1.93	40.63	3.39	2.64	.75
Adelphocoris rapidus Say	13	1.99	53.89	4.48	2.16	.48
Liocoris desertus (Knight)	18	5.52	355.33	20.90	15.80	.76
Nabis alternatus Pshly.	13	1.32	43.08	3.59	.98	.27
Misc. aphids	11	.99	6.67	.67	.28	.42
Cuerna costalis (F.)	13	1.19	15.43	1.28	1.54	1.20
Bruchomorpha oculata Newn.	13	1.32	39.04	3.35	3.50	1.07
Estigmene acraea (Drury)	18	3.57	121.77	7.15	4.62	.65
Apanteles sp.	14	.86	26.37	2.02	2.10	1.04
Halictus confusus Smith	13	.56	9.82	.82	.88	1.07
Melanoplus sp.	13	7.85	244.87	24.50	14.84	.61

FIGURE TITLES

Fig. 1. Effect of previous nights minimum temperature on sweep net collections of *Hydnocera subfasciata* Lec.

Fig. 2. Relationship between sample values and regression model for *Collops bipunctatus* Say.

Fig. 3. Relationship between sample values and regression model for *Adelphocoris rapidus* Say.

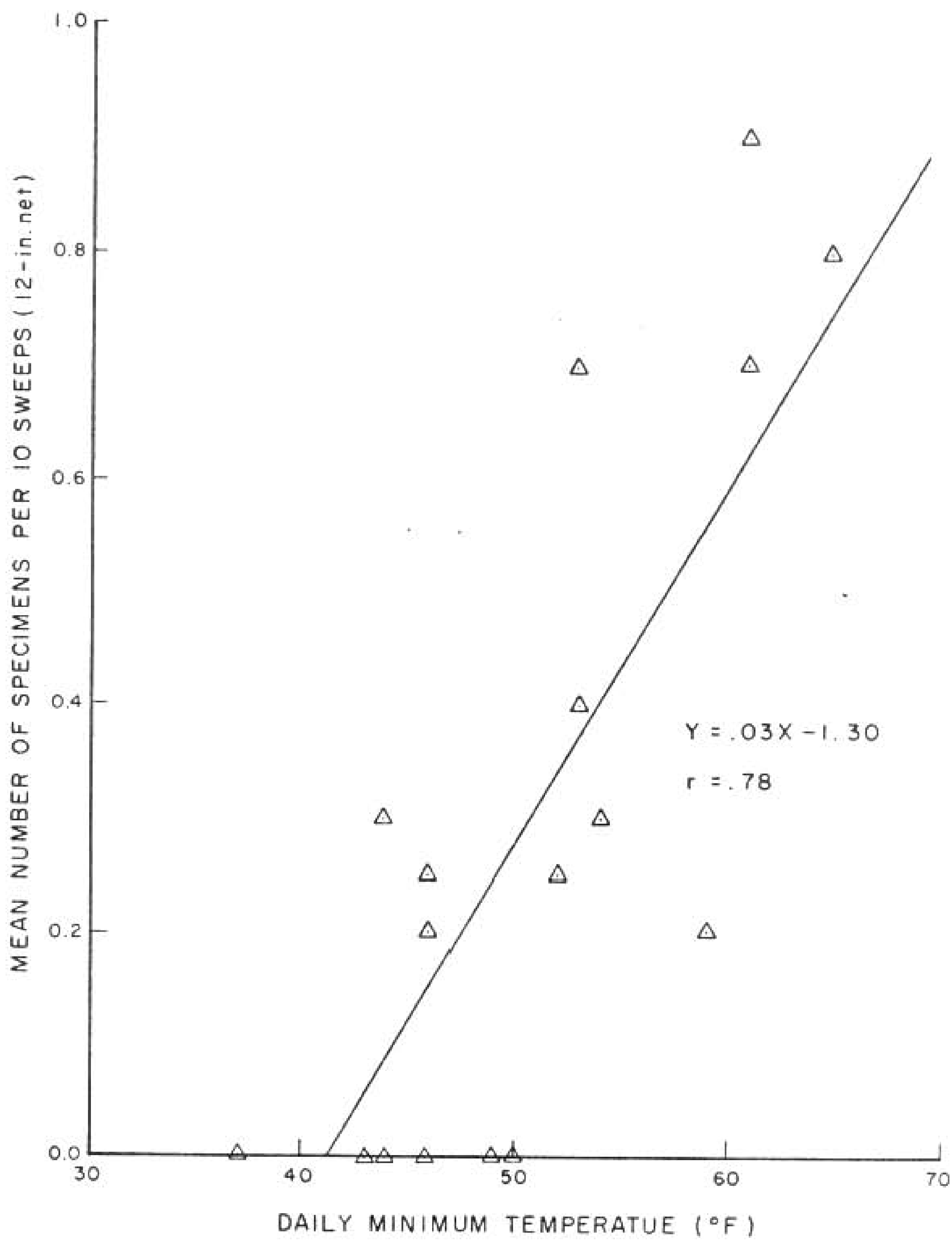

Fig. 1. Effect of previous night's minimum temperature on sweep net collections of *Hydnocera subfasciata* Lec.

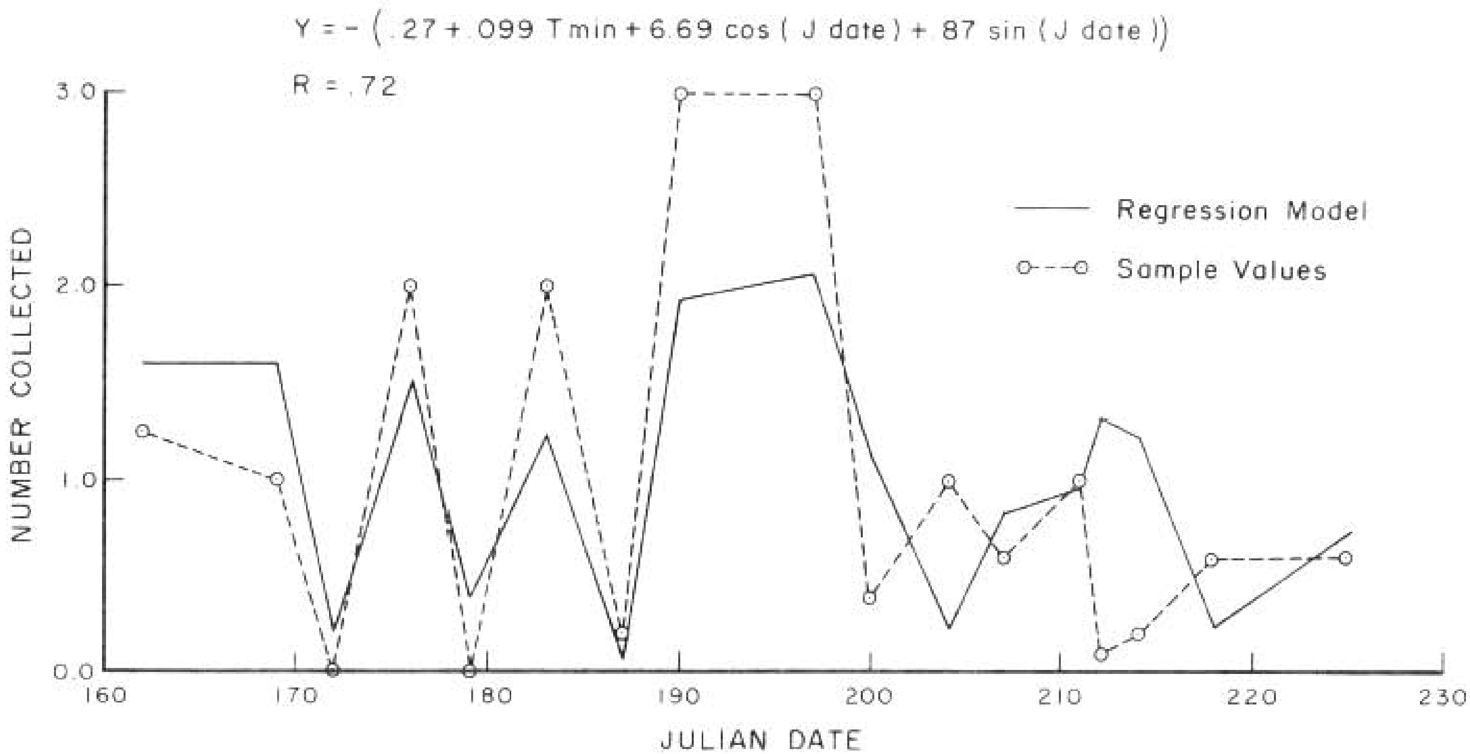

Fig. 2. Relationship between sample values and regression model for *Collops bipunctatus* Say.

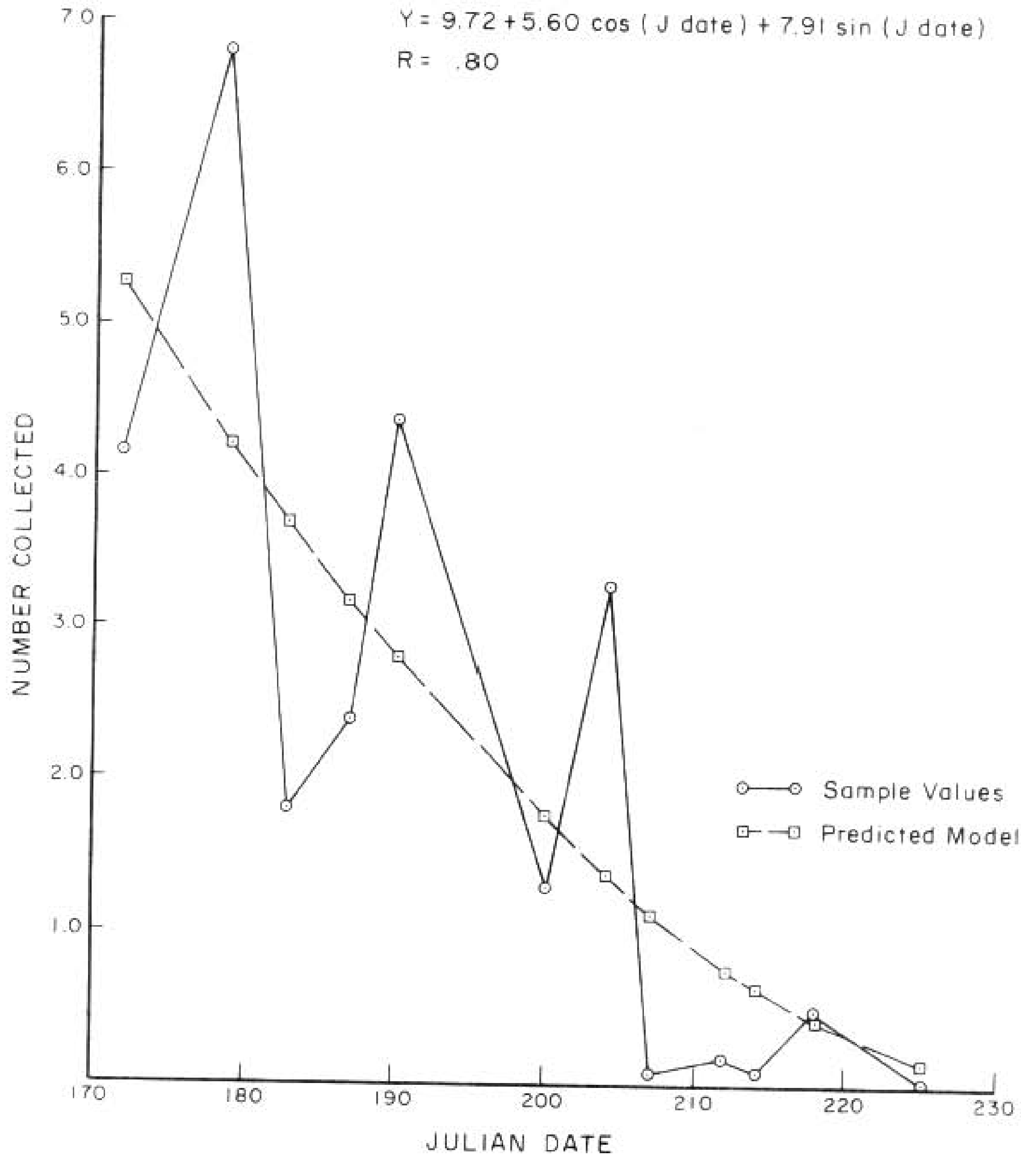

Fig. 3. Relationship between sample values and regression model for *Adelphocoris rapidus* Say.