

***Haliplus leechi* Wallis and *H. salmo* Wallis:  
a new synonymy and sexual dimorphism  
in the relative eye separation (Coleoptera: Haliplidae)**

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**ABSTRACT**

Examination of the holotypes, specimens in the type series and material from across their geographical ranges for *Haliplus leechi* Wallis and *H. salmo* Wallis shows that the two names are conspecific; *H. salmo* is placed as a junior subjective synonym of *H. leechi*. A sexual dimorphism in the relative eye separation is present in members of this complex, *H. canadensis* Wallis and *H. subguttatus* Roberts. Preliminary data suggest that this dimorphism may also be present in other haliplid species. This dimorphism should be taken into account in constructing keys for the determination of haliplids.

**INTRODUCTION**

*Haliplus leechi* Wallis and *H. salmo* Wallis are very similar structurally. *Haliplus leechi* is a widespread (Vondel 2005) species described from material collected in Stanley Park, Vancouver, BC. *Haliplus salmo* was described from specimens recovered from the stomach of a trout caught in Jasper, AB and has a more restricted distribution (Vondel 2005). Wallis (1933), in his description of these species, admitted that "it is possible that one is but a geographical race of the other". However, he felt that these two taxa could be separated based on differences in background color, maculation, punctulation and relative eye separation. The results of an investigation of the taxonomic status of *H. leechi* and *H. salmo* are reported here.

Relative eye separation, the dorsal distance between the eyes divided by the headwidth, is a character frequently used in keys for the determination of haliplids (Wallis 1933; Holmen 1987; Vondel 1991, 1993, 1995; Vondel and Spangler 2008). In his revision of the Nearctic species of *Haliplus* Latreille, Wallis (1933) used this character in separating three species pairs: *H. leechi* and *H. salmo*, *H. subguttatus* Roberts and *H. salinarius* Wallis, and *H. immaculicollis* Harris and *H. robertsi* Zimmermann. Leech (1964) showed that relative eye separation was not a useful character in separating the second pair and noted an apparent sexual dimorphism in this character. Subsequently both the second and third pairs were synonymized (Vondel 1991, 2005).

**MATERIALS AND METHODS**

The minimum distance between the eyes, IO, and the maximum headwidth, HW, were measured using an ocular micrometer on a stereomicroscope (Wild M5, Leica MZ12.5). Specimens were positioned such that the structure being measured was parallel to the optical plane. Relative eye

separation,  $R_{IO}$  was calculated by dividing IO by HW.

The holotypes and allotypes of *H. leechi* and *H. salmo* and the paratypes of these species in the Canadian National Collection of Insects (Ottawa, ON) were examined. The relative eye separation,  $R_{IO}$ , was meas-

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ured for both these specimens and a number of other specimens previously identified as *H. leechi* or *H. salmo*. Approximately a third of the males in these latter series were dissected to allow examination of the genitalia. The dissected genitalia were examined while they were floating in liquid, to prevent possible distortion due to drying and mounting. In addition,  $R_{10}$  was measured for specimens identified as *H. subguttatus* and *H. canadensis* Wallis. The specimens examined are in the author's collection or were borrowed from the following museums: California Academy of Sciences

(San Francisco, CA), D. Kavanagh; Canadian National Collection of Insects (Ottawa, ON), Y. Bousquet; J.B. Wallis Museum (University of Manitoba, Winnipeg, MB), R.E. Roughley; James Entomological Collection (Washington State University, Pullman, WA), R. Zack; Michigan State Collection of Insects (Michigan State University, East Lansing, MI), G. Parsons; Museum of Zoology, Invertebrate Section (University of Calgary, Calgary, AB), J.E. Swann; Spencer Entomological Museum (University of British Columbia, Vancouver, BC), K. Needham.

## RESULTS AND DISCUSSION

**Specific status of *H. leechi* and *H. salmo*.** Wallis (1933) suggested that *H. leechi* and *H. salmo* could be separated by: i) background color, ii) maculation, iii) punctulation and iv) relative eye separation.

i) The color of preserved specimens is often more a function of their previous treatment than of the particular species involved (e.g. Kenner 2005). Wallis acknowledged this when he suggested that the color of the *H. salmo* type series may have "undergone some change" due to being recovered from the stomach of a trout. It is the current author's experience, based on the examination of large numbers of specimens belonging to the *H. leechi*-*H. salmo* complex, that the apparent background color is variable but the variation is not correlated with any other morphological character.

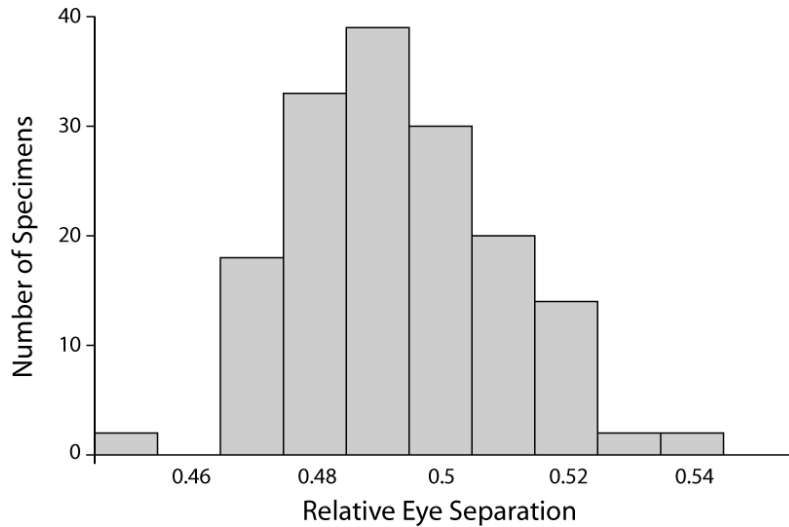
ii) One of the most obvious differences in the two holotypes is in the elytral maculation, with *H. leechi* having elytral blotches and *H. salmo* being immaculate. However, the maculation in *H. leechi* is variable, with some of the paratypes "losing almost all traces of spots on the elytra" (Wallis 1933). On most *H. leechi* specimens with very reduced maculation, one can still detect the position of at least some of the elytral blotches, due to infuscate 'halos' around the stria punctures in the appropriate positions. At least one of the *H. salmo* paratypes shows this same

effect. It appears that there is a continuum in elytral maculation, with *H. salmo* being at one extreme and the putative subspecies *H. leechi carteri* Leech (1949) at the other. Note that the latter has since been synonymized with the nominate subspecies (Vondel 2005). The maculation of the head and thorax are similarly variable and do not provide a reliable character for separating *H. leechi* and *H. salmo*.

iii) Examination of a large number of specimens in the current complex suggests that the small differences in punctulation seen between the two holotypes is within the variation seen in the population as a whole and does not seem sufficient to justify erecting separate species.

iv) Wallis gives  $R_{10}$  of the *H. leechi* and *H. salmo* holotypes as 0.46 and 0.54, respectively. The current author's remeasurement of the holotypes gives a smaller difference in  $R_{10}$ : 0.48 and 0.51, respectively. The mean  $R_{10}$ s for the two type series (*H. leechi*: holotype, allotype and nine paratypes; *H. salmo*: holotype, allotype and five paratypes) are 0.48 (range 0.46–0.50) and 0.51 (range 0.50–0.52), respectively. Wallis uses  $R_{10} < 0.50$  (*H. leechi*) and  $R_{10} \geq 0.50$  (*H. salmo*) in his key; this character does not even correctly separate all members of the two type series.

$R_{10}$  was measured for 142 specimens previously identified as either *H. leechi* or *H. salmo*; these specimens are from a vari-



**Figure 1.** The frequency distribution of the Relative Eye Separation,  $R_{10}$ , for specimens identified as *Haliplus leechi* and *H. salmo* including the type series for each. Wallis used  $R_{10} < 0.50 = H. leechi$  and  $R_{10} \geq 0.50 = H. salmo$  to separate the two species.  $R_{10}$  for the holotypes of *H. leechi* and *H. salmo* are 0.48 and 0.51 respectively.

ety of localities. A histogram of  $R_{10}$  from these specimens plus the specimens from the type series (Fig. 1), gives a unimodal distribution with a mean of 0.49 (range 0.44–0.54). It appears that there is a continuum in the values of  $R_{10}$ , which suggests that it is not a good character for separating these two species.

This leaves possible differences in the male genitalia to separate these two species. The apparent differences in Wallis's drawings of the aedeagi are largely an illusion caused by the fact that Wallis did not draw the basal part of the aedeagus for *H. salmo*. If his two drawings are overlaid, one finds that the differences are on the order of a linewidth. Examination of the mounted genitalia of the two holotypes shows that the only significant difference is in the length of the digitus on the left paramere: longer in *H. salmo*. Due to possible distortions caused by drying and mounting, it is not clear if this difference is real. Examination of a large number of genitalia from both putative *H. leechi* and *H. salmo* specimens suggests that the difference is not constant.

Based on the similarity in the genitalia of the two holotypes and the apparent clinal

nature of all other characters given by Wallis to separate these two taxa, *H. salmo* is placed as a junior subjective synonym of *H. leechi*. *Haliplus leechi* was chosen as the senior synonym to maintain stability in the literature as it is the much more widely recognized and cited name and to maintain the tribute to Hugh Leech intended by Wallis (1933).

**Sexual dimorphism in the relative eye separation.** In the data from the  $R_{10}$  investigation discussed above, the smallest values of  $R_{10}$  are from male specimens while the largest values are from female specimens, although there is extensive overlap. This suggests that  $R_{10}$  may be sexually dimorphic. However, since headwidth is proportional to size and is smallest in males and largest in females, this could actually be a dependence on size rather than on sex.

To test for a possible sexual dimorphism in the relative eye separation, the specimens were sorted by HW and the mean value of  $R_{10}$  for each size group was calculated separately for males and females. A paired *t*-test (Whitlock and Schluter 2009) with a null hypothesis of no difference in  $R_{10}$  for males and females gives a mean  $R_{10}(\text{♂-♀}) = -0.013$  ( $t = -3.71$ ,  $df = 15$ ,  $P = 0.002$ ). The

null hypothesis can be rejected with a high degree of confidence. Since males and females of the same size were compared, one can conclude that there is a sexual dimorphism in  $R_{10}$  for *H. leechi*, with females averaging larger.

To determine if this is also true in other species, similar tests were performed for *H. canadensis* and *H. subguttatus*. For *H. canadensis*: mean  $R_{10}(\text{♂-♀}) = -0.016$  ( $t = -2.60$ ,  $df = 8$ ,  $P = 0.032$ ); for *H. subguttatus*: mean  $R_{10}(\text{♂-♀}) = -0.016$  ( $t = -6.23$ ,  $df = 10$ ,  $P < 0.001$ ). In both of these species the null hypothesis can be rejected with a high de-

gree of confidence and a sexual dimorphism in  $R_{10}$  is supported. Preliminary tests on other species suggest that this dimorphism may occur more widely in haliplids (Kenner unpublished). While the difference in  $R_{10}$  for males and females of a given species are not large, one can end up with a situation, as the current author has, where males and females go to opposite sides of a couplet using  $R_{10}$  as the primary character. Future keys should take this sexual dimorphism into account when the difference in  $R_{10}$  is not large for the taxa being separated.

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