

## STUDIES OF THE FOOD HABITS OF UTAH LIZARDS.<sup>1</sup>

G. F. KNOWLTON AND M. J. JANES.<sup>2</sup>

During the summer of 1931, 606 lizards were collected principally from desert areas in Tooele and Box Elder Counties, in northern Utah. Most of these were taken on Russian thistle areas near shadscale, sagebrush, or greasewood; most of the collections were made in connection with sugar-beet leafhopper predator studies. Almost the entire food of the lizards consisted of insects, with the addition of some spiders. A much larger number of lizards were examined in 1931 than during the studies carried on during the preceding year.<sup>3</sup>

Most of the lizards were collected with a .22 rifle, using shot shells. After an incision was made in the body cavity, each specimen was preserved in 80 per cent alcohol. The stomach contents were examined microscopically in the laboratory. No attempt was made to identify the large number of insect fragments present in most of the stomachs.

Nearly all of the forms recovered from the lizard stomachs were injurious or of unknown importance. However, beneficial forms, such as *Geocoris decoratus* Uhl. and *Nabis ferus* (L.), predators, and *Pipunculus* sp. parasites upon *Eutettix tenellus* were taken, along with some beneficial Hymenoptera, Diptera and Carabidae.

An analysis of the stomach contents of the two most common forms is given in Table I. Because of the large number of beet leafhoppers consumed,<sup>4</sup> these species are considered as being beneficial in the areas studied.

The stomach contents of the following specimens of the brown-shouldered Uta, *Uta stansburiana stansburiana* (B. and G.), are fairly typical: Specimen (1) collected in a Russian thistle area at Flux (Tooele County), October 19; 3 nymphal *Eutettix tenellus* (Baker), 4 *Nysius ericae* (Schill.), 1 adult and 1 nymphal *Geocoris decoratus* Uhl., 1 lepidopterous larva and

<sup>1</sup>Contribution from the Department of Entomology, Utah Agricultural Experiment Station. Approved for publication by Director.

<sup>2</sup>Associate Entomologist and Graduate Assistant, respectively.

<sup>3</sup>Notes on Insect Food of Two Utah Lizards. By G. F. Knowlton and M. J. Janes. In Proc. Utah Acad. Sci. 8: 140-142 (1931).

<sup>4</sup>The Beet Leafhopper in Northern Utah. By G. F. Knowlton. Utah Agr. Exp. Sta. Bul. 234 (Tech.), (1932).

1 spider. Specimen (2) collected in a Russian thistle area west of Delle, August 14; 8 adults and 1 nymphal *Eutettix tenellus*, 1 *Geocoris decoratus*, 1 *Pipunculus* sp., 1 *Chloropisca glabra* (Meig.), 5 Formicidae, and 7 spiders. One individual (3) taken on June 19 among *Cheirinia repanda* southeast of Timpie, contained an unusual variety of insects consisting of 1 grasshopper nymph, 3 adults and 1 nymphal *Eutettix tenellus*,

TABLE I.

Stomach Contents of *Uta stansburiana stansburiana* (Baird and Girard) and *Sceloporus graciosus graciosus* (Baird and Girard) Collected on Utah Desert Areas, 1931.

Hexapods (Insects)	Total Stomach Contents of 528 Specimens of <i>Uta stansburiana stansburiana</i>		Total Stomach Contents of 61 Specimens of <i>Sceloporus graciosus graciosus</i>	
	Adult Insects	Immature Insects	Adult Insects	Immature Insects
Collembola.....	43	0	0	0
Orthoptera.....	12	44	3	24
Isoptera.....	114	0	0	0
Odonata.....	12	0	0	0
Neuroptera.....	1	3	0	0
Thysanoptera..	4	0	0	0
Homoptera.....	908	656	61	72
Hemiptera.....	651	190	41	27
Coleoptera.....	97	4	25	1
Diptera.....	337	18	8	1
Lepidoptera....	24	57	9	17
Hymenoptera..	458	12	215	0
Total Insects	2,661	984	362	142
ARACHNIDA (Spiders).....	227 and two masses of eggs.		14	
REPTILIA.....	1 small <i>Uta stansburiana stansburiana</i> .			
FOREIGN MATERIAL....	Sand, small pebbles, and plant fragments.			

1 Coreidae, 3 *Nysius ericae*, 3 adults and 2 nymphal *Geocoris decoratus*, 1 Pyrrhocoridae, 1 Reduviidae, 4 Miridae including 3 *Melanotrichus* sp.; 4 Formicidae and 3 Sphecidae. One individual (4) collected under a board among Russian thistle at Delle on October 8 contained 87 termites.

Examples of the stomach contents of the sagebrush swift, *Sceloporus graciosus graciosus* (B. and G.) are: Specimen (1)

collected in sagebrush—Russian thistle area south of Hardup (Box Elder County) July 8; 1 *Eutettix tenellus*, 1 *Thamnotettix venditarius* Ball, 2 Carabidae, 1 Tipulidae, 1 Braconidae, 9 Formicidae including one *Formica fusca* Linn. Individual (2) taken in a Russian thistle—sagebrush area at Showell (Box Elder County), September 7; 2 adults and 7 nymphs of *Eutettix tenellus*, 1 Diptera, 1 lepidopterous larva and 1 Sphecidae.

A larger proportion of ants were found in individuals of these two species during 1931 than among those examined during the preceding year, apparently due to a relative scarcity of other insects.

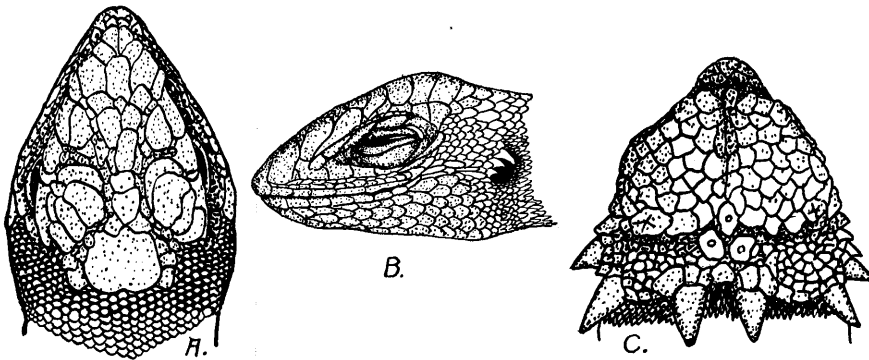


FIG. 1—A and B: Dorsal and lateral views, respectively, of the head of *Uta stansburiana stansburiana* (B. and G.); C: Dorsal view of the head of *Phrynosoma platyrhinos* Girard.

Identifiable insects contained in the stomachs of 528 *Uta stansburiana stansburiana* were:

#### Order

ORTHOPTERA: Locustidae, 54, including *Trimerotropis vinculata* Scudder 2, *Melanoplus femur-rubrum* (DeGeer) 1; Gryllidae 1.

NEUROPTERA: Chrysopidae, 1.

HOMOPTERA: Membracidae, 10; Cicadellidae, 1,550, including *Agallia sanguinolenta* 55, *Xerophloea viridis* (Fabr.) 1, *Eutettix tenellus* 838 adults and 655 nymphs, *Thamnotettix venditarius* Ball 1; Aphidae 1.

HEMIPTERA: Pentatomidae, 1; Coreidae, 2; *Lygaeus reclusatus* Say 1, *L. kalmii* Stal 1, *Nysius ericae* 135, *Geocoris decoratus* 386 adults and 155 nymphs; Phyllorhoridae 1; Reduviidae 1; *Nabis ferus* (L.) 3; Anthocoridae 1; Miridae 151, including *Lygus pratensis* (L.) 134, *Melanotrachus* sp. 3, *Atomoscelis modestus* (Van D.) 5.

COLEOPTERA: Carabidae, 34; Silphidae, 1; Elateridae, 2; Scarabaeidae, 1; Chrysomelidae, 3.

DIPTERA: Culicidae, 1; Stratiomyidae, 1; Tabanidae, 2; Asilidae, 4; *pipunculus* sp., 6; Syrphidae, 1; Tachinidae, 2; Sarcophagidae, 9; Muscidae, 4; *Chloropisca glabra* (Meig.), 99.

HYMENOPTERA: Tenthredinidae, 1; Braconidae, 3; Ichneumonidae, 3; Chalcididae, 26; Formicoidae, 345; Sphecidae, 5; Dryinidae, 1; Vespidae, 6; Andrenidae, 1; Apidae, 6.

In addition, one large brown-shouldered Uta had swallowed a small individual of the same species.

Identifiable insects contained in the stomachs of 61 *Sceloporus graciosus graciosus*:

ORTHOPTERA: Locustidae, 26; Gryllidae, 1.

NEUROPTERA: Chrysopidae, 1.

HOMOPTERA: Cicadellidae, 127, including *Agallia sanguinolenta* 1, *Eutettix tenellus* 53 adults and 71 nymphs; Aphidae, 2.

HEMIPTERA: Pentatomidae, 1; Lygaeidae, 41, including *Lygaeus reclinatus* 1, *Nysius ericae* 13, *Geocoris decoratus* 17, *Lygus pratensis* 7.

COLEOPTERA: Carabidae, 3; Coccinellidae, 2; Chrysomellidae, 2; Curculionidae, 1.

DIPTERA: Tipulidae, 1; Sarcophagidae, 1.

HYMENOPTERA: Braconidae, 1; Ichneumonidae, 1; Formicoidae, 208; Sphecidae, 2; Apidae, 1.

Examination of the stomach contents of nine horned toads, *Phrynosoma douglassii ornatum* (Girard), showed their diet to consist largely of ants; one specimen contained 41, while another possessed 4 ants and 65 ant head capsules. The total for the nine specimens was 161 ants and 157 ant head capsules. Other insects contained were *Trimerotropis vinculata* Scudder 1; *Eutettix tenellus* 1; Carabidae 1; Chrysomelidae 2; Diptera 1; Andrenidae 1.

Stomach contents of six specimens of the horned toad, *Phrynosoma platyrhinos* Girard, consisted mainly of ants. The total insect contents of these was 108 ants and 77 ant head capsules, one specimen possessing 52 individuals. Other insects that had been ingested were *Eutettix tenellus*, 3; Coleoptera, 4, including Coccinellidae 1 and Scarabaeidae, 1; Diptera, 1. The stomach of one specimen contained 5 round worms which apparently were parasitic in the lizard.

A specimen of the desert whiptail lizard, *Cnemidophorus tessellatus* (Say), collected in a greasewood area on the foothills four and one-half miles northwest of Grantsville, May 24, contained 2 Carabidae, 3 larval Elateridae, 1 larval Lepidoptera, and 1 Formicidae.

An individual of *Crotaphytus wislizenii* Baird and Girard taken in sagebrush on the foothills at Hardup, June 24, contained 2 grasshopper nymphs, 1 ant, and numerous insect fragments.

## BOOK NOTICES.

---

### **Fundamentals of Biology.**

This is the second edition of a standard text-book, presenting in a perfectly orthodox manner the basic facts and principles of biology. Little of a controversial nature is touched upon, a fact which makes some of the presentations not strictly up-to-date. For example, no notice is taken of any mechanism of sex-determination other than that of the sex-chromosomes. The list of human hereditary characters is far from modern. Other examples could be mentioned.

The handling of each chapter as a unit, thus facilitating the easy interchange of topics and omission of material on the part of the teacher, is a commendable feature. Many new illustrations have been added. For those who desire a standard orthodox text, the book is quite workable.—L. H. S.

**Fundamentals of Biology**, by Arthur W. Haupt. x + 403 pp. New York. McGraw-Hill Book Co., 1932.

---

### **Botany for College Students.**

This is the most recent text to appear in the field of General Botany. Part I, entitled "General Principles," is essentially an elementary treatment of the structures and processes of the seed plants and is a unit discussion in itself. This section is planned for a semester's work in the subject. Part II, planned for a second semester's work and entitled "The Plant Groups," calls the roll of the plant kingdom. The muster is complete. This is essentially a systematic treatment of plant morphology; it adheres closely to the conventional pattern of such presentations. So wide apart are the two sections in point of view and subject matter that each might be regarded as a separate text, but for the fact that both dwell together between the same two covers.

One of the author's reasons for the production of this text is the "evident need of an American textbook which is a general botany in scope as well as in name." Such an assertion treads imperiously into controversial territory. Many botanists would deny this name to a text which is a stranger to all but the names of such vital and dynamic topics as genetics and ecology.

A commendable feature is the wealth of illustrations, practically all of which are original, or especially redrawn for this edition. Almost without exception these are excellent. In addition to the index there is a glossary of the botanical terms used in the body of the text.—B. S. MEYER.

**College Botany**, by William H. Eyster. 695 pp. New York, Ray Long and Richard R. Smith, 1932.

---

### **Hormones and Nerves.**

This small book is a most interesting account of the recent and novel hypothesis that the nervous system may secrete hormones which act on muscles, glands, chromatophores and other receptors. The hypothesis is in reality a special application of the general principle of hormones, with the hormones in this case usually traveling very short distances from the point of secretion to that of application. Many interesting recent data are brought to bear on this problem, with careful critical discussions, and the reader cannot fail to be impressed with the intimate connection between hormones and nerves. The author concludes that while "nobody today considers seriously the aphorism that 'the brain secretes thought as the liver secretes bile,' yet if what has been set down in the preceding pages be true, nervous secretion plays a part even in our mental operations such as has scarcely been suspected by the modern physiologist."—L. H. S.

**Humoral Agents in Nervous Activity**, by G. H. Parker. x + 79 pp. Cambridge Univ. Press (in U. S. A. from The Macmillan Co.). \$1.75.

### The Evolution of Human Behavior.

Studies of human evolution have of necessity been undertaken largely from the standpoint of man's bodily structure. The present volume is an attempt to approach human evolution from the viewpoint of behavior. The attempt cannot be considered entirely successful since most of the book is given over to discussions of orthodox structural evolution. Nevertheless the result is interesting and somewhat unique. Following a survey of evolution in general, based largely on comparative anatomy, a careful comparison of apes and man is undertaken. Then appears a discussion of the evolution of human culture, based on the author's belief that the differences between man and the apes are mainly cultural rather than biological. Considerable ingenious and plausible speculation is invoked concerning the rise of language and manual dexterity. The differences between present races of man are discussed, largely from a structural viewpoint. The book closes with a chapter on present trends in evolution, including a very sane discussion of eugenics.

The author's speculation occasionally tends to become dogmatic. The statement that "the tri-dactyl foot of the horse is forever lost to the species because of the specialized monodactylism that later evolved" should be compared with Stockard's recent work on dogs. The belief that skin color and similar characters possess no survival value might be open to question. The dogmatic pronouncement that modern warfare is markedly dysgenic is at least a debatable question in the light of recent researches such as those of Gini and Hunt. The author's explanation of heterosis is not the last word on the subject.

The book is, however, a valuable pioneer in the attack on the evolution of human behavior, and as such should be carefully read by every serious student of biology.—L. H. S.

**The Evolution of Human Behavior**, by Carl J. Warden. ix + 248 pp. New York, The Macmillan Co., 1932. \$3.00.

### Organic Chemistry.

A text designed for a short course in the theory of Organic Chemistry, together with instructions for a laboratory course to accompany the lectures. The condensation of the general subject of organic chemistry into slightly more than 200 pages, with 60 pages devoted to fats, carbohydrates, proteins and dyes, does not permit much choice of subject to discuss or deviation from the "beaten path" of theoretical organic chemistry. The author presents his subject in the more or less accepted order of saturated hydrocarbons, alcohols, ethers, halogen derivatives, unsaturated hydrocarbons, aldehydes, ketones, acids, fats, dibasic acids, carbohydrates, amines, proteins, cyclic nitrogen derivatives, aromatic hydrocarbons, phenols, acids, aromatic nitrogen derivatives, and dyes; together with 35 pages of laboratory directions covering some 28 experiments in both aromatic and aliphatic chemistry. The laboratory exercises are well selected and should give the student a good technical training in manipulation and an insight into the characteristic aliphatic and aromatic reactions.

The theoretical portion of the text, in spite of the space limitation, is well prepared and in excellent typographical form. There is an absence of tabular material, particularly in the alcohols. In the first part of the book the emphasis has been placed on individual compounds, rather than on class reactions and homologous series; hence there is very little use of functional groups and type reactions (with the use of the symbol R for any alkyl radical). The section on dyes requires, for a proper understanding, a more comprehensive knowledge of organic chemistry than is obtainable in the previous material in the text. The sections on carbohydrates and proteins, while over emphasized, are well prepared and should make the text particularly useful for a short organic course for students in the biological sciences, where such emphasis is to be expected. Another departure from other similar texts is the omission of proper names, both in regard to important theories and discoveries and to reaction names. The use of the laboratory portion of the text is optional, the book being quite suitable for courses without laboratory instruction.—W. R. BRODE.

**An Introduction to Organic Chemistry**, by Ira D. Gerard. vi+296 pp. New York, John Wiley and Sons, 1932. \$2.75.