UNIVERSIDAD DE GUADALAJARA

CENTRO UNIVERSITARIO DE CIENCIAS BIOLÓGICAS Y AGROPECUARIAS

DIPLOCENTRUS BICOLOR SP.N. (SCORPIONS DIPLOCENTRIDUE) FROM JALISCO, MÉXICO.

TESIS PARA OBTENER EL GRADO DE

LICENCIADO EN BIOLOGÍA

MODALIDAD DE INVESTIGACIÓN Y ESTUDIOS DE POSGRADO OPCIÓN:

SEMINARIO DE INVESTIGACIÓN

PRESENTA:

GERARDO ADALBERTO CONTRERAS FELIX

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ASESOR:

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GUADALAJARA, JALISCO. SEPTIEMBRE 2011

Universidad de Guadalajara

Centro Universitario de Ciencias Biológicas y Agropecuarias

Coordinación de Carrera de la Licenciatura en Biología

COORD-BIO-159/2011

C. GERARDO ADALBERTO CONTRERAS FÉLIX
PRESENTE

Manifestamos a usted, que con esta fecha, ha sido aprobado su tema de titulación en la modalidad de INVESTIGACIÓN Y ESTUDIOS DE POSGRADO opción: Seminario de Investigación con el título: "DIPLOCENTRUS BICOLOR SP. N. (*Scorpiones: Diplocentridae)* FROM JALISCO, MEXICO", para obtener la Licenciatura en Biología.

Al mismo tiempo le informamos, que ha sido aceptado como director de dicho trabajo al Dr. JOSÉ LUIS NAVARRETE HEREDIA, y como asesor M.C. Carlos Eduardo Santibáñez López.

Sin más por el momento, aprovechamos para enviarle un cordial saludo.

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Por medio de la presente comunicamos a usted que ha sido designado como SINODAL, para el trabajo titulación: "*Diplocentrus bicolor sp. N. (Scorpiones: Diplocentridae from Jalisco, Mexico*", elaborado por el alumno(a) GERARDO ADALBERTO CONTRERAS FÉLIX con la modalidad: Investigación y Estudios de Posgrado opción: Seminario de Investigación

Recuerde que como sinodal, se espera de usted aportaciones para mejorar el trabajo y le corresponde a usted evaluar y en su caso aprobar el presente proyecto, para lo cual le suplicamos no exceder de 8 días hábiles.

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Dra. Teresa de Jesús Aceves Esquivias.
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Licenciatura en Biología.
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Presente

Nos permitimos informar a usted que habiendo revisado el trabajo de titulación, modalidad INVESTIGACIÓN Y ESTUDIOS DE POSGRADO, opción SEMINARIO DE INVESTIGACIÓN con el título: "***Diplocentrus bicolor* sp. n. (Scorpiones: Diplocentridae) from Jalisco, Mexico**" que realizó el/la pasante Gerardo Adalberto Contreras Félix con número de código 302096897 consideramos que ha quedado debidamente concluido, por lo que ponemos a su consideración el escrito final para autorizar su impresión.

Sin otro particular quedamos de usted con un cordial saludo.

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Guadalajara, Jalisco a 1 de septiembre de 2011

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López
Director del trabajo

firma
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Diplocentrus bicolor sp. n. (Scorpiones: Diplocentridae) from Jalisco, Mexico

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Abstract

Diplocentrus bicolor **sp. n.** from Huejuquilla el Alto, in northern Jalisco and two nearby localities in Zacatecas is described. It is compared to its geographically closer species from Zacatecas, Aguascalientes and Nayarit. A map with its known distribution is provided.

Key words: scorpion, Diplocentridae, *Diplocentrus bicolor*, new species, Mexico, Jalisco

Introduction

The genus *Diplocentrus* Peters, 1861 holds the highest diversity within the family Diplocentridae with 51 species (Santibáñez-López & Francke, 2008; Santibáñez-López *et al.*, 2011). Its distribution ranges from the southern states of the USA to northern Honduras (Sissom & Fet, 2000; Francke & Ponce-Saavedra, 2005). It is, however, poorly sampled in the Mexican state of Jalisco where only one species had been reported previously near the border with Nayarit (*D. gertschi* Sissom & Walker, 1992). Despite the recent taxonomic work on the genus (Francke & Ponce-Saavedra, 2005; Francke, 2007; Santibáñez-López & Francke, 2008; Francke & Quijano-Ravell, 2009; Santibáñez-López *et al.*, 2011) the knowledge of the genus in Mexico is incomplete. The present contribution provides the description of the second species of the genus *Diplocentrus* known from Jalisco and adjacent southern Zacatecas.

Material and methods

Nomenclature and mensuration follows Stahnke (1970), except for trichobothrial terminology after Vachon (1974), metasomal and pedipalpal carinal terminology after Francke (1977). Surfaces of the pedipalp, carapace, mesosoma and metasoma were observed as in Santibáñez-López & Sissom (2010). Higher level taxonomy of scorpions follows Coddington *et al.* (2004) and Prendini & Wheeler (2005). Photography of the female and male carapace, pedipalp femur, patella and chela under black light follows Prendini (2003) and Volschenk (2005). Measurements were taken with an ocular micrometer calibrated at 10X and are given in millimeters. Abbreviations for depositories: AMNH—American Museum of Natural History, New York. CNAN-Colección Nacional de Arácnidos, Instituto de Biología, Universidad Nacional Autónoma de México, México D.F. México.

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Taxonomy

Family DIPLOCENTRIDAE

Genus *Diplocentrus*

***Diplocentrus bicolor* sp. n.**
(Figures 1–10)

Etymology. The specific epithet refers to the contrasting coloration of the darker body with the legs considerably lighter in color; and it is used as a noun in apposition.

Types. Jalisco: Municipio Huejuquilla el Alto: El Vallecito 15 km from Huejuquilla el Alto along the road to San Juan Capistrano (N 22º 40.27', W 103º 57.63', 1233 m) 6.vii.2005. O. Francke, J. Ponce, M. Córdova, A. Jaimes, G. Francke & V. Capovilla. 1 ♂ (CNAN-T0683).

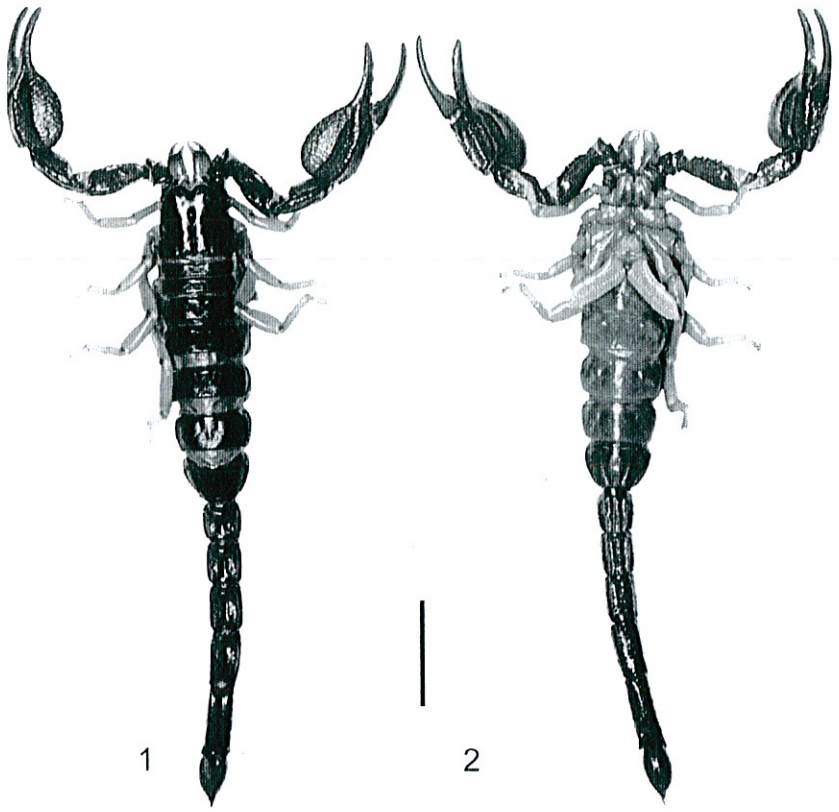
Paratypes: **Jalisco:** Municipio Huejuquilla el Alto: El Vallecito 15 km from Huejuquilla el Alto along the road to San Juan Capistrano (N 22º 40.27', W 103º 57.63', 1233 m) 6.vii.2005. O. Francke, J. Ponce, M. Córdova, A. Jaimes, G. Francke & V. Capovilla. 1 ♂, 2 ♀ (CNAN-T0684). **Jalisco:** Municipio Mezquitic: Carretera a Mezquitic between Mezquitic and Ojuelos (N 22º 21.601', W 103º 38.622', 2089 m) 7.vii.2005. O. Francke, J. Ponce, M. Córdova, A. Jaimes, G. Francke & V. Capovilla. 2 ♂ (AMNH). **Jalisco:** Municipio Huejuquilla el Alto: El Vallecito 18 km from Huejuquilla el Alto along road to San Juan Capistrano (N 22º 40.277', W 103º 57.638' 1233 m) 6.vii.2005. . O. Francke, J. Ponce, M. Córdova, A. Jaimes, G. Francke & V. Capovilla. 1 ♀ (CNAN-T0684).

Other specimens examined: Jalisco: Municipio Huejuquilla el Alto: El Vallecito 15 km from Huejuquilla el alto along the road to San Juan Capistrano (N 22º 40.27', W 103º 57.63', 1233 m) 6.vii.2005. O. Francke, J. Ponce, M. Córdova, A. Jaimes, G. Francke & V. Capovilla. 4 ♂ (CNAN- S03083); 3 ♂ (AMNH). **Jalisco:** Municipio Mezquitic: Carretera a Mezquitic betwen Mezquitic and Ojuelos (N 22º 21.601', W 103º 38.62' 2089 m) 7.vii.2005. O. Francke, J. Ponce, M. Córdova, A. Jaimes, G. Francke & V. Capovilla. 4 ♂ (CNAN-S03049). 3 ♀ (CNAN-S03050) 5 ♂ and 4 ♀ (AMNH). **Jalisco:** Municipio Mezquitic: 4 km to North from Mezquitic (N 22º 24.732', W 103º43.222', 1388 m) 7.vii.2005 . O. Francke, J. Ponce, M. Córdova, A. Jaimes, G. Francke & V. Capovilla. 2 ♂ (CNAN-S03084) 1 ♂ 1 ♀ (AMNH). **Zacatecas:** Municipio Valparaiso: 4.1 km north from San Juan Capistrano (N 22º 40' 44", W 104º 06'22", 1169 m) without date. Unknown colector. 1 ♂ (CNAN-S03029). **Zacatecas:** Municipio Valparaiso: Deviation to Los Tanques (N 22º 40' 14", W 104º 02' 32", 1099 m) 19.ix.2001. E. Gonzalez. 4 ♂, 1 ♀ (CNAN-S03030).

Distribution. Known from two localities, 3 km from each other, in northern Jalisco and from another two in southern Zacatecas (Fig. 11).

Diagnosis. Adults 60 to 70 mm long. Brownish to dark red, legs pale yellow to cream, contrasting sharply with the rest of the body. Frontal notch in anterior margin of carapace "U" shaped, notch moderately deep shagreened. Pedipalp femur orthobothriotaxic, wider than deep, dorsal surface flat, weakly to sparsely granulose. Pedipalp patella orthobothriotaxic; dorsal external carina weak to moderate, smooth in males; ventral submedian carina weak to faint, smooth. Chela orthobothriotaxic; digital carina strong, smooth ending at the base of the fixed finger in males; dorsal surface slightly reticulate to smooth; pedipalp carination weaker and smoother in females. Telotarsal formula 5–6/6–7: 6/7: 7/8: 7/8. Pectinal tooth count on males (n=29) 17–19 (mode= 18); on females (n=10) 14–16 (mode= 15).

Diplocentrus bicolor **sp. n.** is similar to *D. poncei* Francke & Quijano-Revel, 2009 in overall size; the frontal notch of the carapace is "U" shaped in both species; the femur is wider than deep in both species and the dorsal surface flat, and both are similar in pectinal tooth counts. It is geographically closest westward to *D. gertschi* from Nayarit (Sissom & Walker, 1992), sharing a similar telotarsal formula (on the last leg 7/8), the dorsal surface of pedipalp wider than deep, and the pedipalp patella dorsal external carina weak to moderate and smooth in males; it is also closest geographically to the north and the east to *D. zacatecanus* Hoffmann,1932, from Zacatecas, San Luis Potosí, Querétaro, Michoacán, Hidalgo, Guanajuato, Estado de México, Durango y Aguascalientes (Ponce-Saavedra *et al.*, 2009) sharing similar femur dorsal surface shape and similar carination development in the pedipalp patella. *D. bicolor* **sp. n.** can be clearly distinguished from *D. poncei* by the orthobothriotaxic condition on the pedipalp patella and chela (*D. poncei* is neobothriotaxic on both); by a higher telotarsal formula (5/7 5/7 on the last two legs in *D. poncei* whereas on *D. bicolor* **sp.n.** they are 7/8:7/8).Digital carina in the pedipalp chela in males



FIGURES 1–2. Habitus of holotype male. 1. Dorsal view. 2. Ventral view. Scale bar= 10 mm.

of *D. poncei* is faint to obsolete whereas in males of *D. bicolor* **sp. n.** is strong. The legs of *D. poncei* do not contrast in color with the rest of the body as in *D. bicolor.* **sp. n.** It can be distinguished from *D. gertschi* by its higher pectinal tooth count in males (17 to 19 vs 13 to 15 in *D. gertschi*). The frontal notch of the carapace in *D. gertschi* is "V" shaped whereas in *D. bicolor* **sp. n.** is "U" shaped. Surfaces on the pedipalp patella of *D. gertschi* are finely granular and punctate (this condition is present in the species of the genus *Didymocentrus*, some species of the genus *Bioculus* and has been reported only in another three species in the genus *Diplocentrus*, Sissom & Walker, 1992; Armas & Martín-Frías, 2004; Armas *et al.*, 2004; Santibañez-López, pers. obs.) whereas in *D. bicolor* **sp. n.** they are shagreened to granular, without punctation; and *D. gertschi* (adults: 45 to 52 mm) is smaller than *D. bicolor* **sp. n.** It can be distinguished from *D. zacatecanus* by a higher telotarsal formula (7/8 7/8 on the last two legs, whereas on *D. zacatecanus* they are 6/7 7/7), and a higher pectinal tooth count in males (17 to 19 with a mode of 18, whereas on *D. zacatecanus*, it is 12 to 16 with a mode of 13), and in females (15 to 16, with a mode of 14 whereas on *D. zacatecanus*, it is 8–14 with a mode of 11 to 12). The frontal notch of the carapace in *D. zacatecanus* is "V" shaped whereas in *D. bicolor* **sp. n.** is "U" shaped.

Description of the holotype male (Figs. 1–2): **Prosoma.** Carapace reddish brown to dark red, shagreened to sparsely and minutely granular. Frontal notch of carapace "U" shaped, deep, slightly granular and setose; three pairs of lateral eyes subequal in size (Fig. 3). Carapace smooth to minutely granular.

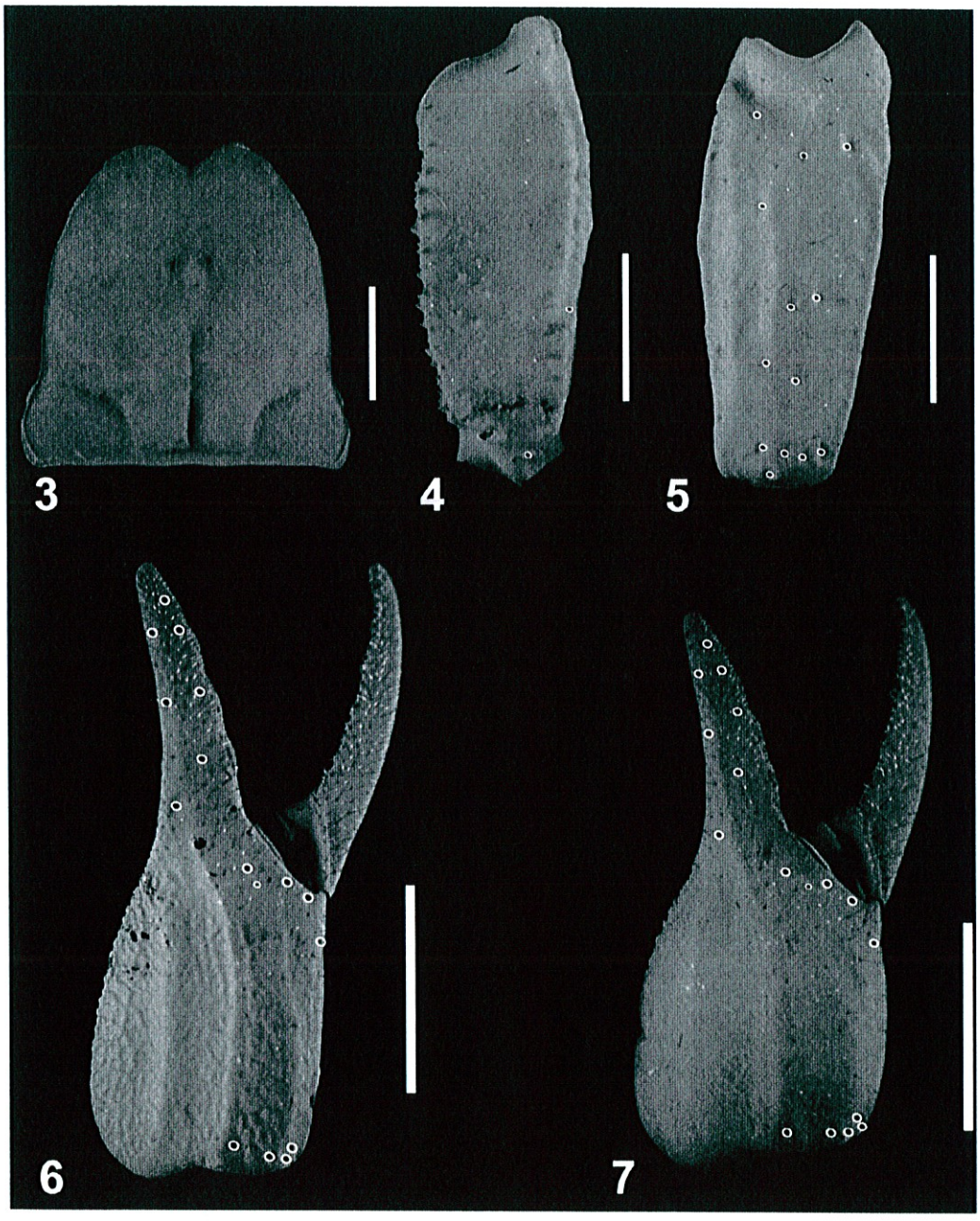
Mesosoma. Tergites reddish brown with fusco-piceus pattern (Darker in female). Tergites I–VI surface shagreened to weakly granular towards anterior margin. Tergite VII shagreened towards the anterior margin and minutely granular towards the posterior margin. Tergite VII presents weak lateral carinae. Pectinal tooth count 17–16 (female with 14–15).

Metasoma. Dark red to reddish brown. Ventral submedian carinae: weak, slightly crenulate on segments I–II; weak to vestigial on segments III–IV. Ventral lateral carinae: strong, smooth and pale on segments I–II; strong, granular and darker on segments III–IV. Lateral inframedian carinae: with a few big conical granules on segments I–II; weak to vestigial on segments III–IV. Lateral supramedian carinae: strong, smooth on segment I; moderate, granular on segments II–IV. Dorsolateral carinae: strong, crenulate on segments I–IV. Segment V slightly longer than pedipalp femur or patella (ratio: 0.97); ventral median and ventral lateral carinae strongly granular with large

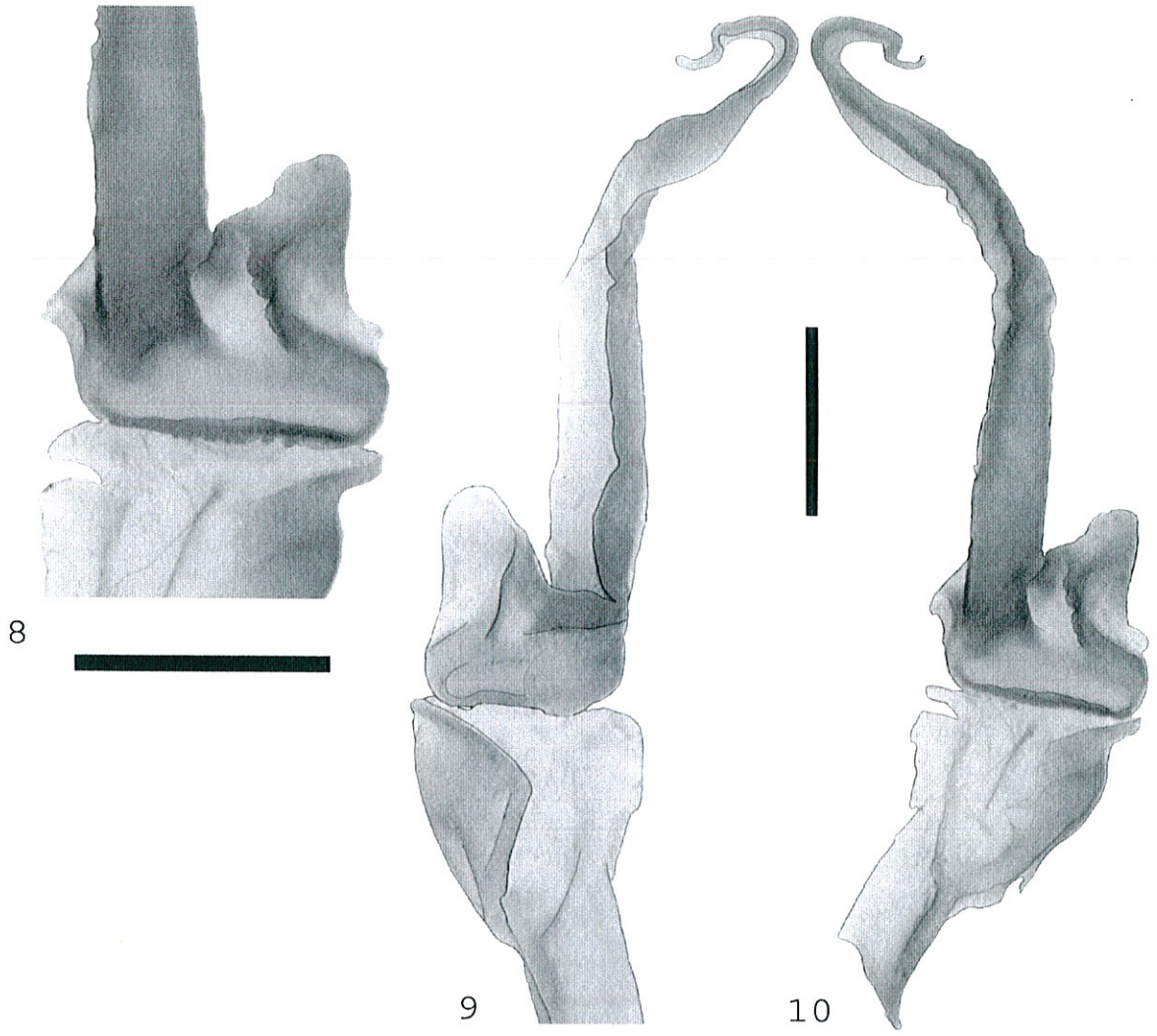
subconical granules; ventral transverse carinae with 5 subconical granules and 5 large dark granules on the posterior end of the segment; dorsolateral carinae weak, smooth to slightly granular (Carinae stronger in female and more granular).

Telson. Reddish brown to dark red (Paler in female), smooth with scattered granules at the base of the vesicle; densely setose ventrally (lenght/width, ratio 0.29).

Pedipalp. Reddish brown to dark red, with carinae darker. Orthobothriotaxic type "C" pattern typical for the genus (Francke, 1977). Femur wider than deep (ratio 0.93) (Fig. 4). Dorsal internal carina strong, granular, becoming obsolete towards posteriorly. Ventral external carina only present basally, weakly granular. Dorsal surface flat with few, small, sparse granules on median portion. Ventral surface flat, shagreened. Internal surface granular with large dark granules.



FIGURES 3-7. *Diplocentrus bicolor* sp. n. 3. Carapace of holotype male. 4. Pedipalp femur, dorsal view. 5. Pedipalp patella, external view. 6. Pedipalp chela, holotype male, dorsal external view. 7. Pedipalp chela, paratype female, dorsal external view. Scale bars= 3 mm.



FIGURES 8–10. Paratype male hemispermatophore. 8. Ental view. 9. Dorsal view. Scale bars= 3 mm. 10. Detail of the capsular region. Scale bar= 1 mm.

Patella (Fig. 5): Dorsal internal carina weak to obsolete, with few large granules, one larger than the others. Dorsal medial carina strong, smooth. Dorsal external carina weak to moderate, smooth. Ventral external carina weak, smooth. Ventral medial carina weak to vestigial, smooth. Ventral internal carina strong, granular. Dorsal, external and ventral faces shagreened; internal surface granular.

Chela (Fig 6): Dorsal marginal carina strong, granular. Dorsal secondary carina weak, smooth. Digital carina strong, smooth. External secondary carina weak to moderate, smooth. Ventral external carina originating at the base of the fixed finger and becoming obsolete basally towards the middle portion. Ventral medial carina strong, smooth. Ventral internal carina originating at the base of the fixed finger, weak, smooth. Fixed finger: dorsal surface basally smooth, densely setose, internal surface moderately concave and external surface slightly convex.

Hemispermatophore: 6.9 mm in total length, lamellate, distal lamella 4.4 mm long. Capsular region 1.2 mm wide. Opercular "hook" narrow, without spines (Figs. 8–10).

Intraspecific variation. *Diplocentrus bicolor* **sp. n.** shows sexual dimorphism: females are darker than males, and the pedipalp chela carinae are more strongly developed in males than in females. Pectinal tooth count variation is as follow: in males (n=29): 6 combs with 14, 2 with 15, 13 with 16, 13 with 17, 14 with 18, 8 with 19 and 2 with 20 teeth; in females (n=10): 1 comb with 12, 7 with 14, 7 with 15 and 5 with 16 teeth.

Legs. Pale brown to yellow, smooth .Telotarsal formula: 6/7 6/7: 6/7 7/8: 7/8 7/8: 7/8 8/8.

TABLE 1. Measurements in millimeters of the holotype male and the paratype female two additional adult males and two adult females of *Diplocentrus bicolor* **sp. n.**

	Holotype	Paratype	male	female	male	female
Total length	75.3	74.7	59.2	65.4	58	62.8
Carapace length	8.1	10	7.5	9.1	7.9	8.6
Mesosoma length	29.8	23.9	17.4	21.9	17.3	21.9
Metasoma length	43.3	41.7	34.3	34.4	32.8	32.3
Telson length	8.4	8.9	7	8.1	6.7	76
Vesicle length	7	7.4	6	70	5.7	64
Vesicle width	3.5	3.8	2.8	36	3.3	3.8
Femur length	9.5	9.4	7.5	8.3	7.8	7.4
Width	3	3.9	3.4	3.5	3	3.3
Depth	2.8	2.7	2.3	2.2	2.2	2.5
Patella length	9	8.2	7.5	7.8	7	7.7
Width	3.5	4	3	36	3	3.1
Chela length	17.7	18	16.5	20.4	16.8	16.2
Width	4.6	6.7	4	5.1	4.8	4.6
Depth	6.7	8.9	7	8.4	7.6	7.6
Movable finger length	11.4	10.8	7.4	8	9.6	9.1
Fixed finger length	8.7	8.6	9.5	10	7.8	6.9
Chelicera length	2.9	3.4	3	3.2	3	3
Width	1.9	2.4	1.9	2	2	2.1
Movable finger length	1.7	2.5	1.7	1.9	2	1.8
Fixed finger length	1.4	1.5	1.5	1.4	15	1.3
Pectinal tooth count	18-16	15-14	17-16	16-16	18-19	15-14

Telotarsal spiniform setae count variation as is show in table2 (n=39):

TABLE 2. Telotarsal spiniform setae count:

Leg #\# of Setae	3	4	5	6	7	8	9	Missing
1 prolateral	1		42	31				1
1 retrolateral			1	34	40	2		1
2 prolateral			4	58	14			2
2 retrolateral				5	50	21		2
3 prolateral			1	10	63	4		
3 retrolateral	1			1	19	55	2	
4 prolateral			1	5	59	9		4
4 retrolateral		1	15			50	8	4

Therefore, the modal formula for the species is 5/7:6/7:7/8:7/8.

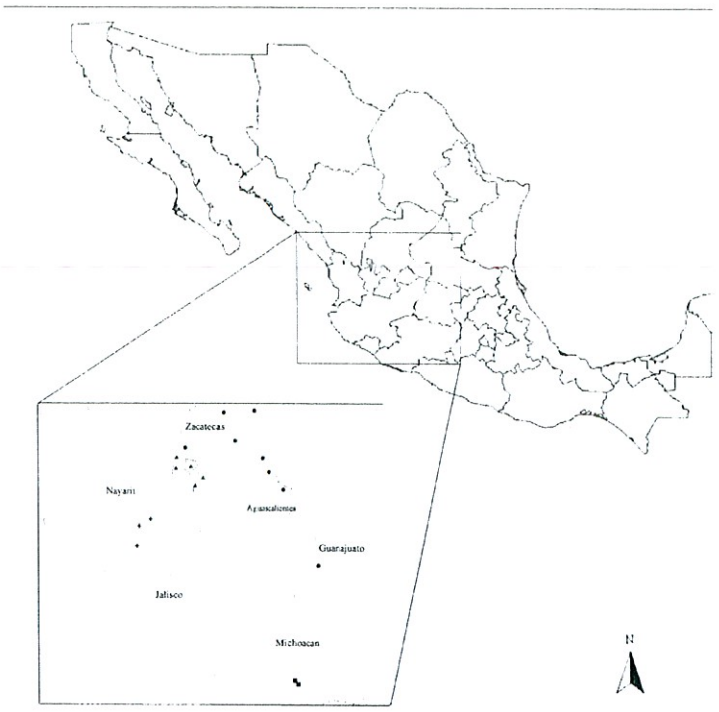


FIGURE 11. Known distribution of *Diplocentrus* species in western México. Legend: Black circle= *D. zacatecanus*, black cross = *D. gertchi*, black square = *D. poncei*, black triangle = *D. bicolor* **sp. n.**

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