

NOTES ON THE LIFE-HISTORY OF A CRANE-
FLY OF THE GENUS GERANOMYIA HALI-
DAY (TIPULIDAE, DIPTERA)

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The genus *Geranomyia* was erected in 1833 by Haliday (Entomol. Magaz., vol. 1, p. 154) for a species, *G. unicolor*, occurring near the sea-shore in England and Ireland. Since the date of its establishment, approximately eighty species have been added to this genus, the members being found in all the major regions of the world.

The habits of the adult flies have been discussed rather frequently in the literature but data on the immature stages are quite lacking. When we consider the comparatively large size of the genus and its wide distribution throughout the world, this fact becomes very striking and *Geranomyia* may be considered as being the largest genus of crane-flies that has thus remained unknown. Mr. Malloch, one of the authors of this paper, was the first to locate the breeding-haunts of a species of *Geranomyia* and to ascertain the rather peculiar life-history. The notes made at the time of this original discovery in 1917 and the subsequent observations made by both authors in 1919 are briefly recorded in the present article.

The adult flies of species of *Geranomyia* are all of medium size. They are distinguished from all other crane-flies by the structure of the elongate rostrum which is approximately one-half the length of the body,

with the paraglossae very elongate and appearing as slightly recurved lobes, the palpi being situated not far from the base of the rostrum. All other crane-flies with the rostrum conspicuously elongated have the palpi reduced in size and borne at the extreme apex. Because of this elongate beak, the flies of this genus superficially resemble very large mosquitoes from which they are readily distinguished by the family characters, the long and excessively slender legs, the almost invariable presence of an enclosed (discal) cell on the wings and the complete lack of scales on the body and wings.

The adult flies are often very abundant and may be swept in numbers from vegetation in the haunts which they frequent. The authors found one of the four species occurring in northeastern North America, *Geranomyia canadensis* (Westwood), very commonly at Alto Pass, Union County, Illinois, on June 6, 1919. At this place there is a low limestone embankment formed by a cut of the Mobile and Ohio railroad, about one hundred yards south of the station. The almost vertical surface of this embankment is continually moist with water percolating from the saturated soil above. On the face of this small cliff the immature stages are spent as described hereinafter and the adult flies occur in numbers in the immediate vicinity. In the evening they appear in small swarms of usually three or four individuals, dancing about only an inch or two from the face of the cliff. The swarming flight is nearly horizontal and in the form of a figure 8, very rapid, but covering a distance of only three or four inches. In repose, the species occur on the face of the wall where they are usually to be found in the act of "bobbing" up and down. In copulation, the pairs rest on plant stems near these haunts, the female above, the male below and partly dorsad of his mate, the posterior legs of both sexes hanging free. The feeding habits of the flies are now comparatively well-known. Knab and other students found that the present species feeds on the nectar of tubular flowers, preferably Compositae (*Eupatorium*, *Solidago*, *Aster*, *Silphium*, *Rudbeckia*, *Cacalia*, *Verbesina* and others), usually in the late

afternoon and evening. The other species whose methods of feeding are known have habits that are very similar to the above. The eggs are deposited in moist situations such as the one described above.

The most striking feature of the life-history is its extreme brevity. This duration was determined in the following manner: In 1917, the Floriculture department of the University of Illinois laid out a portion of the grounds on the south campus as a garden and devoted a small part to flowers found in rocky situations. In this part they installed a bubbling fountain among some rocks at one side of the winding, declivitous walk, the water flowing from the fountain being conducted to the sewer some distance away by means of an open gutter along one side of the walk. This gutter had become obstructed by vegetable growth and while examining an artificial pond near the garden for mosquitoes, the small pools in the gutter were also examined to discover if any mosquito larvae were present. No mosquito larvae were found but among the aquatic insects along the gutter were some interesting forms, including an Anthomyiid, *Lispa tentaculata* (De Geer), some species of Dolichopodidae, about three species of Chironomidae, and larvae, pupae and imagines of *Geranomyia canadensis*. The larvae and pupae of the last named species were found on the surfaces of the rocks over which the water from the fountain flowed very swiftly, some on the vertical portions, and were remarkably conspicuous owing to the fact that the surfaces on which they lay were coated with a rusty colored diatomaceous deposit from the water, which is of artesian origin.

Several of the larvae were removed to jars and kept alive for over a week but failed to pupate. Adults were found commonly alongside the gutter, resting on the vegetation, feeding on the nectar of flowers or in copulation. In 1919, this bubbler in the Rock Gardens was turned on for the season on April 25. On May 24, the rock surface was thickly covered with diatomaceous ooze but no larvae could be found and, if present, must have been very small. On June 28, just five weeks later, half-

grown and fully-grown larvae and a few cast pupal skins were found. This proves that the entire life-cycle to the adult condition is not more than two months and probably only six or seven weeks. At Alto Pass, in the situations previously described, the larvae of *Geranomyia canadensis* were found living in the irregularities and crevices on the wet face of the cliff. They were found lurking in delicate, silken tubes covered with a deposit of silt and diatoms. They emerged from these cases to feed on the exposed surface of the wet rocks during twilight and even during the hours of sunlight but upon being disturbed or alarmed they retreated instantly and with great agility into their tubes. The pupa occurs in a short, nearly vertical, burrow in the same situations as the larvae; here they rest with only the long, conspicuous breathing-horns projecting from the entrance to this burrow. When transformed, the empty pupal skin projects from the mouth of the burrow nearly to the ends of the wing-sheaths. Numerous larvae, three pupae and many cast pupal skins were found. The very scanty number of pupae as compared with the abundance of larvae and pupal skins leads us to believe that the pupal existence is of very short duration, else this stage would be found more often.

It is probable that the flies pass the winter in the larval condition, although this has not been proven. In the green-houses of the Department of Floriculture of the University of Illinois, the adult flies were found in large numbers throughout the winter. On February 26, 1920, at least one hundred individuals were seen in one of the buildings where the heat was maintained at approximately 70° in the day and 60° at night. Many of these flies were gravid females, a few were teneral, as though newly emerged, and still others were in copulation. However no evidences of the immature stages could be found in spite of a diligent examination of all possible situations wherein these flies might be breeding. The only possibility of their breeding in these buildings would appear to be in damp earth since no situations

comparable to their out-door breeding situations are maintained in the green-houses.

Last fall (1919) a number of adults were found in the greenhouse at the University Vivarium building, resting on the sides of the small overflow troughs or channels. Several times since, efforts have been made to discover if the species passes the winter there and, if so, in what stage. No stage has so far been discovered in this situation, only adults in spider's webs remaining as evidence of their occurrence there.

It may be seen from the above account that the general features of the immature stages are quite in agreement with other members of the tribe Limnobiini, the larvae living in silken tubes into which they retreat when danger threatens. A similar habit is found in the genera *Limnobia*, *Dicranomyia*, *Rhipidia*, *Discobola*, *Elliptera*, *Antocha* and others.

The immature stages may be briefly described as follows:

Larva.—Length, 12—12.5 mm.

Diameter, 0.8—0.9 mm.

The living larva is grayish subhyaline in color, the alimentary canal and the tracheae showing very clearly through the integument; on the posterior lateral portion of the prothorax a large orange area is evident; the transverse welts on the segments dark brown. Upon dropping the larvae in alcohol they soon become opaque white.

Body moderately long and slender, the thoracic segments gradually decreasing in length from the prothorax to the metathorax; first abdominal segment short, the abdominal segments gradually elongated to the fifth, then shortened to the end of the abdomen. The ventral surface of the last two thoracic segments and the first eight abdominal segments are each provided with a basal transverse welt which is densely set with microscopic short hairs or points. On the mesothorax and metathorax these are broad, the spicules most dense medially to form a broadly triangular region, the lateral portions with

fewer hairs; the area on the first abdominal segment is much smaller than those on the succeeding segments and not raised into a welt; the area on the eighth abdominal segment is less conspicuous than those of the preceding seven segments which are raised into broad oval welts. The areas on the dorsal surface of the segments are much narrower and not raised into welts; they occur as a narrow, parallel-sided band on the anterior margin of the metathorax and on abdominal segments two to eight, occupying a position nearly opposite the welts on the sternum but with no connection across the pleural region except the areas on the metathorax and the eighth abdominal segment where the bands completely encircle the body although less developed on the pleural regions. The body setae are very small and scattered, a widely separated pair a short distance caudad of the ventral abdominal welts, on the thoracic segments occupying corresponding positions but with two setae to a puncture. The dorsal setae are very small and widely separated, situated nearly midlength between the welts.

The spiracular disk is very similar to that found in the genus *Dicranomyia*, the spiracles being very large, elongate-oval, placed obliquely on the sides of a deep split and so capable of close approximation. The usual ventral lobes of the disk are represented by two contiguous, roughly circular, dusky areas, (fig. 7) each with three or four tiny setae near the middle of its caudal margin. Anal gills (fig. 6) four in number, distinct, each gill rather short, simple, tapering gradually to the blunt tip.

The head-capsule is of the simple, generalized structure of this tribe, with flattened, mussel-like constituent plates. Labrum (fig. 1) transverse oval, the margin provided with short yellow hairs, a larger tuft on either side. On the disk are two oval subhyaline areas, each of which are provided with three sensory papillae; at either end of the labral sclerite a roughly conical chitinized supporting structure. Mentum (fig. 5) broad, the anterior margin gently convex and provided with 11 teeth, the median tooth largest, the others gradually decreasing in size to the outermost which is very small and indistinct;

the three intermediate teeth have the margins projecting as thin, pale wings. Hypopharynx (fig. 2) formed as in this tribe, a roughly circular chitinized collar provided with a crown of strong teeth that are curved strongly outward. Antennae (fig. 4) two-segmented, the last segment rather stout, cylindrical, slightly curved; the apical papilla is small but high, subhyaline. Mandibles (fig. 3) broad and flattened with a small dorsal tooth, and a row of five teeth along the ventral cutting edge, the outermost exceeding the apical point in size, the teeth thence decreasing in size to the basal one which is directed strongly basad. Maxillae of the usual generalized structure of this tribe, the inner and outer lobes subequal in size, densely hairy, the cardines large.

Pupa.—Length (including breathing-horns), 8-9 mm.;
breathing-horns alone, 1.2-1.3 mm.
Width, dextro-sinistral, .85-.9 mm.
Depth, dorso-ventral, 1-1.05 mm.

Pronotal breathing horns grayish subhyaline. Head, thorax and sheaths of the appendages dark brown, becoming darker with age. Abdomen white or whitish, the chitinized terminal hooks and the transverse rows of spicules on the segments brown.

Cephalic crest small, indistinctly bilobed, distinctly set off from the antennal bases by deep grooves. Front long and parallel. Rostral sheath (fig. 12) very long and slender, subtended on either side by the sheaths of the paraglossae (fig. 12, Pa.); the latter project considerably beyond the tip of the former, extending to almost opposite the wing-tip; the rather acute apex of the rostrum ends just before midlength of the metatarsal sheaths. Margins of the cheeks prominent, flattened, as in this sub-tribe, overlying the knee-joint of the fore-legs. Antennal sheaths (fig. 8, Ant) short, ending slightly beyond the base of the wing-pad.

Pronotal breathing-horns (fig. 9) very long and prominent; viewed from the side (fig. 8) they are broadest before midlength where there is a distinct bulge on the anterior margin nearest the eye, thence tapering to the

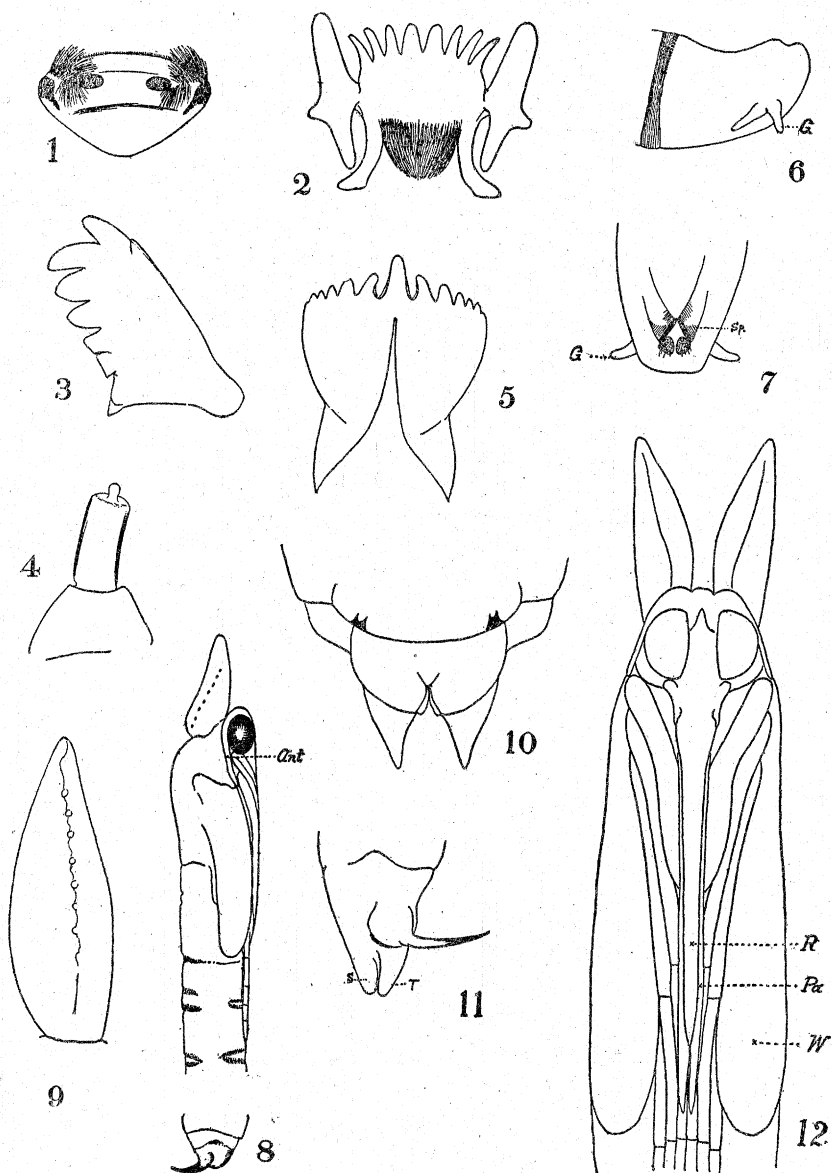
blunt tips. Viewed dorsally it is seen that the breathing-horns are not contiguous basally as in the genus *Elliptera* but are inclined proximad so that the tips touch one another, or nearly so; the dorsal margin is flattened and provided with about a dozen separated beathing-pores. Mesonotum smooth and not at all precipitous. Wing-sheaths rather long, ending opposite the base of the third abdominal segment. Leg-sheaths ending about opposite midlength of the fourth abdominal segment or slightly beyond, the tarsal sheaths ending nearly on a level or the two inner pairs a little longer than the outer pair.

Abdominal segments three to seven near the base are provided with two bands of chitinized hooks enclosing a transverse area, these interrupted on the venter by the leg-sheaths. There are about four or five distinct rows of hooks in each of these bands, those of the anterior band directed cephalad, those of the posterior band directed caudad, the hooks on the outer margin of these areas smallest, almost hair-like, the hooks increasing in size toward the enclosed area. Male cauda (fig. 10) chitinized, the tergal region produced into a powerful curved hook on either side, this bent strongly dorsad; in this sex the sternal valves do not project caudad beyond the level of this spine; in the female the sheaths of the ovipositor (fig. 11) project considerably beyond the spine which is thus situated at about midlength of the tergal valves.

Nepionotype (type larva), Alto Pass, Union County, Illinois, June 6, 1919 (Alexander and Malloch).

Neamotype (type pupa), with the type larva.

Paratypes, numerous larvae and cast pupal skins with the types; other material from the Campus of the University of Illinois, Champaign County, summers of 1917 (Malloch) and 1919 (Alexander).



EXPLANATION OF PLATE

Ant—antennal sheath; G—gills; Pa—sheaths of the paraglossa; R—sheath of the rostrum; S—sternal valves of ovipositor; Sp—larval spiracles; T—tergal valves of ovipositor; W—wing sheath.

Fig. 1. Larva of *Geranomyia canadensis*; labrum.

Fig. 2. Larva of *Geranomyia canadensis*; hypopharynx.

Fig. 3. Larva of *Geranomyia canadensis*; mandible.

Fig. 4. Larva of *Geranomyia canadensis*; antenna.

Fig. 5. Larva of *Geranomyia canadensis*; mentum.

Fig. 6. Larva of *Geranomyia canadensis*; lateral aspect of caudal end.

Fig. 7. Larva of *Geranomyia canadensis*; dorsal aspect of caudal end.

Fig. 8. Pupa of *Geranomyia canadensis*; lateral aspect of male.

Fig. 9. Pupa of *Geranomyia canadensis*; dorsal aspect of pronotal breathing-horn.

Fig. 10. Pupa of *Geranomyia canadensis*; ventral aspect of male cauda.

Fig. 11. Pupa of *Geranomyia canadensis*; lateral aspect of female cauda.

Fig. 12. Pupa of *Geranomyia canadensis*; ventral aspect of male.