

their faculty to range considerable distances from their breeding grounds and their propensity for seeking out and devouring injurious insects, they are indeed a friend to

the farmer and gardener. For an account of their feeding habits, the reader is referred to the following article in this issue of the Bi-Monthly Bulletin.

References:

- (1) Bragg, Arthur N. Observations on the Ecology and Natural History of Anura I Habits, Habitat and Breeding of *Bufo cognatus* Say. *American Naturalist* 74(753): 322-349 (554): 424-438 (1940).
- (2) Wright, Anna Allen and Albert Hazen Wright. *Handbook of Frogs and Toads*. Comstock Publishing Co., Inc., Ithaca, New York, 286 pages (1942).

## Toads Feed Upon Sweet Clover Weevils\*

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**P**ROF. A. H. KIRKLAND (3,4), a Massachusetts biologist, made the astounding statement that a single American toad was worth annually about \$20. This figure was based upon the number of injurious insects, mostly cutworms, devoured daily and the loss caused by these insects to agriculture. More recently, Bragg (2) from Oklahoma stated that the great plains toad, *Bufo cognatus*, our most common toad in North Dakota, had an annual value of \$25. He valued the American toad *Bufo americanus*, also occurring here, at \$15. The authors placed these high values on toads due to their feeding upon cutworms, serious pests of gardens and field crops. Under the conditions of the Oklahoma study, the first insects appearing in the spring were cutworms. The hungry toads coming out of hibernation fed readily upon them, as there were few other insects this early in the spring upon which to feed. Beetles, ants and spiders were more frequently taken during the summer.

It would be difficult to evaluate in dollars and cents the beneficial effects of our North Dakota toads. They have been particularly abundant the last 3 years due undoubtedly to increased rainfall. This has resulted in the creation of numerous temporary prairie ponds which furnished ideal breeding areas for our species. In any attempt to estimate the value of toads, such factors as their abundance, feeding habits and prevailing crop prices should be taken into consideration. Toads are hearty eaters and apparently exercise little choice in the insects they devour, but will gorge themselves with all available in-

sects. Should they destroy all cutworms in a valuable garden they are worth considerable.

Studies on the feeding habits of the great plains toad were begun at this station when it was observed under field conditions that this toad was feeding upon adults of the sweet clover weevil, a new and serious pest of sweet clover. The following report is the result of stomach analyses of 74 great plains toads from 1 inch to 2¼ inches in length collected in or adjoining sweet clover fields from the following North Dakota localities during the summer of 1943:

\*Progress report on Bankhead-Jones Project No. 28, "Biology and Control of the Sweet Clover Weevil" [*Sitona cylindricollis* (Fabr.)].

20 specimens—5 miles west of Mapleton.....	August 11
6 specimens—Grandin.....	August 10
10 specimens—1 mile south of Mapleton.....	August 11
12 specimens—Experiment Station plots, Fargo.....	July 29
26 specimens—Coleharbor.....	August 3

All specimens were immediately preserved in 80 percent alcohol after collecting. A summary of the type of food taken from their stomachs is presented in the following table:

	Frequency of occurrence	Total number of specimens	Percent of total number of all kinds of organisms	Percent by volume*
Sweet clover weevil.....	54	1407	58.9	33
Ants.....	37	382	15.2	3
Adult beetles.....	52	203	8.5	29
Beetle larvae (grubs).....	15	206	8.6	3
Black field crickets.....	25	68	2.8	32
Misc. flies (diptera).....	16	24	1.0	..
Spiders.....	8	9	0.4	..
Grasshoppers (nymphs).....	11	11	0.5	..
Aphids.....	9	19	0.8	..
Misc. Hymenoptera (bees, wasps).....	17	19	0.8	..
Lepidoptera larvae (caterpillars).....	9	10	0.4	..
Misc. Homoptera.....	30	9	0.4	..
Misc. Hemiptera.....	4	8	0.3	..
Misc.....	9	10	0.4	..

\*Volumetric computations were based on the five principal food items.

From the above it is apparent that the majority of insects devoured were sweet clover weevils. The toads from the experimental plots at Fargo contained by far the most weevils per individual. In several specimens they comprised the entire stomach contents. Specimens containing 80 or 90 weevils were common; the maximum number found in any toad examined was 130. Many of the weevils recovered were light in color, indicating that they may have been devoured soon after reaching the surface of the soil upon emerging from their pupal cases.

Weevils were most numerous on the experiment station plots during the latter part of July. However, by August 7 an estimated 90 percent had disappeared. Since a relatively heavy toad population was present throughout the summer, their feeding activities may have resulted in the abrupt reduction of the weevils. This condition, however, may have been localized, for frequent weevil specimens were taken from toads near Mapleton on

August 11, although there was a general weevil reduction in the Fargo vicinity after the first part of August.

Ants comprised over 15 percent of the total number of insects taken and were most abundant from the toads recovered at Coleharbor. The economic status of ants is debatable. A representative sample was sent to Dr. George C. Wheeler, Professor of Biology of the University of North Dakota, for determination. Seven species were determined. The two most common were *Formica fusca neoclara* Emery and *Formica cinerea altipetens* Wheeler.

Black field crickets, *Gryllus assimilis* (Fabr.), are well known economic pests damaging many field crops and gardens. They are also a nuisance when they invade the home.

The majority of larval and adult beetles were carabids or ground beetles. These are largely beneficial since they feed upon injurious insects, such as cutworms, army-

worms, wireworms and similar insects. The next most abundant beetles were determined by Mr. W. S. Fisher of the U.S. National Museum as *Anchicera ephippiato* Vimm. These insects belong to a group which feed largely upon fungi or decaying vegetable matter, so are probably of little economic importance. Undetermined weevil larvae (not sweet clover weevil) were also frequently observed. An occasional adult wireworm, *Aelus mellilus* (Say), and wireworm larvae were also recovered. The fact that toads occasionally take wireworm larvae, which are subterranean insects, suggests that they may dig for a part of

their food, although wireworms will feed near the soil's surface when there is considerable moisture.

Miscellaneous organisms taken were damsel flies, armyworm and cutworm moths, cutworm larvae, snails and mites. The reason why so few cutworms were recovered from the stomachs was probably due to the fact that they occur early in the spring while this investigation was conducted during midsummer. The flies or diptera taken included chironomid midges, fungus gnats (mycetophilids) and minute black scavenger flies (scatopsids).

#### REFERENCES

- (1) Bragg, Arthur N. 1940. Observations on the Ecology and Natural History of Anura. I. Habits, Habitat and Breeding of *Bufo cognatus* Say. American Naturalist 74 (753):322-349, (754):424-438.
- (2) ————— 1943. On the Economic Value of Oklahoma Toads. Trans. Okla. Acad. Sci. 23:37-39.
- (3) Kirkland, A. H. 1897. The Habits, Food and Economic Value of the American Toad, *Bufo lentiginosus americanus* (LeC.) Hatch Exp. Sta. Mass. Agri. Col. Bul. No. 46, 30 pages.
- (4) ————— 1904. Usefulness of the American Toad. USDA Farmers' Bul. No. 196, 16 pages.

## North Dakota Farm Prices

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**A** CHANGE has been made in the table which has been a part of this Bi-monthly report on North Dakota farm prices and upon which the report has been based.

This report as it has appeared in the Bi-Monthly Bulletin regularly since March 1940 has contained information concerning the prices received by farmers for 14 commodities produced by North Dakota farmers. These 15th of the month farm prices were compiled by the Office of the Agricultural Statistician, Fargo, North Dakota. The NORTH DAKOTA FARM PRICES report has here-to-fore contained price information on most of the principal North Dakota farm commodities but has not included price information for all the commodities as compiled for North Dakota by the Office of the Agricultural Statistician.

In order to give our readers more complete information on farm prices this NORTH DAKOTA FARM PRICES report has been expanded to include 26 commodities rather than 14. The price relatives for the various farm commodities will also be included in the table. As in the past, the lower part of the table will contain certain index numbers or indices of North Dakota agriculture. The North Dakota index numbers, however, are based on a different series as will be explained in the next paragraph. All of the data