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Phylogeny of genus *Vipio latrielle* (Hymenoptera: Braconidae) and the placement of *Moneilemae* group of *Vipio* species based on character weighting

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Abstract

The Phylogeny of genus *Vipio* is re-investigated. Characters of *moneilemae* species group were added to data to decide the placement of the *moneilemae* species group in genus *Vipio*. Cladistic analysis were conducted which showed that genus *Vipio* is more closely related to genus *Glyptomorpha* Holmgren than to other glyptomorphine genera. The species *moneilemae* appeared as a sister group of lineage comprising *Mesobracon*, *Angustibracon*, *Merinotus*, *Glydinobracon*, *Bathyaulax*, *Euvipio*, *Odeia*, *Rhytimorpha*, *Glyptomorpha* and *Vipio*. In the second stage of analysis successive approximations to character weighting were employed which showed *moneilemae* species group as more closely related to genus *Vipio* than to other genera of tribe Glyptomorphini. The analysis showed that genus *Victoroviella* is more near to glyptomorphines than other tribes of Braconinae.

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Introduction

Genus *Vipio* Latrielle is a member of tribe Glyptomorphini of the subfamily Braconinae. In their revision of the Genus *Vipio* Latrielle, Inayatullah *et al.* (1998) hypothesized the monophyly of the *Vipio* as the presence of two groups of clypeal guard setae which are often twisted apically.

Within Glyptomorphini the *Vipio* is more closely related to Genus *Glyptomorpha* than other glyptomorphines. Both genera have short marginal cells: the vein SRI (radius) of the fore wing joins the anterior wing margin well before the apex of the wing. Additionally, the scape is longer dorsally than ventrally and the dorsolateral carina is usually present on T1 (Quicke, 1987). Because of these similarities, many previous workers did not correctly distinguish between these two genera and some *Glyptomorpha* and *Vipio* species were incorrectly placed. For a time, *Glyptomorpha* was even regarded as a junior synonym of *Vipio* (Muesebeck and Walkley, 1951; Shenefelt, 1978; Marsh, 1979). Quicke (1984) rejected the synonymy and considered *Glyptomorpha* as a valid genus separate from *Vipio* based on some consistent morphological differences between the two genera.

Vipio, also, is closely related to *Rhytimorpha* Szepliget. Both genera have short marginal cells, short r vein (typical of Glyptomorphini) and a baso-medial area is present on T2. However, the distinctly postfurcal fore wing vein cu-a, moderately to strongly curved fore wing vein 1-M and the distally expanded second submarginal cell in *Rhytimorpha* make it distinct from *Vipio*.

Phylogeny of the genera of the Braconinae and the position of *Vipio* within tribe Glyptomorphini has been proposed by Quicke (1988). Based on the cladistic analyses of 87 selected genera (including *Vipio* as *Isomecus*), subtribes and tribes in his 4 data sets, Quicke presented some preliminary results. He also suggested that additional taxa and characters needed to be added in order to reach a better

understanding of the taxa, and before anyone made further taxonomic changes. The aim of present study was to add more data and character weighting to Quicke (1988) data set 1 and to re-investigate the phylogeny of *Vipio* and to decide the placement of *moneilemae* group of species within tribe Glyptomorphini and subfamily Braconinae by using Hennig 86, computer programme.

Material and methods

A good deal of work has been done on the phylogeny of Braconinae [genus *Vipio* (as *Isomecus*, was included by Quicke (1988)]. In the cladistic analyses, he constructed four data sets and examined a total of 86 characters. Not all, but 59, 38, 30 and 22 of the 86 characters were employed in data sets 1, 2, 3 and 4 respectively. For selection of characters see Quicke (1988).

Quicke's data set 1 was utilized in this study. Data set 1 included 48 tribes, subtribes and genera chosen so as to represent most of the variation within the subfamily Braconinae. He employed 59 characters for the analyses of data set 1 and suggested incorporation of more taxa and data before reaching a conclusion and making taxonomic changes.

In the present study we made five additions/changes in his data set 1. One-Characters of *Vipio* were added to the Data set 1. Two- Characters for *moneilemae* species group were also added in the data set 1, because *moneilemae* species group differs from other *Vipio* species by the absence of notauli and the silky appearance of the clypeal guard setae but is identical in all other characters. By incorporation of these two taxa the number of taxa was raised to 50, while Quicke analyzed 48 taxa (Table- 1). Three-Character 6 in the Quicke's data set 1 had been incorrectly coded as 0 for *Angustibracon* while the actual code according to the description should be 1. Therefore correction for character 6 for *Angustibracon* was done. Four – Quicke utilized 48 characters for *Vipio* (as *Isomecus* Kreichbaumer) in his data set 2. We sought and incorporated 11 more characters for *Vipio* and *moneilemae* species group

to his data set 1 (Table-1). Five: Quicke did not employ characters weighting in his work. In the

present work character weighting was employed in the second stage of analysis.

Table 1. Quicke's (1988) Data Set 1, with characters for Vipio and Moneilemae added, and Correction Substituted for Character 6 for Angustibracon.

Primitive	0?0000000000000000200000?00?0002100?2??00??0 11?01?11001302
<i>Adeshini</i>	0?02000000000000011201101000?00?200110101002111001000000?000
<i>Alienoclypeus</i>	1?001000000000000000000000000010012001000000010010010010101000
<i>Angustibracon</i>	10001100100011000010000000000000200200020120000000011?00200
<i>Aphrastobracon</i>	0102100010200002000000000002100020100100001300?101?010103302
<i>Archibracon</i>	00001000100000020001000001000010000100100?10010010010102302
<i>Aspidobrecon</i>	0?020000000000011120100100110001001001010??111000001000?000
<i>Atanycolus</i>	0?0111001000000200000000001100020010010013?0010010010103001
<i>Bathyaulax</i>	00001000100010000001000001001101100210000000010010011102001
<i>Bracon</i>	01010000000000101?100000000100020010010100200?0010000001000
<i>Calcaribracon</i>	1100001000000000001000000021000?20111110010000200100003000
<i>Callibracon</i>	00001000?00000000000000000210002000000000??0000110010002101
<i>Calobracon</i>	11001100102001020001000001210002000010000120000000000102012
<i>Campyloneurus</i>	00001000111000000020001000110002000001000??0111011011102101
<i>Cervellus</i>	000010001000000100100000001000020001000000110010010010002101
<i>Chaoilta</i>	10011100100000010000000000010002001000001320010000011102001
<i>Coeloides</i>	??0200000000000200200000000100020010010002200100101?0002012
<i>Compsobraconoides</i>	11001000102100010001000001200002100100000330000000110012011
<i>Cratobracon</i>	10001000100000000020002000100002000000000??0013011011112001
<i>Cyanopterus</i>	110010000000000000000000000010002000001000??0010010000002101
<i>Cyclaulax</i>	11011100102100010000000001210002101?01000000000000100002001
<i>Digonogastera</i>	00001000100000010010000000110001000000000110011010010?02201
<i>Euurobracon</i>	10000000000000010001000000110000100211000010100000010012302
<i>Euvipio</i>	00001000100010010010000001001101000200000220010010011102001
<i>Fraterar</i>	00001000110000010000000000100001000200000??0101010010102302
<i>Gammabracon</i>	0102100010200001001000000020000200100000123021201101?011001
<i>Glyptomorpha</i>	10100020100000000020010010001111100000001220010000011110000
<i>Hemibracon</i>	100111001000000200000000002100021010000003?01110100101?3111
<i>Hybogaster</i>	?0000000100000010000000000000001000100000320012010010002302
<i>Iphiaulax</i>	00001000100000010000000001110002000200000110010000011003011
<i>Lasiophous</i>	11011000001001000000000001110001000001000210010010010?13302
<i>Leptobracon</i>	01001000?000000001100000010000210020000001000000000?0????
<i>Megabracon</i>	00011000000000010001000000010001100000000210010000000012301
<i>Merinotus</i>	10001000112000020010000000100001100200001130000012011?1?00?
<i>Mesobrac</i>	11000000100000000020100000000001001210000011011001010002000

(Fig. 2) was as follows. The species, *moneilemae*, appeared as sister group of *Vipio*. *Vipio* (+ *moneilemae*) appeared as a sister group of *Glyptomorpha*. All the three taxa (*moneilemae* + *Vipio* and *Glyptomorpha*) appeared as sister group of *Rhytimorpha*.

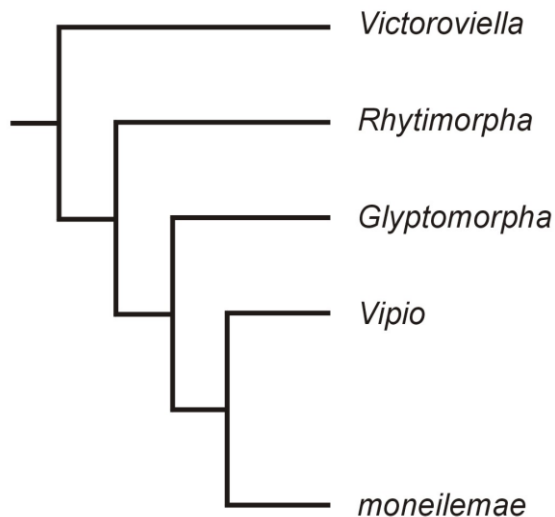


Fig. 2. Cladogram showing relationship of *Vipio* and *moneilemae* species group with other braconines after employing character weighting.

Quicke (1988) analysis shows genus *Victoroviella* as a sister group of Bathyaulacini + Glyptomorphinae which he states as reasonable (see Quicke Fig. 2). He further states that additional characters will have to be found before *Victoroviella* is placed with certainty. Our analysis, after employing character weighting, shows *Victoroviella* as more closely related to Glyptomorphini than Bathyaulacini as shown in Fig. 2.

To summarize, in the cladogram generated (Fig. 1 and 2), *Vipio* appeared in close association with other genera of the tribe Glyptomorphini. Based on this new analysis, *Vipio* is more closely related to *Glyptomorpha* than to other members of the tribe Glyptomorphini of the subfamily Braconinae. Within Glyptomorphini *moneilemae* species group appeared as more closely related to *Vipio* than other glyptomorphine genera which justify its placement in *Vipio*.

Phylogenetic Position of Vipio within the Braconinae

In his cladistic analyses, Quicke (1988) utilized four data sets and examined a total of 86 characters. Not all, but 59, 38, 30 and 22 characters were employed in data set 1, 2, 3 and 4 respectively. Quicke's data set 1 included 48 tribes, subtribes and genera chosen so as to represent most of the variation within the subfamily. Data set 2 included 34 genera of Bathyaulacini and Glyptomorphini, together with a number of potentially related taxonomic groupings. In data set 3, a reduced subset of data was analyzed, and in the 4th data set, 21 genera belonging to the tribe Braconini, including the *Plesiobracon* group were analyzed.

Quicke included the prominent member of the tribe Glyptomorphini, *Glyptomorpha* Holmgren, in data set 1. In the second data set, *Vipio* (as *Isomecus* Kriechbaumer) was added. In data set 3 and 4 other braconines were added.

In the Quicke's analyses of the data set 1, *Glyptomorpha* Holmgren + *Rhytimorpha* Szepliget were shown to be the sister group of *Angustibracon* Quicke. These three genera (*Angustibracon*, *Glyptomorpha*, *Rhytimorpha*) + (*Merinotus* + *Rhydinobracon*) [Glyptomorphini] were shown to be the sister group of *Odesia* [Bathyaulacini]. In his analyses of data set 2, again Bathyaulacini and Glyptomorphini were shown to be sister groups. Within the Glyptomorphini, the *Glyptomorpha*+*Teraturus* combination appeared as sister group of *Vipio* (see Quicke, 1988, Fig. 2).

In the Quicke's data analysis *Angustibracon* was shown to be the sister group of *Glyptomorpha* + *Rhytimorpha*. In our analysis of data set 1 *Vipio* appeared as sister group of *Glyptomorpha* when data for *Vipio* was incorporated into the Quicke's data set 1. This change in the position of *Angustibracon* occurred because of character 6, which was incorrectly coded for the genus. In his analysis of the second data set, Quicke included mostly genera of the tribe Glyptomorphini. *Vipio* (as

Isomecus Kreichbaumer) was shown to be a sister group of *Glyptomorpha* + *Teraturus*. Since *Teraturus* has been regarded as a subgenus of *Glyptomorpha* (Sarhan and Quicke, 1989), therefore it can be said that according to Quicke, and the present re-analysis, *Vipio* is more closely related to *Glyptomorpha* than to other glyptomorphine genera. The study showed *Victoroviella* closely related to glyptomorphine genera. Our analysis also showed the *monilemae* group of species, though a little different from other *Vipio* species, is more closely related to *Vipio* than other glyptomorphines and therefore belong to genus *Vipio*.

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References

- Farris JS.** 1969. A successive approximations approach to character weighting. *Systematic Zoology* **18**, 374-385.
- Farris JS.** 1988. Hennig 86. version 1.5. James, S. Farris, 1988.
- Inayatullah M, Shaw SR, Quicke DLJ.** 1998. The genus *Vipio* Latreille. (Hymenoptera: Braconidae) of America North of Mexico. *J. Natural History* **32**, 117-148.
- Marsh PM.** 1979. Family Braconidae. Pp: 144-295. In: *Catalogue of Hymenoptera of America North of Mexico*. (Eds. Krombein, K. V. et al.) Smithsonian Institution Press p. 1198.
- Muesebeck CFW, Walkley LM.** 1951. Family Braconidae. Pp. 90-184. In: *Muesebeck et al. (Eds.). Hymenoptera of America North of Mexico. Synoptic Catalogue*. USDA Agricultural Monograph **2**, 1420.
- Shenefelt RD.** 1978. *Vipio* Latreille. Pp: 1838-1865. In: *Achterberg, C. van and Shenefelt, R. D. (Eds.). Hymenopterorum Catalogus, part 15. (nov. ed.) Braconidae part 10*.
- Quicke DLJ.** 1984. Further classification of Afrotropical and Indo-australian Braconidae (Hymenoptera: Braconidae) *Oriental Insects* **18**, 339-353.
- Quicke DLJ.** 1987. Old World Genera of braconine wasps (Hymenoptera: Braconidae). *J. Nat. History* **21**, 43-127.
- Quicke DLJ.** 1988. Higher classification, Biogeography and biology of Braconinae (Hymenoptera: Braconidae). *Advances in Parasitic Hymenoptera Research* **1988**, 117-138.
- Sarhan AA, Quicke DL J.** 1989. A new subgenus and species of *Glyptomorpha* (Hymenoptera: Braconidae) from Arabia, Egypt, Pakistan and Yemen, with reappraisal of the status of *Teraturus*. *Systematic Entomology* **14**, 403-409.