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GROUND BEETLES OF THE GENUS **LEBIA** LATREILLE IN ARKANSAS (COLEOPTERA: CARABIDAE): ECOLOGY AND GEOGRAPHICAL DISTRIBUTION[1]

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Fifteen of the 47 known North American species of the genus **Lebia,** family Carabidae, are found in Arkansas. Adult beetles of this genus are active on the foliage of various herbaceous plants; a few species are numerous on the foliage of trees and shrubs. So far as known, the larvae are predaceous on the pupae of leaf beetles, family Chrysomelidae. The larvae of each species of **Lebia** tend to be host-specific; their leaf beetle hosts are usually limited to a single genus of plants. Wherever a species of **Lebia** has been reared, a given larva matured on a single pupa of a leaf beetle in the soil.

There is comparatively little information in the literature on the genus **Lebia.** Although various writers including Horn (1872, 1881, 1882), Casey (1913, 1920), Blatchley (1910), and others dealt with the taxonomy and identification of various species of **Lebia,** it was not until Madge's investigations (1962) that the species picture was clarified. It is now possible, with the use of Madge's keys, to identify North American **Lebia** with little difficulty.

In reference to **Lebia** species as predators, there is a particular paucity of knowledge. Glover (1869) and Riley (1871) reported **Lebia grandis** Hentz as an important predator on the Colorado potato beetle, **Leptinotarsa decemlineata** (Say). Not only are the adults predaceous on the eggs and larvae of the Colorado potato beetle, but, as discovered by Chaboussou (1939), the larvae of **Lebia grandis** attack the Colorado potato beetle pupae in the soil. Silvestri (1904) found **Lebia scapularis** Fourc. feeding on all stages of the elm leaf beetle, **Galerucella luteola** (Mueller). Rosenberg (1911) reported the larvae of **Lebia crux-minor** Linn. feeding on immature stages of the galerucine beetle, **Adimonia tanaceti** Linn. Hinds and Dew (1915) reported **Lebia analis** Dejean as predators on immature stages of the fall armyworm, **Spodoptera frugiperda** (J. E. Smith). Cushman and Isely (1916) reported **Lebia ornata** Say [**L. fuscata** Dejean, according to Madge (1962)] feeding on the pupae and callow adults of the cherry leaf beetle, **Galerucella cavicollis** (LeConte). **Lebia viridis** Say was observed by Isely (1920) to feed on eggs, larvae, and pupae of the grape flea beetle, **Altica chalybea** (Illiger). Chaboussou (1939) found that **Lebia grandis** was an important predator of the Colorado potato beetle and attempted to introduce **L. grandis** into France. Whitcomb and R. Bell (1960) and Whitcomb and

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K. Bell (1964) reported that five species of **Lebia** were present on cotton foliage and that **Lebia analis** fed on the eggs of the bollworm, **Heliothis zea** (Boddie), under laboratory conditions.

Silvestri (1904) was the first to describe the life history of a species of **Lebia.** He found that **Lebia scapularis** laid its eggs in the soil. A campodeiform larva hatched from the egg and searched for the pupae or mature larvae of the leaf beetle, **Galerucella luteola.** After locating the host pupa, the first-instar larva punctured the integument, embedded its head, and fed voraciously. Prior to the first molt and before larval feeding was complete, a lemon-yellow cocoon was spun from silk secreted by the Malpighian tubules. At the time of the first molt, the larva assumed a grub-like form, with the legs greatly reduced. This was followed by a prepupal and then a pupal stage. Each larva fed on a single pupa. Two generations were produced each year.

Chaboussou (1939) investigated the life history of **Lebia grandis.** He described the newly hatched larva as having the shape of a staphylinid larva, 3 to 4 mm. long and 0.5 mm. wide. Upon hatching, the larva began to search through the soil for a mature larva or newly formed pupa of the Colorado potato beetle, **Leptinotarsa decemlineata,** which it immediately attacked, burying its head in the integument. When finished feeding, it molted to a grub-shaped second-instar larva with reduced appendages. This second-instar larva did not feed and, after a relatively short period of time, molted again to form a pupa without passing through a prepupal period. The entire period from eclosion to adult lasted from 15 to 20 days at 20° C.

Lindroth (1954) described the life history of **Lebia chlorocephala** Hoffman. The larvae of this beetle attacked mature larvae and freshly formed pupae of **Chrysolina varians.** Under laboratory conditions, Lindroth was able to feed the larva of **Lebia chlorocephala** as many as four host larvae or pupae. The life cycle of **L. chlorocephala** was very similar to that of **L. grandis;** neither a cocoon nor a prepual stage was formed.

FINDINGS IN ARKANSAS

Madge (1962) found four subgenera of the genus **Lebia** present in North America: **Loxopeza, Lamprias, Lebia,** and a new subgenus. Of these, only **Loxopeza** and **Lebia** have been collected in Arkansas. Most species of both subgenera were found on low herbaceous plants in cultivated fields, in turn-rows, in abandoned fields, or in open places in the woods. Usually, when numerous, they were associated with a leaf beetle of the family Chrysomelidae and with the host plant of the leaf beetle. Where the host plant was a weed in a cultivated field, the adult **Lebia** were sometimes well-distributed over the crop plants and other weeds, as well as over the host plants. Most species came readily to the standard USDA light traps.

Subgenus **Loxopeza**

Three species of this subgenus have been taken by us in Arkansas.

Lebia grandis and **Lebia atriventris** Say are common everywhere in the state, but only a few specimens of **Lebia tricolor** Say were taken. The two collected in numbers were usually found in association with leaf beetles of the subfamily Chrysomelinae.

Lebia (Loxopeza) grandis Hentz

Lebia grandis is the largest beetle of this genus in Arkansas. It is widely distributed in the state, often in association with the Colorado potato beetle, **Leptinotarsa decemlineata,** on horse nettle, **Solanum carolinense** L. This species was routinely taken in Arkansas corn fields, apparently because horse nettle is a common weed there. Both under laboratory conditions and in the field, **Lebia grandis** adults fed freely on eggs and larvae of **Leptinotarsa decemlineata.** As mentioned above, Chaboussou has shown that the eggs of **Lebia grandis** are laid in the soil and that the larvae hatch and seek out pupae of **L. decemlineata.** So far as is known, the larva of **Lebia grandis** is host-specific. No eggs of **L. grandis** were obtained in the Arkansas experiments, although repeated attempts were made; the reason for this is not yet clear.

Lebia (Loxopeza) atriventris Say

This species is apparently well distributed over the state, although most specimens for study came from Washington, Conway, Jefferson, and Mississippi Counties. Except in light traps, it was always taken in association with **Zygogramma heterothecae** Linell, a chrysomeline leaf beetle. It was sometimes numerous in cotton, corn, and soybean fields but never without the presence of the weed **Heterotheca subaxillaris** (Lam.), the plant host of **Zygogramma heterothecae.** The adults of **Lebia atriventris** fed freely on larvae and eggs of **Zygogramma heterothecae.** No eggs were obtained.

Lebia (Loxopeza) tricolor Say

Only a very few specimens of this species were taken in Arkansas, all from Washington County. Nothing is known of its host relationship.

Subgenus **Lebia**

We collected 12 species of this subgenus in Arkansas. Most species were quite abundant; a few were apparently scarce, probably because we did not collect in the proper habitat. Most known and suspected hosts of the subgenus **Lebia** belong to the subfamily Galerucinae, as indicated by the work of Silvestri (1904), Cushman and Isely (1916), and others. However, where we found association between a beetle of the subgenus **Lebia** and a given leaf beetle, it was with a member of the subfamily Halticinae.

Lebia (Lebia) analis Dejean

This is the most abundant species of **Lebia** in Arkansas. It is found from April until September. Adults are common predators in soybeans, cotton, corn, alfalfa, vetch, lespedeza, and weed fields, although their numbers vary from year to year. The adult beetle is a general predator

feeding on noctuid eggs, leafhoppers, many kinds of chrysomelid larvae, and other insects. They consumed an average of 6.03 bollworm eggs per day in the laboratory. There is an apparent association between **Lebia analis** and **Disonycha glabrata** Fabr., a striped flea beetle, that feeds on **Amaranthus** spp. Wherever **Disonycha glabrata** was found, **Lebia analis** was also found. Often, if the weeds were parted and the ground searched, gravid **L. analis** females could be found. Very few fertile eggs were obtained; the reason for this is still not known. **L. analis** adults tended to descend to the lower parts of the plants or to the ground during the hot, dry periods of the day and to climb high on the plants during the cool, humid periods of the evening. **L. analis** adults have been taken in December and January in clumps of broom sedge, **Andropogon virginicus** L., where they apparently overwinter.

Lebia (Lebia) viridis Say

Lebia viridis is only slightly less abundant than **L. analis.** It is actually more numerous than **L. analis** in legume crops, especially alfalfa, vetch, and clover. This beetle is taken throughout the state from May to September. There is an apparent association between it and the flea beetle, **Altica foliacea** Lec. **A. foliacea** is found early in the season (May and June) on **Oenothera laciniata** Hill and late in the season (late July, August, and September) on **O. biennis** Linn. **O. laciniata** is a low weed in the field. **O. biennis** is a tall weed in the turn-row. **Lebia viridis** is found in numbers associated with **Altica foliacea** on both plants. One of the remarkable things in the association between **Lebia viridis** and **Altica foliacea** is the similarity in physical appearance. **Lebia viridis** has been taken in the winter in clumps of broom sedge, presumably in hibernation.

Lebia (Lebia) abdominalis Chaudoir

This is another species of **Lebia** not uncommon in Arkansas cotton and soybean fields. It has been taken in Conway, Lee, Faulkner, and Washington Counties but is widely distributed in the state. No association has yet been found between it and a leaf beetle. It has been taken overwintering in broom sedge.

Lebia (Lebia) viridipennis Dejean

This species is also taken in the cotton field but is somewhat more uncommon. It has been collected in Washington, Conway, Mississippi, and Pulaski Counties. It is attracted by light and has been taken at the light trap in Washington County as early as mid-June. No association has been found between it and a leaf beetle.

Lebia (Lebia) vittata (Fabricius)

This species was common at lights in Conway, Washington, Franklin, and Little River Counties but was seldom collected in the field. One specimen was taken on hogweed, **Amaranthus** sp., in Franklin County. Obviously, collections have not yet been made in the proper habitat.

Lebia (Lebia) pulchella Dejean

This species was common on soybeans, cotton, corn, alfalfa, and weeds. It was collected in Washington, Johnson, Conway, Cleveland, and Mississippi Counties. No association with a leaf beetle has been observed. It has been taken overwintering in broom sedge in Washington and White Counties.

Lebia (Lebia) marginicollis Dejean

This species was found in cotton, corn, alfalfa, and soybeans in Conway, Washington, and Hempstead Counties. No association was found between this species and any leaf beetle.

Lebia (Lebia) pumila Dejean

This species was taken in cotton and alfalfa fields and on weeds in Washington, Conway, Madison, and Mississippi Counties. No association has been found between this species and any leaf beetle.

Lebia (Lebia) fuscata Dejean

This species was less common than the others. It was taken overwintering in leaf trash in Washington and Hempstead Counties.

Lebia (Lebia) lobulata Lec.

In Arkansas, this is the rarest **Lebia** species. Only one specimen was collected; it was found in Washington County.

Lebia (Lebia) solea Hentz

This is another rare species of **Lebia,** taken only occasionally and collected only in Washington County.

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