Field Notes on the Distribution and Life Habits of the Tiger Beetles (Cicindelidae) of Indiana

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INTRODUCTION

In the summer of 1915 I began to collect material for the preparation of a paper on the comparative cytological study of the Cicindelidæ. From the outstart I was confronted with difficulty in obtaining the desired specimens. This necessitated a close investigation in many different parts of the state. While making these collections, incidental observations on the distribution and various life habits became so fascinating that this line of field study was extended throughout the western and north central part of the state. (See map.)

SURVEY BY COUNTIES

Pike and Gibson Counties. The first daily collections were made from Aug. 25 to Sept. 10, 1915, at a number of points in Pike and Gibson counties, especially in the vicinity of Petersburg and Oakland City.

Cicindela vulgaris, the most abundant species in these counties, were more or less colonized in definite localities, usually with certain barren spots as centers. For example, vast numbers swarmed the college athletic field at Oakland City, and the county fair grounds at Petersburg. Radiating from these points as centers, the number of beetles decreased in proportion to the distance and environment. After leaving one of these barren centers, one might travel three or four miles without observing a single beetle.

Only one specimen, a mature female, of *C. formosa generoso*, was captured. This was found on a dusty road in Gibson county, September 15, 1915. Very close search was made for other specimens but of no avail. Since this is a double brooded species, I am unable to explain why this female should be mature at this late date.

In the latter part of August, 1915, two specimens of *C. purpures* were collected along the road-side, in western Pike county.

Three visits to the above mentioned counties, during the spring of 1916, revealed about the same distribution. The beetles, however, were less abundant than in the preceeding fall.

Daily observations were made again from Sept. 5 to 15, 1916 with especial regard to the lowland regions. A few *C. vulgaris* were found in company with vast numbers of *C. repanda* along the banks of the south fork of Potoka river, and other small streams.

A few solitary specimens of C. *punctulata* were found on the upland fields and roadsides.

Dubois County. May 1, 1916, collections were made in the vicinity of Huntingburg. The race track at the county fair grounds proved to be a choice feeding and breeding spot for *C. repanda.* The track had been covered with straw to prevent washing. On one side was a steep clay bank, while on the other ran a small stream. The latter furnished a good feeding place for the beetles in dry weather. At the time of collecting, however, the ground was extremely wet and large numbers were to be seen sunning on the banks. Others were feeding on the small insects and worms found in the straw.

Observations were made through the lowland districts near town but no beetles were seen. Then the hill land was studied, with interesting results. After collecting a few *vulgaris* and one *ancocisconensis* in a red clay wheat-field, a point was reached where the public road had been cut through a ridge, leaving the banks on either side about fifteen feet high. A strong wind directed hundred of *C. vulgaris* into this retreat, where they would settle on the warm banks. They were so abundant that they could be captured with perfect ease by swinging the net through the air.

Perry County and neighboring parts of Kentucky. Observations were made in the vicinity of Rome, Tobinsport, Cannelton, Tell City, and Troy, Indiana, and Cloverport, and Hawesville, Kentucky. A rather critical study of the sand bars and banks on either side of the Ohio river was made at intervals from Rome, Indiana, to Hawesville, Kentucky, with a view of ascertaining whether or not this stream affected the distribution of Indiana and Kentucky Cicindelidæ. In this comparative study only one species. *C. repanda*, was found. This, however, was very abundant. In the two different surveys made of this region during the months of May and June, 1916, no indications were found of the river's acting as a barrier. The same species and apparently the same brood that was found on the Indiana side, was found at adjacent points in Kentucky. Indications were that these beetles sometimes fly across the river, as many were watched for at least half the distance, when they disappeared from sight.

The next observations were made over the red clay hilly region of this county from Troy to Bristow, a distance of about thirteen miles. *C. purpurea* and *C. sexguttata* and *C. vulgaris* were found abundantly in damp ravines but rarely in upland regions.

Spencer County. In the latter part of May, 1916, two different collections were made in the locality of Lincoln City. It so happened that each visit was made during extremely wet weather and thus little data were obtained. A single specimen of C. *sexguttata* was found on a concrete walk, also a number of *C. vulgaris* were collected along the muddy roadways and on barren spots in clay pasture fields. These were very sluggish and easily captured, indicating that they had been forced from their hiding places either by the excessive rain or by hunger.

Orange County. Four collections were made in this county, with West Baden and French Lick as centers. The dates were as follows—September 10, 1915, May 6, May 30, and September 14, 1916. On May 6, 1916 (after collecting a few solitary specimens of *C. sexguttata* and *C repanda* from among the hills and valleys), a very productive colony *C. sexguttata* was discovered. The gravel beds along the stream and the limestone rocks projecting from the water, seemed to be the most satisfactory feeding, sunning and mating places. The gravel banks, overlaid with sandy loam, were found to be the winter homes. Here many places were noted where the burrows were so numerous that they honey-combed the bank.

Since *C. sexguttata* were found to be more abundant in Orange county than in any other field in the state, a special trip (May 30, 1916) was made for the purpose of making a detailed study of the feeding habits of this species. An old damp, woodland roadway proved to be the most satisfactory place for this study. By lying in the dense shade, while observing the specimens in the sun, I was enabled to get within two or three feet of them without disturbing them. The wet roadway abounded in small winged ants, small red and large black ants, gnats, flies, medium sized spiders, and various kinds of worms. All of these were attacked with equal violence. However, in case of the larger and more active prey, the beetles would make a sudden retreat if met by a counter attack. They usually made one dauntless charge, and when repulsed gave up in fear. A few second attacks on large black ants were noted, and in practically every instance the prey returned the assault and chased his enemy some distance.

The observations made on the egg laying habits corroborate those of Shelford on *C. purpurea*, "she holds the anterior part of the body as high as possible and, extending the posterior part of the abdomen (ovipositer), she digs a vertical hole with the gonapophyses of the adbomen, from 7 to 9 mm. in depth. She tries the soil by making holes without laying any eggs. About fifty eggs are laid, singly and large end uppermost in such uncovered holes by one female."

C. punctulata was the only species found during the September visits.

Knox and Vigo Counties. A survey of the river and hill regions at Vincennes, and a similar survey at Terre Haute were made in the month of August, with practically the same results. In each locality *C. repanda* swarmed the sand bars and barren river banks, while only a few scattered specimens of *C. punctulata* were found in the upland corn, wheat and pasture fields. The latter were more abundant along a private cattle driveway near Terre Haute, where they were attracted by dung maggots.

Sullivan County. After making a close search through the hilly districts about Sullivan, a large number of *C. repanda* was observed along the banks of a brook which flowed through a meadow. On one small sand bar they were feeding upon small red ants.

Colony after colony of these ants were devoured by a certain group of beetles. At one time, twenty-seven of these greedy ant-eaters were counted

on a sloping sand bank in a spot about six feet square. One case was observed where two hungry beetles devoured a whole colony of ants. Each would take every other ant that appeared at the mouth of the hole. In case one was unsuccessful in his catch, he would chase his prey some distance, while in the meantime his partner would do his utmost to devour every ant that appeared. The average rate of consumption for twelve minutes was an ant for each beetle every ninety-five seconds. When no more ants would appear one *repanda* destroyed the mound and dug half the length of his body into the ground in quest of more food.

One solitary *C. punctulata* was found in an old pasture field.

Monroe County. Field observations of the Cicindelidæ in the vicinity of Indiana University were made in the spring and fall of 1915 and 1916.

C. ancocisconensis was the only species found colonized in this county. This colony inhabited the steep banks, made by the Jordan river cutting through a hill, about a quarter of a mile east of the University. The banks are about ten feet high and the burrows were found in the soil at the summit. This position was especially advantageous, as there were large stones both on top of the hill and also in the cut, which sheltered the larvae and adults from the cold, and served as brooding places for small ants—tiger beetles' favorite food—and other prey.

During the early spring days when the ground was cold and wet, the beetles spent most of their time sunning and feeding on the stones and barren spots at the top of the hill. However, as the warm days of spring approached they inhabited the moist central regions of the banks, while later when all the ravine was dry except along the bed of the Jordan, they were found only at the base of the cut.

In the fall when even the stream was dry, practically all the new brood were found near the edge of a pond, about two hundred feet further down the ravine, where the food was more abundant. The majority of this colony disappeared in late June. The imagoes emerged in August.

During the dry weather one specimen of *sexguttata* was found feeding with the above colony. Single specimens of *sexguttata* were also found on the university campus, along flat, rocky ravines, and more frequently on the clay hills near the University water works. The latest specimens of this single brooded species were collected in late June.

Punctulata were ofttimes found on the campus along the beaten paths, and also in the fields about Bloomington. The single brooded fall species was found as late as the first of November.

A few specimens of *vulgaris* and also of *purpurea* were collected in this county.

Putnam County. In June, 1916, a number of *C. repanda* were collected from the sand bars of a creek, about one mile north of Greencastle. Although no highland species were found in this locality, one specimen of *sexguttata* was found in the spring collections of Depauw University students. The

University also had a few *vulgaris* and one *punctulata* which, supposedly, had been collected near Greencastle.

Vermillion, Fountain and Montgomery Counties. In April, 1916, observations were made at various points along the Wabash river, between Vermillion and Fountain counties. In every case *C. repanda* were found in abundance in cornfields, over which a deep layer of white sand had been deposited by the over-flow of the river. This condition was especially noticeable at the entrance to the river bridge opposite Perrysville.

C. ancocisconensis were quite abundant along Cole Creek east of Newtown. The banks which were about four feet high and overlaid with black sandy soil, were penetrated at various angles by numerous burrows. Large groups of adults were feeding along the edge of the overhanging turf or enjoying the sunshine along the banks. Others were copulating and depositing eggs.

Although two days were spent in Fountain and Montgomery counties, in the neighborhood of Mellott, Newtown and Linden, searching for other species, no data were obtained.

Carroll and Cass Counties. A comparative study of the old brood of *C. repanda* along the Wabash river at Delphi (in June), and the emerging brood at the junction of the Eel and Wabash rivers at Logansport (Aug. 22), showed greater abundance of the latter under similar conditions. The former spent their time in mating, depositing egs and collecting food, while the latter were very unsocial and seemed to have no object in view other than obtaining food.

No *C. punctulata* were found in these counties during June. In August, however, they were collected from every field visited. During a four hour trip out to Clymers, they were observed in the following surroundings:—in a cattle lot, in a wheat stubble field, among the scattered straw near an old straw stack, in a meadow feeding under the grass at the edge of a pathway, in a clover field, in a field of growing corn, and in newly plowed ground. They were never found colonized but scattered here and there among the vegetation.

Miami County. Near Chile, special attention was given to a certain wide valley, with steep bluffs on either side, through which ran a winding, shallow stream. *C. repanda* swarmed the small sand bars and rocky edges of the creek.

The feeding habits of about thirty individuals were studied on a sandy plot about five feet square. It was mid-August and the temperature was about 100 degrees in the shade. When undisturbed the beetles spent their time feeding in the shade under the grass surrounding the barren spot. At the least provocation they would rush from the shady places into the barren spot where they were free to take flight if necessary. Repeated observations show that such behavior is common with a number of species which are said to inhabit barren places. However, they really spend the greater part of their unmolested time among the vegetation where the food is most

abundant, and rush to the barren places only upon the approach of the observer.

One *C. ancocisconensis* was found with these *repanda*. No other specimens were found throughout the county.

Upon the bluffs and in level upland fields several *C. punctulata* were observed. At points where the banks were sloping the two species were frequently found feeding together, but when flushed each took flight in the direction of his own habitat, namely, the *repanda* to the damp lowlands and the *punctulata* to the upland fields.

Kosciusko County. June 19, 1916, was devoted to a close survey of the B. and O. railroad cut one mile east of Milford Junction. From the base of the cut flowed a number of small springs, which had washed sediment from the bank and thus formed a sand clay marsh between the bank and the railroad. At a number of points there was sufficient water to form small pools along the track. This gave, within two hundred feet, the following varied environment, wheat and pasture lands, turf overhanging a ten feet perpendicular clay bank contiguous with an eroded sand clay bank, level sand clay beds bordering upon the marsh, water pools and lastly the railroad track.

Three species of Cicindelidæ were found in abundance under these conditions, and when disturbed each responded to the natural environmental impulse of the species. *C. repanda* would take flight toward the railroad track and light on the ties over the water, or on the barren spots at the edge of the marsh. *C. sexguttata* would fly in the opposite direction to the top of the cut, or passing on into the fields beyond, while *C. ancocisconensis* would usually alight on the sloping banks.

The Cicindelidæ are comparatively scarce in central Kosciusko county, due no doubt, to the unfavorable physcial conditions of the land. The borders of the lakes and waterways are either marshy fields or rolling hillsides covered with dense vegetation, presenting unfavorable breeding places.

With the exception of *C. punctulata*, the specimens from this county were collected here and there and not found in large colonies. This was also the case in many other counties. A few scattering specimens of *sexguttata*, *repanda* and *ancocisconensis* were found in June and early July, after which they disappeared. The new brood of the last two species appeared in late July, about the time of the coming of the single brooded *punctulata*.

C. punctulata became abundant in dry pathways and open fields by the first of August. They were especially numerous in sandy potato patches, where they were attracted by the smaller of the potato beetle larvae. They were ofttimes seen on the leaves of the potato plant enjoying their tender food. This is the only species that I have observed securing its food from, or even perching upon, vegetation of any kind.

August 19, 1916, was spent in studying the life habits of a formerly selected colony of *C. punctulata*. These inhabited a semi-barren spot in an

old pasture field, near Winona Lake. In addition to collecting food, the females were depositing eggs, while the males busied themselves in finding receptive mates, or in attacking their opponents. The ground was so hard and dry, that the females were unable to penetrate it with the ovipositor, and thus since they could not construct the usual cell, they were compelled to deposit their eggs in small cracks and other unfavorable places. All this time they were continually annoyed by the males attempting copulation. In one instance a male forced a female to submission by clasping her between the pro-and mesothorax with his powerful mandibles. After copulating about five minutes, he remained in position over thirty minutes without seeming to disturb the female in her feeding and egg laying habits.

The food of this colony consisted of small ants and worms which were collected under the vegetation. The feeding habits here were comparatively the same as those noted with the *repanda* near Chile.

Elkhart County. The afternoon of June the 9th was spent east and southeast of Elkhart. The only Cicindelidæ found was a large colony of *repanda* in a gravel pit, southeast of town. The environmental conditions were especially advantageous to both larvae and adults. The high banks were covered with sandy loam and turf favorable for larval growth and adult hibernation. The banks also gave protection from the cold while the various insects attracted to the water at the bottom of the pit, furnished an abundance of food.

On account of the small feeding area in comparison to the number of Cicindelidæ, close observation of the beetles while feeding was possible. Ants, small beetles, flies and worms seemed preferable. One *repanda* continued to cling to a large green worm until after he was caught in the net and transferred to a collecting bottle.

Observations were made near Goshen, at the mouth of Rock Run Creek, but since *repanda* was the only species found, no new data were obtained.

St. Joseph County. On June 10, 1916, a careful survey was made along the St. Joseph River between Spring Brook Park and South Bend, and also through the uplands on the opposite side of the river from the city. Here again only *repanda* were collected. On account of the dense vegetation along the river banks, the beetles were confined in small colonies to the sandy deltas of the small inlets. At these points, however, they were very abundant and easily captured.

Laporte County. Collections were made June 11, 1916, in late afternoon around Pine Lake and among nearby hills, However, only a few specimens of *repanda* were secured from the sandy lake shores.

SUMMARY

One or more Cicindelidæ collecting trips were made in the twenty-one counties indicated on the map, and specimens were received from a number of other points.

C. repanda are by far the most abundant of all lowland species, if not the most numerous of all Indiana Cicindelidæ. They swarm the lake shores, river banks, sand bars and deltas in Indiana from early spring until late fall with the exception of a few weeks in July and August. They are found not only along the larger waterways but appear in great abundance in gravel or sand pits or in any other natural or artificial depression, containing water and surrounded by barren banks. They may be collected in almost any number along small ditches through lowland pasture fields.

Observations indicate that the *C. punctulata* are more numerous throughout the state than all other upland species combined. This is a single brooded species and does not appear until the latter part of July (perhaps earlier in southern Indiana). They have a greater diversity of habitat than any of the observed Cicindelidæ. Although they were usually found in fields among the vegetation, they did not seem to object to a home in the woods, on sloping grounds or even on wet sand bars. In fact they were seen scattered over every collecting ground visited during their season. This does not corroborate the observations of Criddle who suggests that the Manitoba *C. punctulata* are confined to few spots where they are usually plentiful.

C. sexguttata represents another single brooded species of the state. They appear in early spring, are most abundant in May and June and disappear in early July. They may be found on barren spots in upland regions, but they are especially fond of damp woodland paths and rocky ravines. This species was found in great numbers in only one locality, but single specimens were distributed over wide areas.

C. vulgaris and *C. oncocisconensis* are both double brooded species, the adults appearing in early spring and disappearing in late July about three weeks before the imagoes are seen. Neither of these species is well distributed but is found in localities where it is abundant. The former is more widely distributed and extends further south than the latter. They both might be classed as upland species even though *oncocisconensis* inhabits the banks along running brooks, while *vulgaris* is found in dry clay fields and roadways.

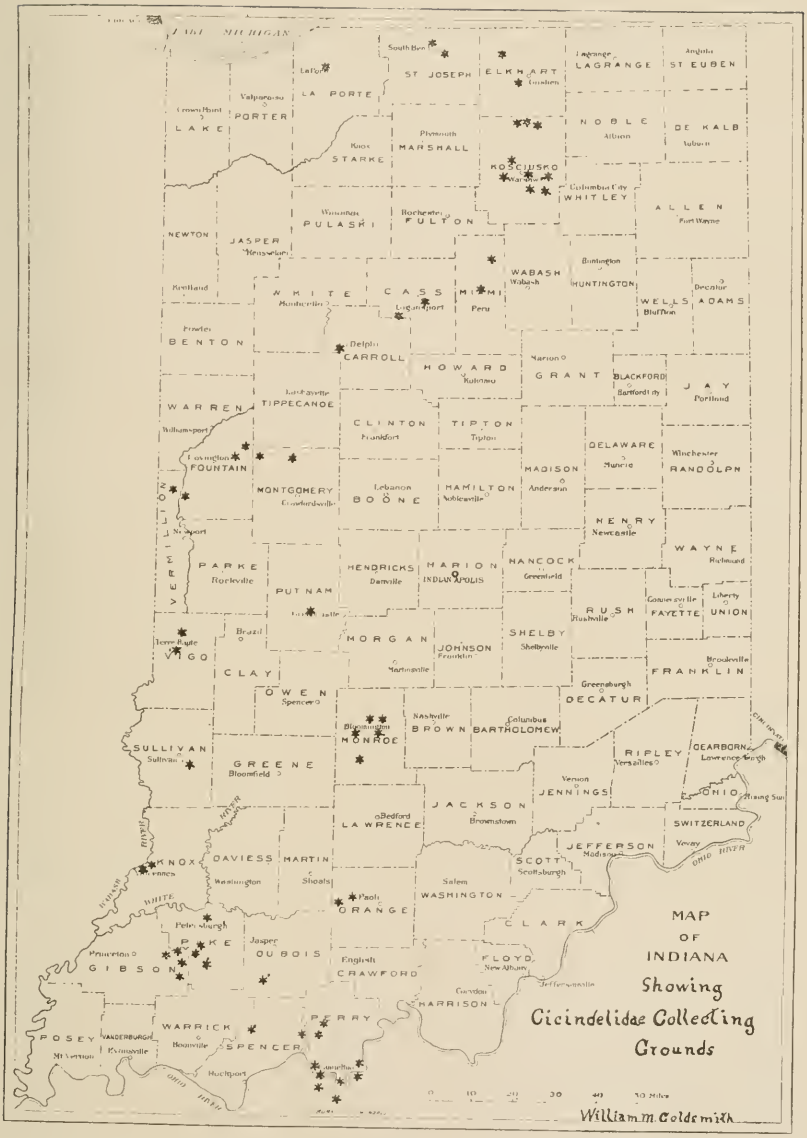
One mature female of *C. generoso* Dej. a variety of Say's *formoso* and a few *scutellaris* were found in Pike county, August 15, 1915.

C. purpurea Oliv. were seen only in southern Indiana.

All immature Cicindelidæ are very unsocial, even cannibalistic and especially so when crowded in cages.

Tiger beetles do not spend their time in barren spots as is usually supposed but seek such places only upon approach of strangers. These beetles were found to be in no way "tiger"-like in their attacks on larger and more active prey. They, on the other hand, confine their food to small and helpless specimens such as small ants, gnats, worms and larvae of various kinds.

Since the Cicindelidæ are entirely carnivorous, living upon insects, larvae and the like, which are as a whole injurious to growing vegetation, their economic value should receive greater recognition.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