

LIZARDS IN INSECT CONTROL

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Lizards consume large numbers of injurious insects each year, thus constituting an important biological factor in environmental resistance. The extent of the benefit derived from lizards depends upon a number of factors, including (1) the abundance and distribution of lizards in a given area, and (2) the abundance and availability of the insect pests as compared with the availability of other acceptable food.

The feeding habits of any particular lizard species may be such as to make it especially useful or useless in the control of a particular insect pest. For instance, the larger lizards usually fed more extensively upon caterpillars, grasshoppers and larger insects, often disregarding tiny insects such as beet leafhoppers. On the other hand, several of the smaller lizard species, and to a less extent immature specimens of some of the larger lizards, fed more readily upon small insect pests if such occurred in abundance.

A number of agricultural insect pests breed in areas frequented by lizards and are extensively fed upon by these animals. This often results in a perceptible limitation of pest multiplication, with resulting benefits to agriculture.

Satisfactory estimates of lizard population density are difficult to make. Several seasons of study of small tracts of land in Tooele County, Utah, led the writer to conclude that populations of from fifty to four hundred northern brown shouldered utas per acre were not unusual in favorable breeding and feeding locations. Where small areas of unusual insect abundance occur in desert areas, such as on narrow strips of succulent roadside Russian thistle bordered on both sides by large dry areas of shadscale, high lizard populations have been observed especially during the evening feeding period shortly before sunset. This condition was particularly evident in the case of *Uta stansburiana stansburiana*. The data which follow relate to lizards collected in Utah.

Coleonyx variegatus (Baird). Two specimens of the banded gecko were collected at St. George, April 26, 1935, by C. F. Smith. Recognizable stomach contents consisted of 1 leafhopper; 2 beetles, 3 Lepidoptera, caterpillars; and 1 spider.

Crotaphytus collaris baileyi (Stejneger). The western collared lizard was usually collected upon the top of boulders on range land. Most of the specimen's stomachs were well distended with insect food. Grasshoppers, caterpillars and ants are three of the groups of insects most destructive to range plants; the first two had been fed upon commonly by the specimens examined. An examination of 93 stomachs showed 50 Lepidoptera to be present, 47 being caterpillars in 47 stomachs; 85 Coleoptera in 29 stomachs; 168 Orthoptera in 49 stomachs, 106 being nymphs, and nearly all of the specimens being grasshoppers; 11 Hemiptera in 7 lizards; 22 Diptera in 9 stomachs; 19 Homoptera in 7 stomachs, 18 being cicadas; 168 Hymenoptera in 39 lizards, only 19 being ants in 3 specimens; 1 Odonata; 3 Neuroptera; and 9 spiders in as many stomachs. In addition, one stomach contained 95 parasitic roundworms.

Crotaphytus wislizenii (Baird and Girard). The leopard lizard is another range species, which has an apparent "preference" for larger insects, particularly grasshoppers. Stomachs of 92 specimens were examined, showing 213 Orthoptera present in 87 stomachs, 62 being nymphs in 28 stomachs, all but a few of the specimens being grasshoppers; 14 Lepidoptera in 8 stomachs, all caterpillars; 4 Hemiptera; 3 Homoptera, cicadas; 8 Coleoptera in 6 stomachs; 13 Diptera in 11 stomachs, 10 of which were robber flies; 20 Hymenoptera in 14 stomachs, only 4 of which were ants; 5 spiders in as many lizards; and 2 round worms in one stomach. Federal entomologists estimated that \$2,000,000 worth of poison bait would be needed to control the grasshoppers during 1937 in the western United States, and the Federal Government appropriated funds to make effective control possible. Lizards eating from one to several grasshoppers each day do much to retard grasshopper abundance wherever such lizards and grasshoppers occur together in abundance.

Callisaurus draconoides ventralis (Hallowell). The stomachs of 35 desert gridiron-tailed lizards were examined, the total contents consisting of 11 Orthoptera, grasshoppers, 6 being nymphs; 18 Neuroptera, 14 being ant lion larvae, and 4 aphid lions; 23 Isoptera in 1 stomach; 33 Hemiptera in 11 stomachs, 13 false chinch bugs and 13 Pentatomidae being the principal injurious forms; 12 Homoptera, 16 being leafhoppers, of which 4 in four stomachs were beet leafhoppers, and 4 aphids; 21 Coleoptera, including 1 Buprestidae, 4 Chrysomelidae, and 2 Scarabaeidae; 55 Lepidoptera in 15 stomachs, all but two being caterpillars; 88 Hymenoptera in 23 stomachs, only 10 of which were ants in 3 stomachs; 29 Diptera in 7 stomachs; 49 Arachnida in 16 stomachs; besides 6 plant blossoms and one plant leaf. This lizard evidently selects a wider variety of food than some of the less active species.

Uta levis Stejneger. The Rocky Mountain tree utra differs to some extent in food habits from its more common relative, *Uta s. stansburiana*. An examination of the stomachs of 44 *Uta levis* showed them to contain 3 Orthoptera, grasshoppers; 16 Hemiptera; 16 Homoptera, 6 being leafhoppers, of which two were beet leafhoppers in two stomachs; 30 Diptera, 11 being Calliphoridae; 28 Coleoptera, 1 being a larva;

21 Lepidoptera, of which 18 were caterpillars; 2 Thysanura; 70 Hymenoptera, 36 being ants in 11 stomachs; besides 11 Arachnida.

Uta stansburiana stansburiana (Baird and Girard). The northern brown shouldered uta feeds to a considerable extent upon small insects, although nymphal and adult grasshoppers occur rather commonly in its diet. An examination of 3,541 stomachs of this species showed the following food material to be in recognizable condition: 1 Thysanura; 635 Collembola; 1,093 Orthoptera, 749 being nymphs, of which 6 were Mantidae, 3 Gryllidae, most of the others being grasshoppers; 305 Isoptera or termites; 27 adult and 60 nymphal Neuroptera; 1 Ephemerae; 23 Odonata; 85 Thysanoptera; 3,349 Hemiptera, including 51 adult *Lygus elisus* and *L. hesperus*, 7 lygaeid nymphs, 53 Pentatomidae, 682 adult and 55 nymphal *Nysius ericae* or false chinch bugs; 4,470 adult and 14,221 nymphal Homoptera, of which 2,713 were adult and 7,971 nymphal beet leafhoppers, *Eutettix tenellus* (Baker), besides 381 adult and 90 nymphal leafhoppers of other species, 14 Fulgoridae, 3 Cercopidae, 11 Membracidae, 1,323 aphids, 6 psyllids, and 22 Coccidae; 346 adult and 101 larval Coleoptera, including 6 Staphylinidae, 5 Cucujidae, 60 Chrysomelidae, 1 Scolytidae, 3 Curculionidae, 7 Tenebrionidae, 9 Melyridae, 2 Buprestidae, 65 Scarabaeidae, 10 adult and 2 larval Elateridae, 17 Silphidae, 1 Meloidae, and 2 Dermestidae; 708 Lepidoptera, all but 12 being caterpillars, including a large number of diamond back moth larvae; 304 adult and 454 larval Diptera, including 128 *Chloropisca glabra*, 10 Calliphoridae, 40 mosquitoes, 11 Muscidae, 15 Asilidae, 18 Chironomidae, 5 Tipulidae, 3 Tabanidae, 1 Simuliidae; 2,670 Hymenoptera, including 2,522 ants, 61 Chalcididae, 17 Sphecidae, 18 Apidae, 13 Ichneumonidae, 6 Braconidae, 10 Chrysididae, 10 Andrenidae, 1 Dryinidae, and 7 Vespidae; a number of Arachnida and several plant fragments also were present in the stomachs. An examination was made of 4,021 brown shouldered utas collected among Russian thistle, *Atriplex rosea*, and other hosts of the beet leafhopper, during the seasons of 1930 to 1935, inclusive. It was found that 2,249, or approximately 55.96 percent of the stomachs contained *Eutettix tenellus*, the total number of beet leafhoppers being 10,576 nymphs and 5,390 adults, or 15,966 in all. With lizard populations in desert breeding areas of the beet leafhopper estimated at from 50 to 400 per acre in various Tooele County, Utah, areas and the average being 7.09 beet leafhoppers for each stomach containing *E. tenellus*, this lizard seems to be an important aid to the agriculturists of the west.

Sceloporus graciosus graciosus (Baird and Girard). An examination of 1,332 sagebrush swifts, collected among sagebrush, rabbit brush, Russian thistle, and miscellaneous other plants, showed the following to be present: 2 Collembola; 203 adult and 289 nymphal Orthoptera, of which 4 were Gryllidae, nearly all of the others being grasshoppers; 89 Isoptera; 17 adult and 11 larval Neuroptera, 7 being Chrysopidae; 1 Odonata; 5 Thysanoptera; 672 adult and 809 nymphal Homoptera, of which 120 were adult and 122 nymphal beet leafhoppers, besides 119 other leafhoppers, 7 Cercopidae, 1 Membracidae, 601 aphids, 5 Fulgoridae, 1 Chermidae, and 1 Coccidae; 642 adult and 809 nymphal

Hemiptera, including 257 adults and 382 nymphs of the false chinch bug, 18 adult and 26 nymphal *Lygus elisus* and *L. hesperis* combined, 68 Pentatomidae, 12 Tingidae, as well as 45 adult and 5 nymphal *Geocoris decoratus*, an insect predator of the beet leafhopper; 169 adult, 602 larval, and 2 pupal Lepidoptera; 314 adult and 20 maggots of Diptera, including 6 Asilidae, 34 *Chloropisca glabra*, 6 Chironomidae, 5 Muscidae, 2 Calliphoridae, 2 mosquitoes, 1 horse fly, as well as 6 Sarcophagidae, 4 Tachinidae, and 1 Pipunculidae; 540 adult and 79 larval Coleoptera, including 136 Chrysomelidae, 17 Staphylinidae, 1 Meloidae, 6 Elateridae, 18 Scarabaeidae, 17 weevils, 1 Histeridae, 2 Cucujidae, 7 Tenebrionidae, 2 Dermestidae, 3 Buprestidae, as well as 109 ladybird beetles and 53 Carabidae; 3,357 Hymenoptera, 2,756 being ants, 10 Chalcididae, and such beneficial forms as 14 Ichneumonidae and 15 honey bees. In addition was recognized 189 spiders and mites; 1 scorpion; 1 small lizard, a *Sceloporus g. graciosus*, 83 round worms, 9 insect eggs; 2 mollusc shells; and a few plant fragments, the latter apparently accidentals.

Sceloporus magister Hal. Desert scaly lizards contained numerous insects in the 44 stomachs examined, recognizable material being: 7 Orthoptera in 5 stomachs; 1 Isoptera; 2 Neuroptera; 10 Hemiptera in 5 stomachs, 4 being false chinch bugs; 13 Homoptera in 3 stomachs; 88 Coleoptera in 23 stomachs; 83 larval Lepidoptera in 16 stomachs; 4 Diptera; 733 Hymenoptera in 33 stomachs of which 698 were ants in 28 stomachs. In addition 7 spiders; and 19 parasitic roundworms were found in 4 stomachs.

Cnemidophorus tessellatus tessellatus (Say). Desert whiptail lizards are common in a number of sections of Utah. The stomachs of 326 specimens were examined; these contained: 117 Neuroptera in 50 stomachs, 67 being Myrmelionidae in 30 stomachs, and 5 aphid lions; 1,643 termites in 39 stomachs; 262 Orthoptera in 113 stomachs, including 52 adult and 188 nymphal grasshoppers, 4 Mantidae, 16 crickets in 13 stomachs, and 1 phasmid; 75 Hemiptera in 30 stomachs, including 7 false chinch bugs, 13 pentatomids, 2 mirids and 2 tingids; 388 Homoptera in 57 stomachs, including 36 adult and 23 nymphal beet leafhoppers in 15 stomachs, 31 leafhoppers of other species, 11 Fulgoridae, 11 cicadas, 27 coccidae in 3 stomachs, 9 aphids in 3 stomachs, 70 adult and 62 nymphal psyllids in 5 stomachs; 223 Coleoptera in 112 stomachs, including 21 Tenebrionidae in 16 stomachs, 22 Scarabaeidae in 20 stomachs, 3 weevils, 32 Chrysomelidae in 5 stomachs, and 16 long horned beetles in 3; 111 Diptera in 50 stomachs, 2 being larvae, and 37 pupae; 775 Lepidoptera in 186 stomachs, 731 being caterpillars in 169 lizards and 27 pupae, 23 *Plutella maculipennis* larvae being found in the stomach of one specimen collected among *Cheirinia repanda*; 43 Hymenoptera in 28 stomachs, 33 being ants. Also contained were 93 spiders, 2 mites, and 1 small *Uta s. stansburiana*.