Late Paleozoic Trilobites from Kansas and Nebraska

A Thesis

Presented in Partial fulfillment of the requirements
for the degree Bachelor of Science
in Geological Sciences

by

Robert E. Swisher

The Ohio State University
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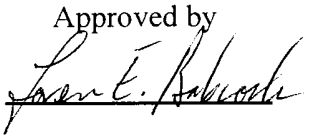
Approved by



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Abstract

Species of late Paleozoic trilobites reported from Nebraska and Kansas include *Ameura missouriensis*, *Ditomopyge decurtata*, *Ditomopyge scitula*, and *Anisopyge whitei.* Restudy indicates that *A. whitei* is a subjective junior synonym of *D. decurtata.* Species of *Ditomopyge* seem to represent end members in a gradational evolutionary series. The earlier species, *D. scitula* (Carboniferous: Pennsylvanian) may have given rise to *D. decurtata* (Permian: Cisurialian) through evolutionary processes.

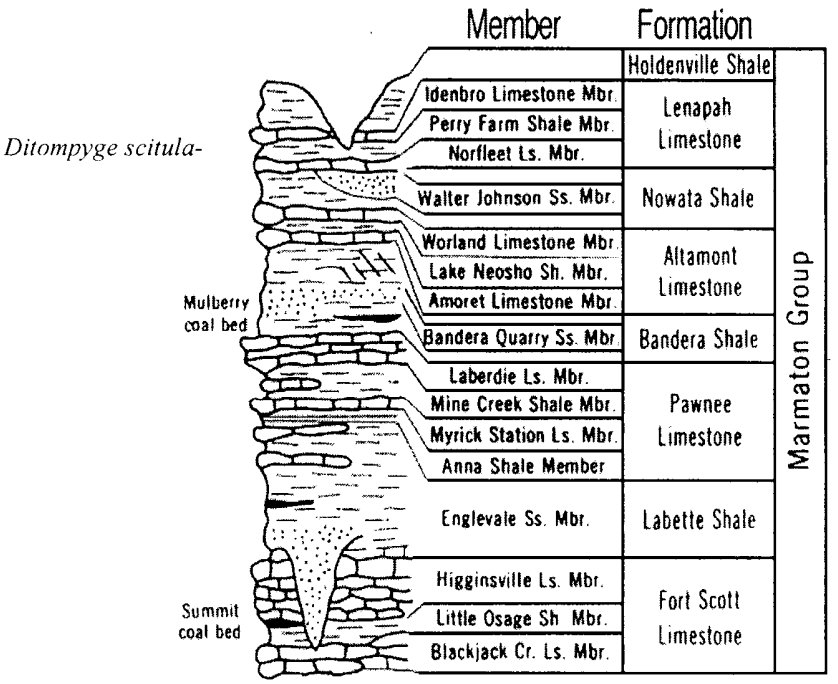
Acknowledgments

My sincerest appreciation and thanks go to Dr. Loren Babcock for his guidance, assistance, and understanding for the completion of this thesis. I would also like to thank all those who collected the specimens used in this study, including Dr. Babcock. For assistance with preparations of the specimen figures used I thank Dr. Babcock for help with the set up and use of equipment, and Brad Walls for assistance on presentation and formatting of the pictures.

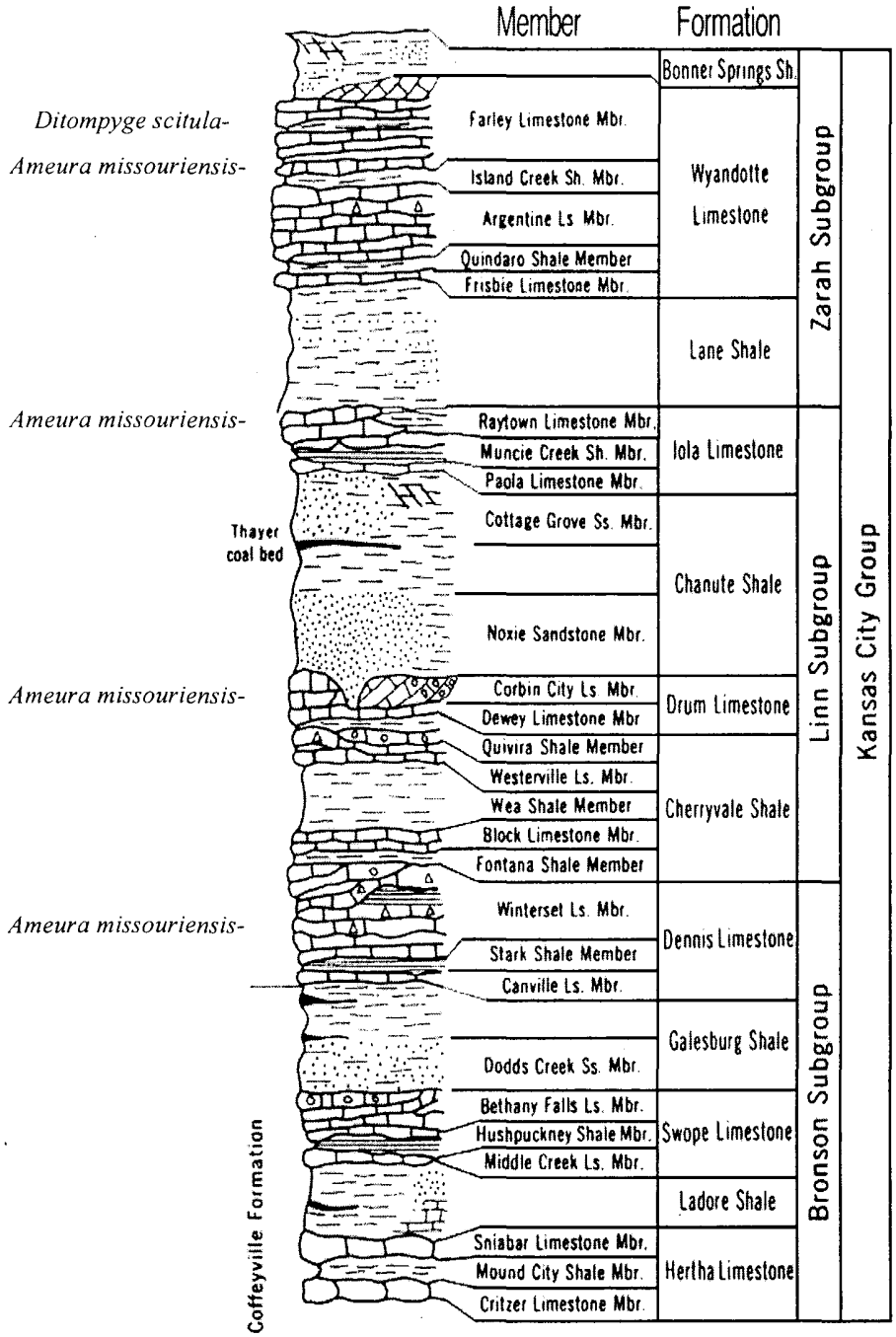
Introduction

The goal of this study is to evaluate and systematically review four species of trilobites from Carboniferous and Permian strata of Kansas and Nebraska. The species of late Paleozoic trilobites examined in this study are: *Ameura missouriensis*, *Ditomopyge decurtata*, *Ditomopyge scitula*, and *Anisopyge whitei*.

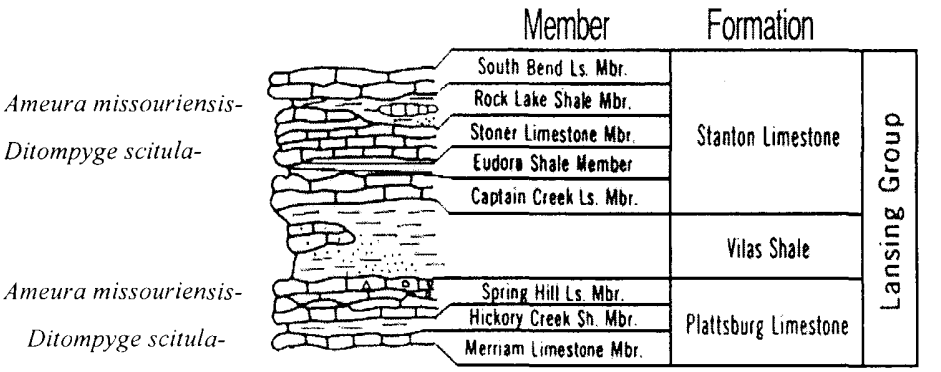
Ameura missouriensis, has the mostly clearly defined and distinguishable features making it the easiest of the four species to identify. Distinguishing *D. decurtata*, *D. scitula,* and *A. whitei* is more complicated. *Ditomopyge scitula* and *D. decurtata* can often be difficult to separate based on morphological characteristics, with variations present often being gradational (Brezinski, 1988), leaving few examples of clearly identifiable specimens. Often the stratigraphic position of specimens has factored into the identification with *D. scitula* occurring in the Carboniferous (Pennsylvanian Series) and *D. decurtata* occurring in the Permian (Cisuralian Series). Temporal end members are distinct enough to recognize separate species (Brezinski, 1988) but it is also possible that the two forms represent a single gradational series. *Ditomopyge scitula* represents the earlier form. *Ditomopyge decurtata* may have evolved from *D. scitula* during the early part of the Permian through phyletic gradualism. The presence of forms transitional between the temporal end members supports this assumption. As described below, *A. whitei* seems to represent a synonym of *D. decurtata*.



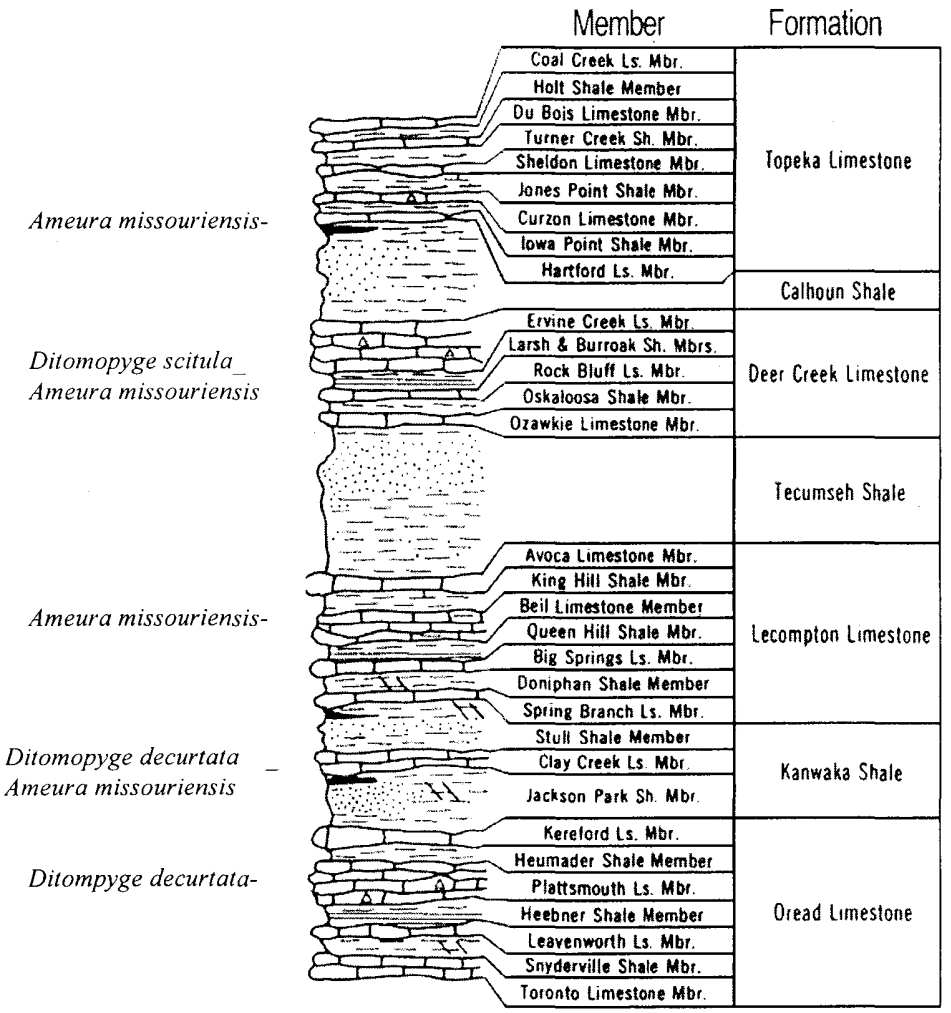
Figures 1. Generalized Marmaton Group (Carboniferous: Pennsylvanian Series) stratigraphy of eastern Kansas showing lithologic units bearing trilobites. From Zeller 1968.



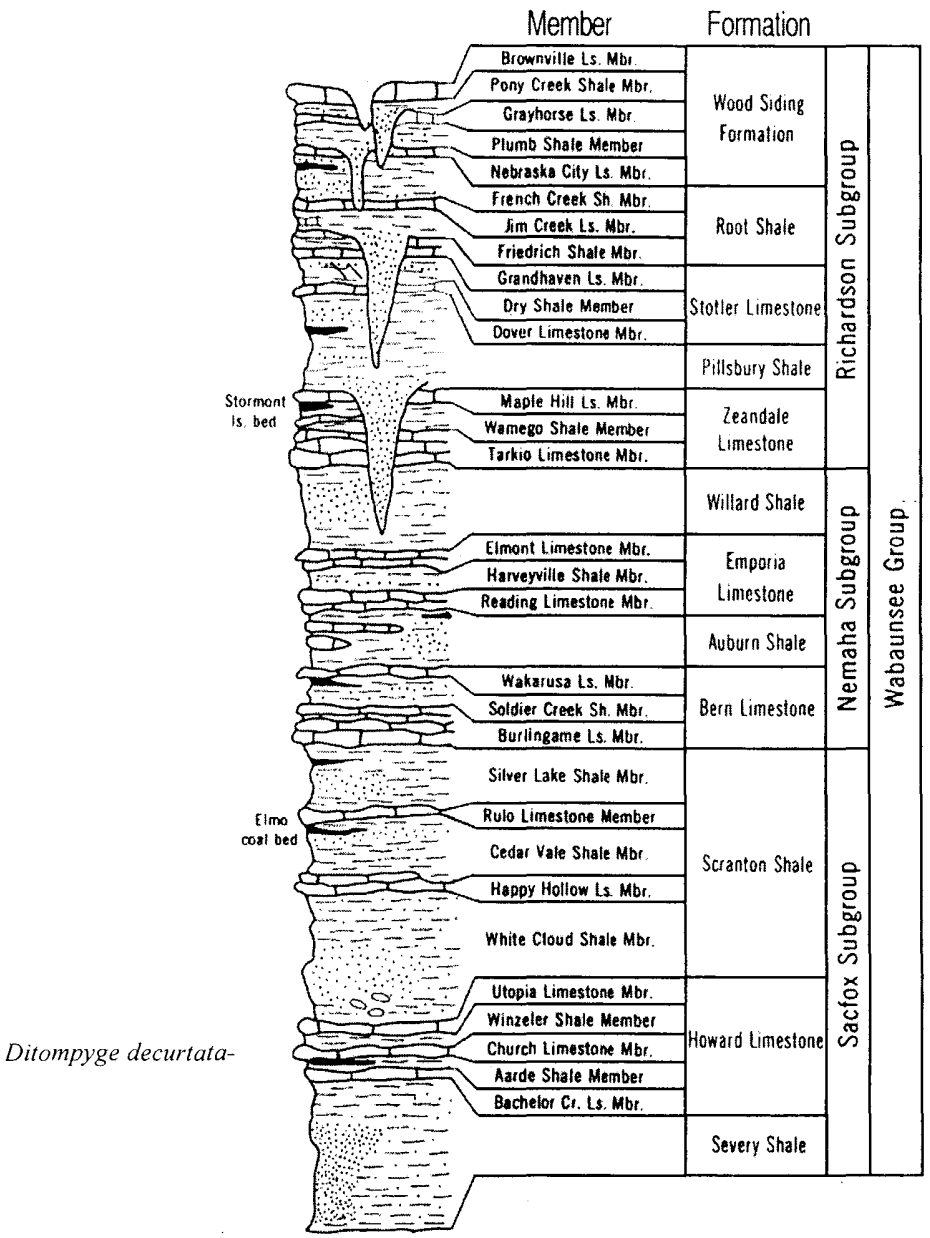
Figures 2. Generalized Kansas City Group (Carboniferous: Pennsylvanian Series) stratigraphy of eastern Kansas showing lithologic units bearing trilobites. From Zeller 1968.



Figures 3. Generalized Lansing Group (Carboniferous: Pennsylvanian Series) stratigraphy of eastern Kansas showing lithologic units bearing trilobites. From Zeller 1968.



Figures 4. Generalized pre-Wabaunsee Group (Carboniferous: Pennsylvanian Series) stratigraphy of eastern Kansas showing lithologic units bearing trilobites. From Zeller 1968.



Figures 5. Generalized Wabaundsee Group (Carboniferous: Pennsylvanian Series) stratigraphy of eastern Kansas showing lithologic units bearing trilobites. From Zeller 1968.

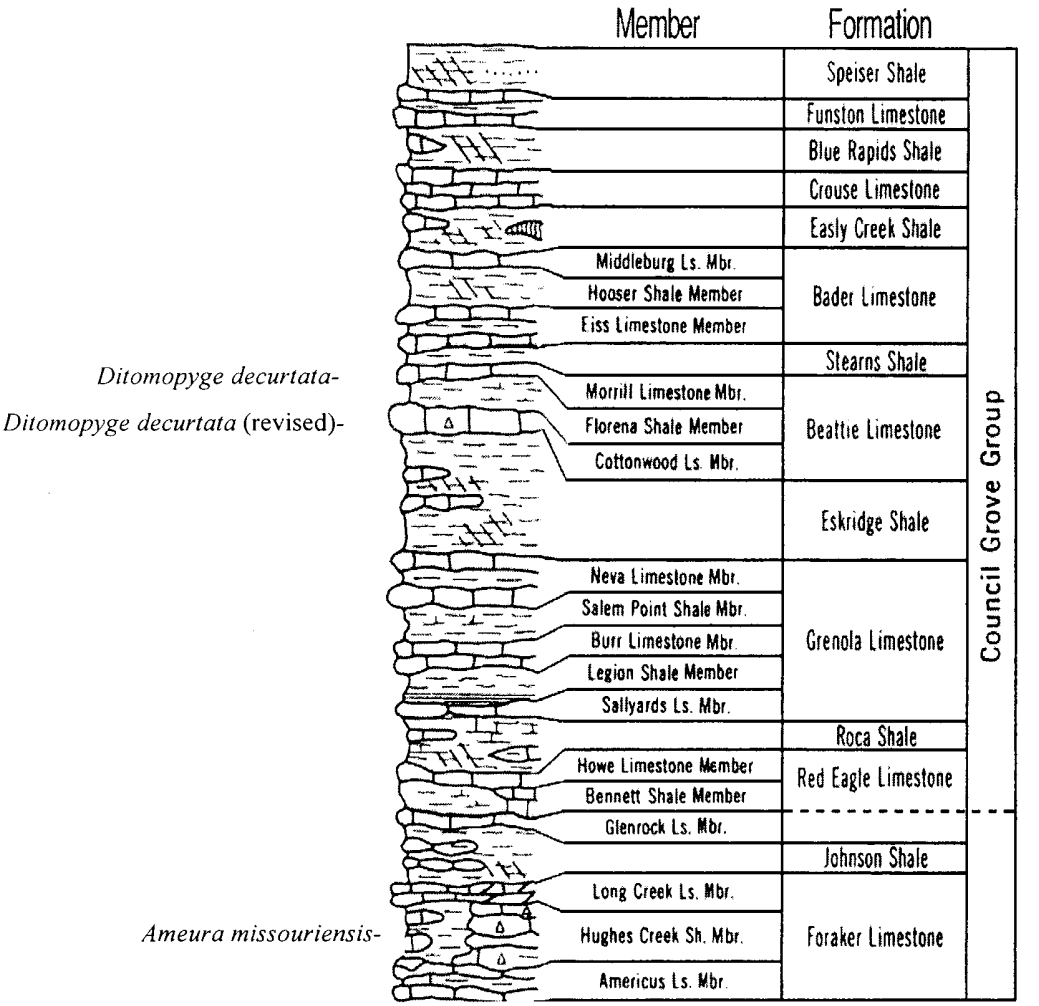


Figure 6. Generalized Permian (Cisuralian) stratigraphy of eastern Kansas showing lithologic units bearing trilobites. From Zeller 1968.

Ameura missouriensis ranges from the Carboniferious (Pennsylvanian Series) to the Permian (Cisuralian Series) It usually occurs in limestone. Specimens referable to *D. decurtata* from the Carboniferious (Pennsylvanian Series) through the Permian (Cisuralian Series). They are mostly in shale units. *Ditomopyge scitula* occurs only in the Carboniferous (Pennsylvanian Series) and is found in shale and limestone units.

Geographic Locations

Trilobite Species	Geographic Localities of Specimens

Ameura missouriensis: Coffey Co. KS, Greenwood Co. KS, Lawrence Co. KS, Lecompton KS, Riley Co. Ks, Sunpy Co NE.

Ditomopyge decurtata: Elk Co. KS, Eudora KS, Greenwood Co. KS, Lecompton KS, Osage Co. KS, Wabaunsa Co. KS, Richardson Co. NE.

Ditomopyge scitula: DeSota KS, Montgomery Co. KS, Cass Co. NE.

Systematic Paleontology

Genus AMEURA Weller, 1936

AMEURA MISSOURIENSIS (Shumard, 1858)

Figure 7

Phillipsia missouriensis Shumard, 1858, p. 225.

Ameura missouriensis Shumard. Chamberlain, 1969, p. 60-62; Pabian and Fagerstrom, 1972, p. 811-813; Brezinski 1988, p. 941 (see for further synonymy).

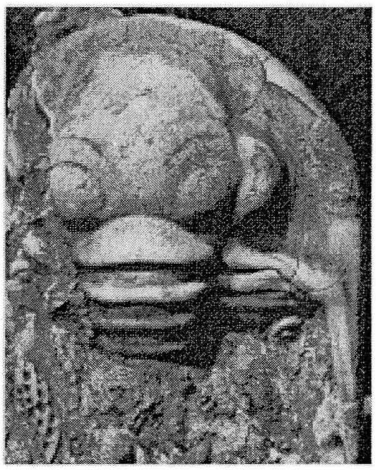
Material.- 33 pygidia, 3 cephalons, 5 free cheeks.

Description.- Chamberlain (1969, p. 60-62).

Remarks. – Specimen proportions are slightly smaller than usual. Free checks and genal spines are slightly shorter, while pygidia are also slightly smaller compared to other described *A. missouriensis* specimens. However these variations fall within the range

described (Chamberlain, 1969). Some specimens show a reduction in the posterior pygidal boarder.

Occurrence.- Clay Creek Limestone Member of the Kanwaka Shale; Curzon Limestone Member of the Topeka Limestone; Drum Limestone; Farley Limestone Member of the Wyandotte Limestone; Raytown Limestone Member of the Iola Limestone; Winterset Limestone Member of the Dennis Limestone; Stoner Limestone Member of the Stanton Limestone; Spring Hill Limestone Member of the Plattsburg Limestone; Deer Creek Limestone; Beil Limestone Member of the Lecompton Limestone.



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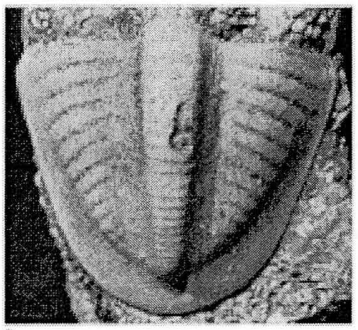

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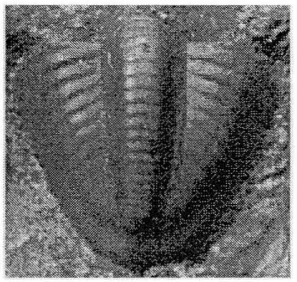

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Figure 7.

Figure 7. *Ameura missouriensis,* from the Carboniferous of Kansas. Specimens are reposited in the University of Kansas Museum of Invertebrate Paleontology (KUMIP).

1. Cephalon and anterior thorax; x2. Curzon Limestone Member of the Topeka Limestone, Coffey County, Kansas; KUMIP_.

2. Complete pygidium x2. Drum Limestone, SW of Coffeyville, Kansas; KUMIP_.

3. Complete pygidium; x2. Clay Creek Limestone Member of the Kanwaka Shale, Greenwood County, Kansas; KUMIP_.

Genus DITOMOPYGE Newell, 1931

DITOMOPYGE DECURTATA (Gheyselinck, 1937)

Figure 8

Phillipsia (Neophillipsia) decurtata Gheyselinck, 1937, p. 56.

Ditomopyge decurtata (Gheyselinck) Weller, 1944, p. 320-321; Shimer and Shrock, 1944, p. 645; Mudge and Yochelson, 1962, p. 96-97; Hahn and Hahn, 1970, p. 175; Owens, 1983, p. 26; Brenzinski, 1988, p. 941-942.

Material.- 122 enrolled specimens, 5 cephalons, 33 pygidia, and 4 free cheeks

Description.- See Brezinksi (1988, p. 941-942).

Remarks. - The studied *Ditomopyge decurtata* specimens cited above are from the following localities; the Kanwaka shale of the Carboniferous Pennsylvannian Series and the Florena Shale Member of the Beattie Limestone (Permian: Cisuralian Series).

Specimens from the Kanwaka Shale are slightly smaller than average. Cephalic proportions in the glabella, preoccipital lobes, and other measurable features are almost identical to those of *Ditomopyge scitula*. The main deviations are a decrease in genal spine length, shorter with a more triangular appearance with the spine reaching the second through third thoracic segments. While being less consistent with *D. scitula*, these lengths are similar to those seen in *Anisopyge whitei*, with genal spines reaching the second through third thoracic segments and showing a triangular appearance. Pygidia are semicircular in appearance, they resemble those of *D. scitula*. Pleural regions show a lack of geniculation seen more predominantly in *D. scitula*, and also have a more uniform

width throughout the length of the pygidium and occur in a ratio of 6 pleural lobes to 10-11 axial lobes. Along the axial profile a subrounded appearance is present.

Specimens from the Florena Shale Member of the Beattie Limestone (Permian: Cisuralian Series) have a relatively large variance in size and measurable features. Many of the specimens are enrolled, accounting for some of the variation. Cephalic proportions in the gaballer region, preoccipital lobes, and other measurable features are almost identical to those of *D. scitula*. Differences are in the length of genal spines, with a relatively shorter length resulting in a more triangular appearance than that of the longer *D. scitula* specimens. Lengths of genal spines range from the second through fourth thoracic segments. While being less consistent with *D. scitula*, these lengths are similar to those seen in the *Anisopyge whitei*, with genal spines reaching the second through third thoracic segments and showing a triangular appearance. A large degree of variation is seen the anterior glabeller borders of the specimens. Narrow to wide anterior borders are not present in *D. scitula*, and are similar to the borders in *A. whitei*.

Pygidia also show a large degree of variation in the *D. decurtata* specimens. The axial profile ranges from subrounded to a slightly longer and less rounded form than those of *D. scitula* (see Brezinski, 1982). Pleural lobes in the pygidium range from seven to eight, and axial rings range from fifteen to sixteen. Pleural regions lack the geniculations of the pleural lobes seen more predominantly in *D. scitula*, and also have a more uniform width along the length of the pygidium. Granules on top of the axial lobes run the length of the pygidium in some specimens. Pygidial shape outline tends to be subrounded to triangular.

The variations seen between the two sets of *D. decurtata* specimens are consistent with findings on other specimens described. The Kanwaka Shale specimens show 10 through 11 to six pygidial lobes and ribs ratio and smaller pygidal sizes similar to those in Appalachian *D. decurtata* specimens (Brezinski. 1988); while the Florena specimen are similar to the Wolfcampian Series specimens of mid continental North America with a ratio of 15 through 16 to eight for lobes to ribs. Explanations of variation include phyletic size increase of holaspid individuals, or ecophenotypic responses (Brezinski, 1988).

Anisopyge whitei and *D. scitula* have been associated together in the past, with *D. scitula* being considered a probable ancestor of Permian *A. whitei* (Pabian and Fagerstrom, 1972). While many morphological characteristics and biometric measurements have been taken to show the similarities between the two, variances where present provide distinction, between the species. *D. scitula* lacks or has a very narrow anterior gabellar lobe, while *A. whitei* has a relatively wide anterior border. Genal spines of *D. scitula* extend to the fourth to fifth thoracic segments, while those of *A. whitei* extend to the second to the third segment. Also *D. scitula* has a larger range of pygidial lobes ranging from 11 to 14 axial and seven to eleven pleural ribs, *A. whitei* shows a similar but more stable count fourteen to fifteen axial and seven to eight pleural ribs, with the pleural ribs showing a more uniform width (Pabian and Fagerstrom, 1972). While these differences are minor they do offer some distinction.

The range of variation in *A. whitei* is entirely consistent with *D. decurtata*. *Ditomopyge decurtata* specimens do have variation in the anterior gabellar lobe. Some specimens have a narrow border, other specimens have anterior borders of comparable in thickness to that of *A. whitei* specimens. Genal spines are also reduced in *D. decurtata*

extending to the second to the fourth thoracic segments, comparable to the second to the third seen in *A. whitei*. *Ditomopyge decurtata* and *A. whitei's* pygidia are comparable both in a subrounded to triangular outline and in counts of axial and pleural lobes and ribs. Based on these similarities and near indistinguishablity it seems likely that the two are actually the same species. *Anisopyge whitei* has been noted to share more characteristics with the genus *Ditomopyge* than *Anisopyge* (Pabian and Fagerstrom, 1972) and upon comparison with *D. decurtata* it seems the two are actually one in the same.

Occurrence.- Clay Creek Limestone Member of the Kanwaka Shale; Florena Shale Member of the Beattie Limestone; Plattsmouth Limestone Member of the Dread Limestone; Church Limestone Member of the Howard Limestone.

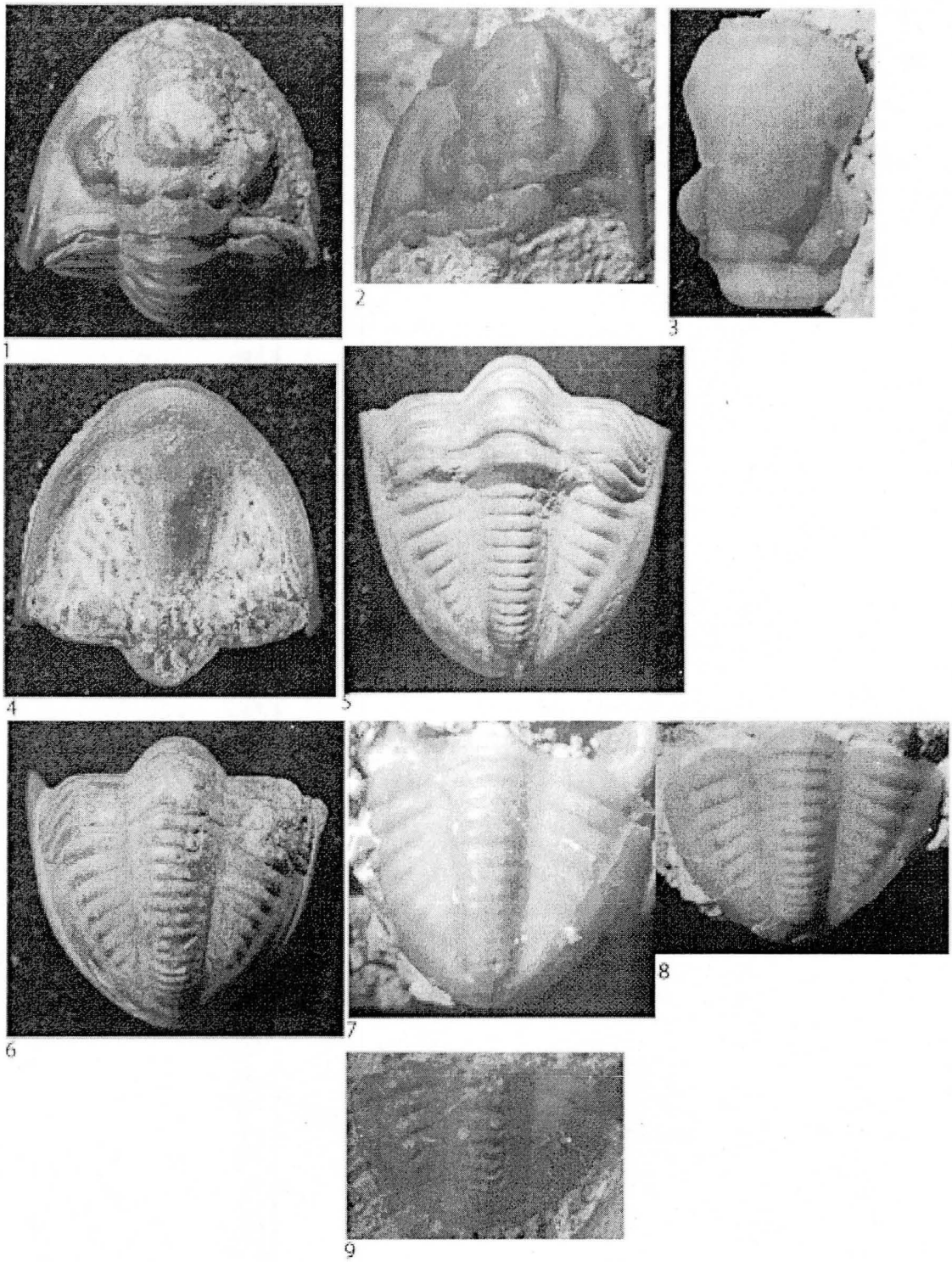

Figure 8.

Figure 8. *Ditomopyge decurtata* from the Permian of Kansas and Nebraska. Specimens in figures 8.2, 8.3, 8.7, and 8.8 were previously referred to as *Anisopyge whitei*; specimen in figure 8.2is the holotype of *A whitei*. Specimens are reposited in the University of Kansas Museum of Invertebrate Paleontology (KUMIP) and the University of Nebraska State Museum (UNSM).

1,4. Dorsal (1), Ventral (4) portion of broken cephlon from an enrolled trilobite; x3. In (4) hypostome is visible with rostral plate. Florena Shale Member of the Beattie Limestone, Grand Summit, Cowley County, Kansas, KUMIP_.

2. Cephalon of revised *D. decurtata;* x3. Damage to upper left of anterior border, slight distortion from burial. Cottonwood Limestone Member of the Beattie Limestone, Richardson Co., Nebraska, UNSM 8092.

3. Gabella of revised *D. decurtata;* x3. Cottonwood Limestone Member of the Beattie Limestone, Richardson Co., Nebraska, UNSM 8094.

5. Pygidium of enrolled specimen; x3. Florena Shale Member of the Beattie Limestone, Grand Summit, Cowley Co. Kansas, KUMIP_.

6. Pygidium of enrolled specimen; x3. Florena Shale Member of the Beattie Limestone, Grand Summit, Cowley Co. Kansas, KUMIP_.

7. Pygidium of revised *D. decurtata;* x3. Cottonwood Limestone Member of the Beattie Limestone, Richardson Co., Nebraska, UNSM 8121.

8. Pygidium of revised *D. decurtata;* x3. Cottonwood Limestone Member of the Beattie Limestone, Richardson Co., Nebraska, UNSM 8113.

9. Pygidium; x4. Clay Creek Limestone Member of the Kanwaka Shale, Greenwood Co., Kansas, KUMIP_.

DITOMOPYGE SCITULA (Meek and Worthen, 1865)

Figure 9

Phillipsia (Griffithides) scitula Meek and Worthen, 1865, p. 270, 271.

Ditomopyge scitula (Meek and Worthen). Brezinski and Stitt, 1982, p. 1242-1248 (see for additional synonymy).

Material.- 5 cephala, 25 pygidia, 9 free cheeks.

Description.- See Brezinski (1988, p. 941).

Remarks.- Genal spines on average are longer and more slender in appearance than in *D. decurtata,* with lengths extending to the fourth and fifth thoracic segments. Other cephalic proportions are almost identical. Slight variation in maximum glabeller width, are present; the border is slightly wider in *D. scitula.*

Occurrence.- Haynies Limestone Member of the Deer Creek Limestone; Perry Farm Shale Member of the Lenapah Limestone; Farley Limestone Member of the Wyandotte Limestone; Stoner Limestone Member of the Starton Limestone; Merriam Limestone Member of the Plattsburg Limestone.

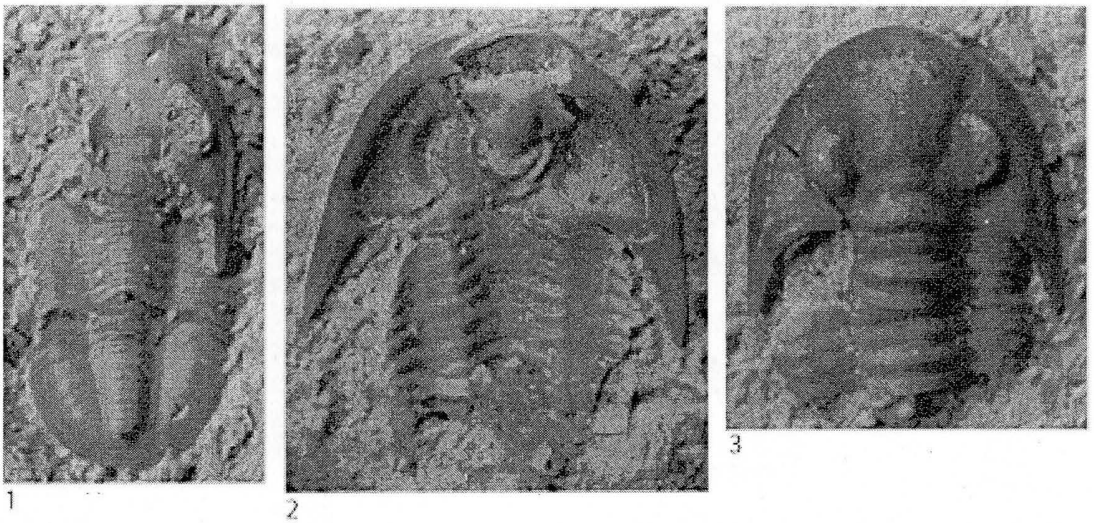

Figure 9.

Figure 9. *Ditomopyge scitula* from the Carboniferous of Nebraska. Specimens are reposited in the University of Nebraska State Museum (UNSM).

1. Complete specimen, damage to left side of cephalon; x3. Haynies Limestone Member of the Deer Creek Limestone, Cass County Nebraska, UNSM 7299.

2. Ventral view of cephalon and thoracic segments, pygidium missing; x3. Haynies Limestone Member of the Deer Creek Limestone, Cass County Nebraska, UNSM 7300.

3. Cephalon and thoracic segments; x3. Haynies Limestone Member of the Deer Creek Limestone, Cass County Nebraska, UNSM 7283.

Graphs

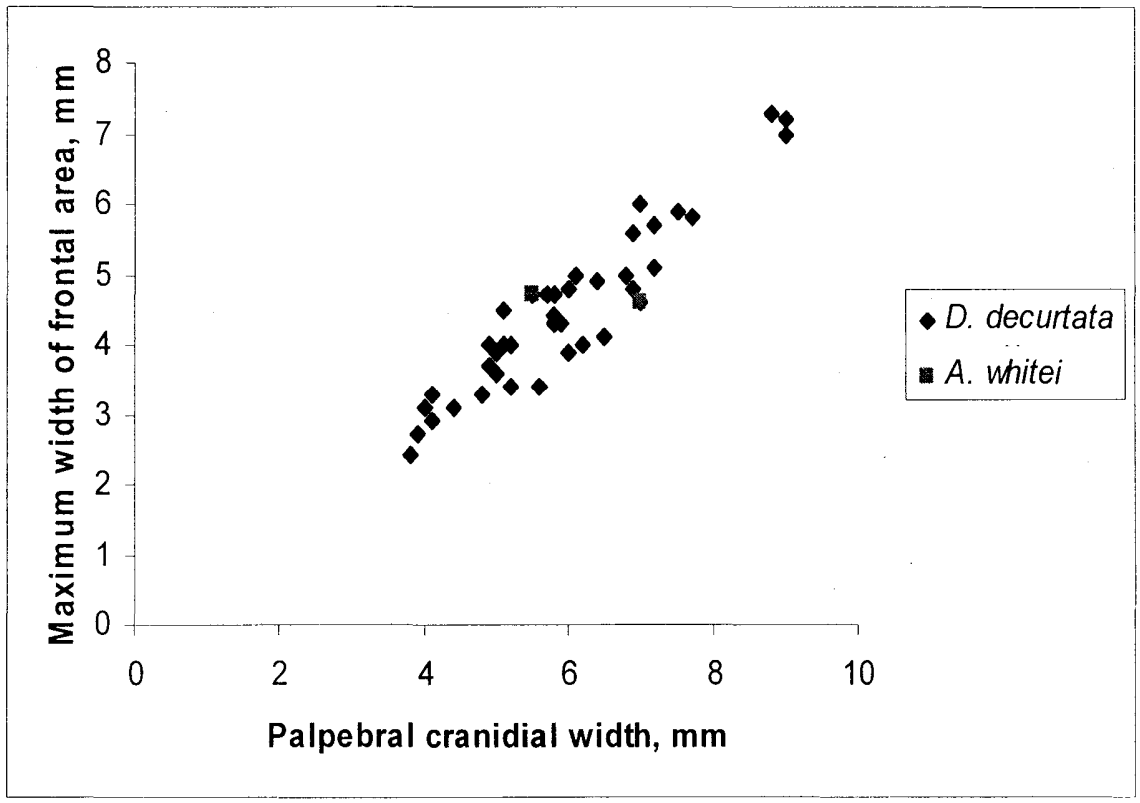

Figure 10. Comparison of cranidal measurements between *D. decurtata* and *A. whitei*.

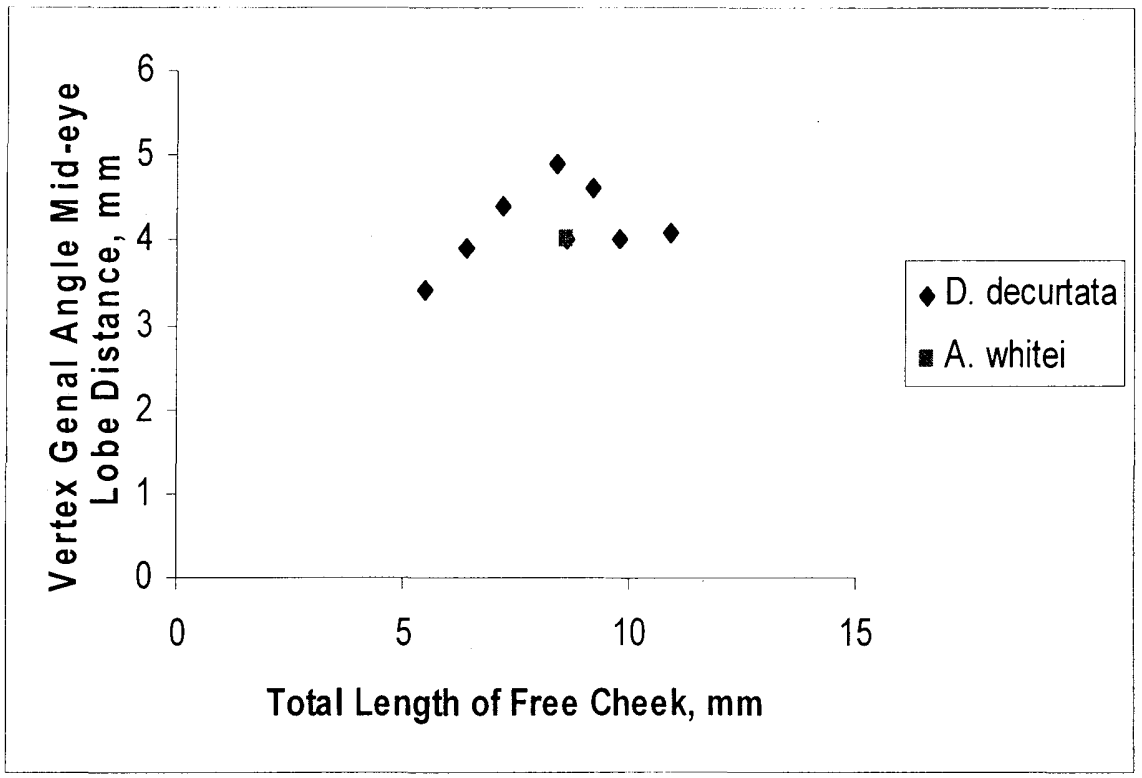

Figure 11. Comparison of measurements of liberigenae between *D. decurtata* and *A. whitei*.

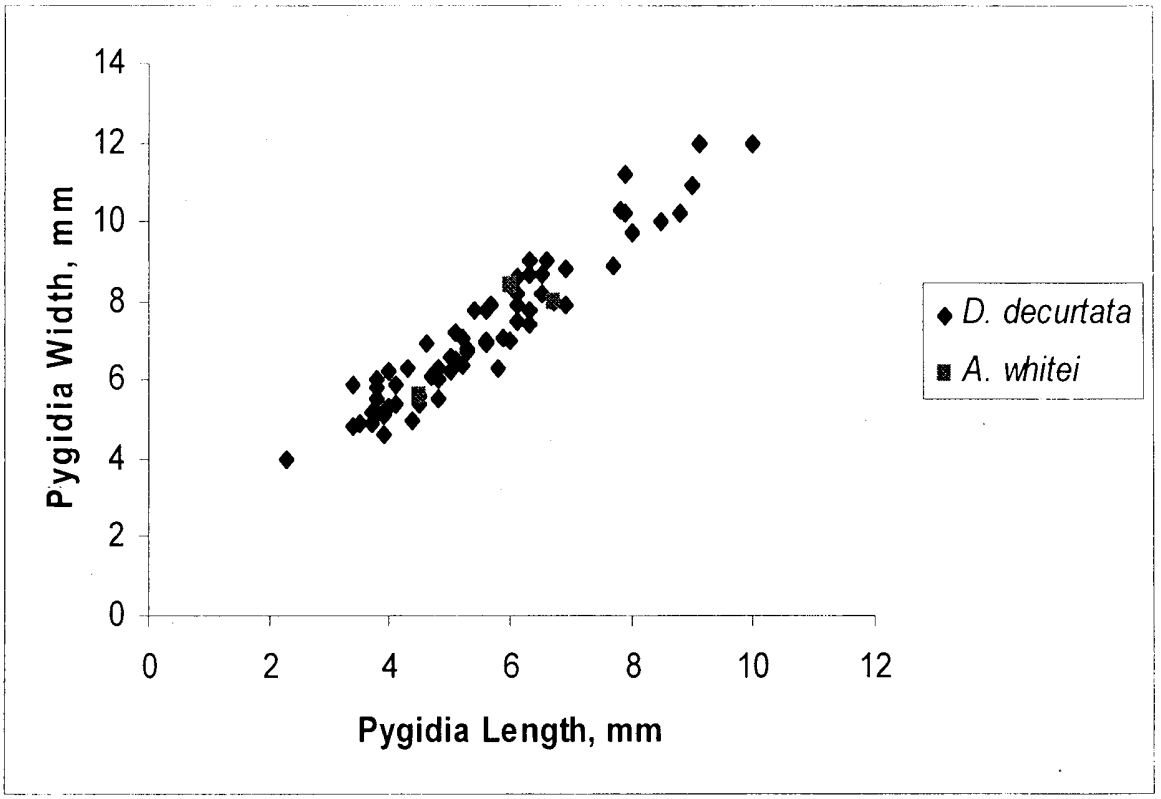

Figure 12. Scatter plot of pygidial length vs. width comparing *D. decurtata* to *A. whitei*.

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