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ENALLAGMA VERNALE, A NEW SPECIES OF
ODONATA FROM MICHIGAN

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WHEN the *Enallagma* material in the University of Michigan Museum of Zoology was being redetermined, in the fall of 1931, there were found among the specimens labeled *Enallagma hageni* Walsh two males that did not seem to be of that species nor of any other in the collection. Mr. E. B. Williamson examined them carefully and remarked that they represented an undescribed species. These two specimens were taken by R. F. Hussey at Third Sister Lake, four miles west of Ann Arbor, on June 2, 1919. Each spring, from 1932 to 1936, H. K. Gloyd and I searched for more material in this locality at intervals from the middle of May to the latter part of June, but found only one male in 1932 and two males in 1933. In 1938 Pierce Brodkorb collected a small series, including females, on the Seney Refuge in the Upper Peninsula of Michigan, where he saw them in considerable abundance on June 1. In 1939 more specimens were taken by I. J. Cantrell and F. E. Lyman at Douglas Lake, Michigan, on May 29.

Enallagma vernale, new species

HOLOTYPE MALE.—Color sky-blue and black; pattern similar to that of *Enallagma boreale* Selys and *Enallagma cyathigerum* Charpentier.

Labium pale (light grayish blue or cream); labrum, genae,

and anteclypeus, blue; postclypeus black, bordered with blue anteriorly and laterally; frons to base of antennae, blue; antennae black, pale apical ring on segment 2; vertex, black; large postocular spots, blue, ocular margin black, posterior margin crenate; occipital plate, blue, encroached with black medianly; rear of head light grayish blue with a small black area on either side of the foramen.

Front lobe of the prothorax blue, margined with black; middle lobe black dorsally with a large blue dorsolateral spot, blue laterally; hind lobe black, posterior margin blue, convex.

Pterothorax (Fig. 1) blue, with black markings as follows: middorsal stripe occupying a little more than half of the mesepisternum, narrowing apically and extending medianly across the antealar sinus and laterally along the anterior border of the antealar carina; humeral stripe at mid-length about half as wide as the blue antehumeral, broadened at the shoulder, narrowed apically; lateroalar carina to region of first lateral stripe, which is represented by an apical spur only; second lateral stripe represented by a small diffused area at base, an oblong spot in upper third and a very fine hairline between the two. Ventrums pale grayish blue.

All three pairs of legs similarly marked as follows: coxae blue with median black area at base; trochanters and femora black externally, broader at apex, grayish blue on other surfaces; tibiae with black streak adjacent to lateroexternal row of spines; tarsi pale, each segment with an apical black ring; claws pale, black tipped. Armature of legs black.

Abdomen (Fig. 1) blue, with black markings as follows: on segment 1, a middorsal spot occupying basal half and a narrow apical band arising mid-laterally and extending to ventral margin; on segment 2, a large middorsal hastate spot in apical half, its apex broadly joined to apical ring; on segments 3-5, dorsal apical area slightly greater than one-fourth the length of each segment and broadly joined to the apical ring, anteriorly diffusely broadened, almost touching the lateral margin of each segment; on segment 6, dorsal apical three-fourths, narrowed to a point anteriorly; on segment 7, entire dorsum except for a narrow blue basal band; on segments 8-9, a small

mid-lateral apical spot, otherwise entirely blue; on segment 10, entire dorsum.

Superior abdominal appendages (Figs. 3-5) mostly black, pale at base; in lateral view about half the length of segment 10, proximal half stout becoming abruptly narrowed and flattened distally, pale apical tubercle directed dorsad; in dorsal view, lateral margin curved mesad at mid-length and upward at mid-width at approximately a right angle forming an extension which bears the pale tubercle across its truncate apex, mesal margin slightly concave. Directly below the tubercle in the region where the appendage is broadest is a shiny black tooth connected with a glossy ridge that curves up and extends along the base of the tubercle, ending at the mesal margin in a sharp projecting point, the area thus outlined forming a shallow cup or basin. Inferior appendages, pale with black apices, curved dorsad and slightly mesad.

VARIATION IN PARATYPE MALES.—In the series of seventeen males the extent of the black areas varies most noticeably in the following regions. The posterior margin of postocular spots is represented by a series of dots in eight specimens; the hind lobe of the prothorax is black with a small median blue spot and blue laterally in six; the humeral stripe is considerably reduced in width, especially near mid-length in six. Abdominal segment 1 has the narrow apical band represented by a mid-lateral spot only in twelve specimens, and by a spot and a hairline on apical margin in five; segment 2 has the mid-dorsal hastate spot separated from the apical ring in one, flattened transversely and very narrowly joined to the apical black in four, and represented by an isolated transverse bar in eight; segment 5 has the black area extended middorsally to cover about the apical third in one, three-fifths in one, half in one, two-thirds in two, and four-fifths in two; segments 3-5 are typical in only one male, in all the others there is no apical lateral broadening of the middorsal black area.

ALLOTYPE FEMALE.—Color much duller than that of the male; grayish blue and black above, cream below.

The markings on the head are similar to those of the male;

occipital plate largely blue, posterior margin of postocular spots interrupted laterally near eye margin and mesally; rear of head, grayish cream.

Front lobe of the prothorax blue anteriorly and laterally, black posteriorly; middle lobe black dorsally with a large dorsolateral blue spot, blue laterally; hind lobe black dorsally with a small median blue spot, blue laterally. Prothoracic pits absent.

The color pattern of the pterothorax (Fig. 2) is similar to that of the male. The humeral black stripe is narrower, and anteapically for about a fifth of its length is reduced to a narrow line on the suture, widening again at its apex.

The mesostigmal laminae (Fig. 6) are black with the lateral thickened tip pale; glossy ridge of mesal margin at about a 45° angle to the middorsal carina, the anterior margin and the ridge near posterior margin subparallel in mesal three-fourths, the sinus thus formed deepest at the mesal anterior angle; the tumid lateral fourth elevated anteriorly and narrowed to a blunt point that does not touch the mesinfraepisternum. Along the caudal margin of the lamina in the mesepisternum itself is a narrow transversely elongated depression.

Coxae and trochanters entirely pale (creamy buff ?); femora, tarsae, and claws as in the male, except that the external black stripe of the femora is interrupted postbasally.

Abdomen (Fig. 2) grayish blue with black markings as follows: on segment 1, a rounded middorsal spot in basal half, a small mid-lateral spot at apical margin; segment 2, dorsum from base to apex angularly widened anteapically, broadly joined to narrow apical ring which ends abruptly mid-laterally; segments 3-8, dorsum from base to apex, narrowed to a point at base, broadest anteapically; segment 9, entire dorsum, broadest at base; segment 10, dorsally from base to apex but about half as broad as at apex of segment 9. Superior appendages pale with a dark suffusion dorsally at base, about two-thirds as long as segment 10, conical with dorsoventrally flattened apices. Valves of the ovipositor pale, narrowly black along the finely serrated ventral margin; apex (not including

styli) does not extend to apex of segment 10. Ventral spine of segment 8, sharp, black tipped.

VARIATION IN PARATYPE FEMALES.—In color pattern the three specimens differ from the allotype as follows: Postocular spots isolated from the pale area of rear of head in one; the posterior margin of hind lobe of the prothorax blue in two; the humeral stripe reduced to a hairline in middle half in one (slightly teneral); and the middorsal black spot on abdominal segment 2 divided transversely at mid-length in one specimen.

WINGS.—Hyaline, venation black and dark brown, the costa usually lighter in color than other veins, pterostigma dark brown or black with pale margins. The following data are based on 36 ♂ and 8 ♀ front and hind wings (18 ♂ and 4 ♀ specimens). Postnodal crossveins: front wing, 10 (♂ 7), 11 (♂ 13, ♀ 3), 12 (♂ 13*,¹ ♀ 4**), or 13 (♂ 3*, ♀ 1); hind wing 9 (♂ 16, ♀ 2), 10 (♂ 12, ♀ 3*), or 11 (♂ 7**, ♀ 1*). Nodal sector (M_2) arises in front wing at fifth postnodal in ♂ 10, ♀ 2, between fifth and sixth in ♂ 12, ♀ 2**, at sixth in ♂ 13*, ♀ 4, between sixth and seventh in ♂ 1*; in hind wings at fourth postnodal in ♂ 10, ♀ 1, between fourth and fifth in ♂ 8, ♀ 3**, at fifth in ♂ 17**, ♀ 4, and between fifth and sixth in ♂ 1. Postnodal sector (M_{1a}) arises in front wing at level of eighth postnodal in ♂ 19, ♀ 3, at ninth in ♂ 16**, ♀ 5**, and at tenth in ♂ 1; hind wing, at seventh postnodal in ♂ 13, ♀ 2, at eighth postnodal in ♂ 18**, ♀ 6**, and at ninth in ♂ 5.

MEASUREMENTS IN MM.—Length of hind wing, ♂ 15.6–19.0 (holotype, 19.0), ♀ 18.5–20.1 (allotype, 20.1); abdomen to apex of segment 10, ♂ 22.0–27.3 (holotype, 26.0), ♀ 23.6–26.4 (allotype, 26.4); superior appendages holotype, ♂ 0.36, allotype, ♀ 0.5; inferior appendages, holotype, ♂ 0.7. The inferior appendages extend about 0.2 mm. beyond the apex of the superiors.

The specimens from Schoolcraft County in the Upper Peninsula are large and robust (♂ abdomen, 25.3–27.3, average, 26.1 mm.; hind wing, 17.8–19.0, average, 18.64 mm.), those from

¹ Each asterisk indicates that the number includes the count for each wing of the holotype ♂ and of the allotype ♀.

Emmet and Cheboygan counties at the northern tip of the Lower Peninsula are not quite so large and robust (σ abdomen, 24.0–25.0, average, 24.48 mm.; hind wing, 17.6–18.0, average, 17.7 mm.) and those from Washtenaw County in the southern part of the state by comparison appear dainty and small (σ abdomen, 22.0–23.8, average, 22.86 mm.; hind wing, 15.6–16.6, average, 16.1 mm.).

MATERIAL EXAMINED.—Michigan: Cheboygan County, Douglas Lake, May 29, 1939, 5 σ , I. J. Cantrall; Fairy Island, Douglas Lake, May 29, 1939, 1 σ , F. Earle Lyman. Emmet County, T. 37 N., R. 4 W., sec. 15, May 29, 1939, 1 σ , F. Earle Lyman. Schoolcraft County, Seney Refuge, 4 miles north of Germfask, June 1, 1938, 3 σ , 2 σ , including holotype and allotype, June 3, 1938, 4 σ , 1 σ , Pierce Brodkorb. Washtenaw County, Third Sister Lake, Forestry Farm of the University of Michigan, June 2, 1919, 2 σ , R. F. Hussey; May 30, 1932, 1 σ , H. K. Gloyd; June 6, 1933, 1 σ , and June 8, 1933, 1 σ , L. K. Gloyd. The types and paratypes are in the Williamson collection, Museum of Zoology, University of Michigan.

The habitat of *Enallagma vernale* seems to be woodland pools, ponds, or small lakes. On the Seney Refuge the species was found at small ponds which were being used for fish culture. At Douglas Lake, a rather large inland lake, approximately four miles long and two miles wide, it was taken at two small pools a few yards from the lake shore at Sedge Point and on Fairy Island, a narrow strip of land, about three-fourths of a mile long, extending into the lake and connected with the southwest shore at times of low water level. It is quite probable that the specimen from Fairy Island came from one of its offshore or inland pools and not from Douglas Lake itself. Third Sister Lake is small, about one-fifth of a mile long and one-tenth of a mile wide. Here *E. vernale* was found only on the southwest part of the lake, where there is a semifloating mat of sphagnum and other vegetation, and on the west end where the shore is soft and muddy. The three males collected by H. K. Gloyd and me were all taken while they were flying from the lake toward some tall wild rose bushes on shore.

The color pattern of *Enallagma vernale* and closely related species varies to such an extent that no part of it can safely be used as a character for identification. The superior abdominal appendages of the male and the mesostigmal laminae of the female, however, exhibit structural characters which are distinct. In *E. boreale* Selys, male, the pale tubercle of the superior appendage is on the mesal margin near the apex, and the black glossy bar extends from the apical end of the tubercle diagonally laterad about halfway across the appendage (Fig. 9). In *E. cyathigerum* Charpentier, the small pale tubercle is directed more caudad than dorsad, is not borne on an apical projection of the appendage as it is in *vernale*, and covers one-third or less of the apical margin; the glossy black ridge below the tubercle is present, but the angle of the arc is less and the tooth smaller and much less prominent than in *vernale* (Figs. 3-5 and 10). In *E. hageni* Walsh, with which the new species was originally confused, the superior appendages are not so robust at base, and in dorsal view the lateral margin makes a smooth curve with the apical margin; the tubercle is large, about half the width of the appendage, and is directed caudad, not dorsad as in *vernale*; and the glossy black bar or ridge is confined to the base of the tubercle (Fig. 11). *Enallagma hageni*, as represented by a series of Michigan specimens, also differs to some extent in color pattern: postocular spots smaller, occipital plate black, prothorax with no dorsolateral pale spots, and dorsal black area on segment 10 larger.

For the females the mesostigmal laminae provide the most reliable means of separating *Enallagma vernale* from species with which it might be confused (compare Figs. 6-8). As pointed out above, the mesostigmal lamina of *E. vernale* has a ridge near the posterior margin, subparallel to the anterior margin, distinctly separating the sinus of the lamina from the adjacent shallow depression in the thorax, and the anterior margin of lateral fourth, or less, is elevated. In *E. cyathigerum* Charpentier, the lamina appears about twice as wide mesally as laterally, the posterior margin is clearly defined but not accented by any ridge, the sinus is confined to the anterior

mesal half of the lamina, slightly less than the lateral third of anterior margin is elevated at about a 45° angle, and there is no adjacent depression in the thorax. In *E. boreale* Selys, the lamina also appears to be triangular, but is only slightly wider mesally than laterally, the posterior margin is depressed, the anterior mesal sinus seeming to be continuous with the well-defined depression in the thorax, and the lateral half, or more, of the anterior margin of the lamina is elevated at about a 60° angle.

PLATE I

Enallagma vernale, n. sp., holotype ♂ and allotype ♀. Seney Refuge, Schoolcraft Co., Michigan, June 1, 1938, Pierce Brodkorb.

FIGS. 1-2. Color pattern of ♂ and ♀.

FIGS. 3-5. Abdominal appendages of the ♂ in dorsal, oblique dorsal, and lateral views.

FIG. 6. Mesostigmal lamina of the ♀ in oblique dorsal view.

Enallagma boreale Selys, ♂ and ♀. Pittsfield Pond, Washenaw Co., Michigan, May 20, 1918, F. M. Gaige.

FIG. 7. Mesostigmal lamina of the ♀ in oblique dorsal view.

FIG. 9. Abdominal appendages of the ♂ in oblique dorsal view.

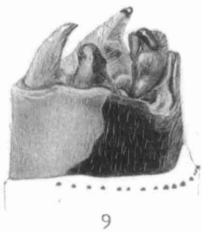
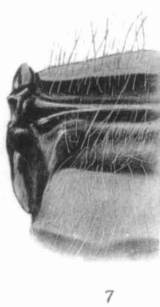
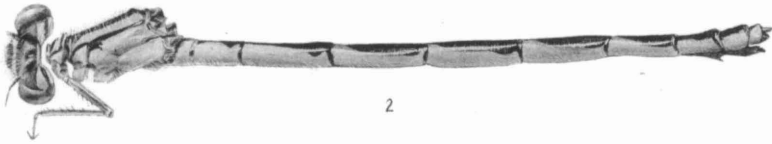
Enallagma cyathigerum Charpentier, ♂ and ♀ (mating pair). Donner Lake, California, July 23, 1914, C. H. Kennedy.

FIG. 8. Mesostigmal lamina of the ♀ in oblique dorsal view.

FIG. 10. Abdominal appendages of the ♂ in oblique dorsal view.

Enallagma hageni Walsh, ♂.

FIG. 11. Abdominal appendages of the ♂ in oblique dorsal view.



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