Cyprinella alvarezdehollari, a New Cyprinid Fish from Río Nazas of México, with a Key to the Lepida Clade

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Cyprinella alvarezdehollari is a new species of cyprinid fish described from Arroyo del Peñón de Covadonga headwaters (Balneario La Concha springs to 8 km downstream), Río Nazas, Durango, México. It is a dwarfed member of the lepida species group, differing from all others by the following characteristics: eye diameter larger than length of snout; heavy tuberculation over most of body and fins in breeding males, especially chin and center of dorsal area of pectoral fin; small spines on lips, on uppermost peduncle scale row, and over entire lachrymal; breast naked; a short vomer; lateral dark band as wide as eye or wider, most noticeable at midbody. Breeding males golden to reddish bronze on body, brighter on cheek and opercular area, with white borders on anal and paired fins; and a black overcast at peak breeding colors, caused by appearance of sparse large melanophores. Comments are presented on other members of the group, and a key is provided for their identification.

Cyprinella alvarezdehollari n. sp. de pez ciprínido, se describe del Arroyo del Peñón de Covadonga (Ojo del Balneario La Concha, a 8 km río abajo), en el Río Nazas de Durango, México. Es un miembro enanizado del grupo de especies lepida; difiere de todos ellos por tener: ojo mayor que el rostro; tuberculación fuerte en todo el cuerpo y aletas, especialmente el centro dorsal de la aleta pectoral, mentón, y espinolas en los labios; vomer corto; su estola es igual o más ancha que el ojo, sobre todo al centro del cuerpo; espinolas en la hílera superior de escamas del pedúnculo, así como en todo el lacrimal; pecho sin escamas; machos maduros dorado a bronce rojizos, más brillante en la mejilla y área opercular; bordes blancos en aletas pares y anal; machos negruzcos conforme al grado de madurez por la aparición de grandes melanóforos dispersos. Se presentan comentarios sobre otras especies del grupo con una clave para identificación de sus especies.

The cyprinid fishes of North America are a complex group with poorly defined genera. This is reflected in the speciose group formerly recognized as Notropis. This group has been repeatedly split and merged into several subgroups, often considered genera or subgenera (reviewed by Mayden, 1989); we follow him and Matthews (1987) in recognizing Cyprinella as distinct genus. One of its subgroups, the lepida species group of Mayden (1989), is composed of C. lepida Girard (1857) from the Edwards Plateau of Texas, and five Río Grande basin forms: C. rutilla (Girard, 1857) from Río San Juan; C. prosperpina (Girard, 1857) from Río Pecos and NE Coahuila; C. xanthica (Minckley and Lytle, 1969), from the Cuatro Ciénebas basin; C. paucipunctata (Hubbs and Miller, 1978) from Río Conchos, and an undescribed form from the Río Salado (Hubbs and Miller, 1978). All are strictly allopatric, occupying discrete sub-basins of the Río Grande, except C. lepida. The Plio-Pleistocene Río Grande included several now isolated interior basin complexes, such as Laguna de Guzmán and Laguna de Mayrán (Meck, 1903, 1904; Farrington, 1904). This whole system is inhabited by the same or closely related fish groups (Meck, 1904), collectively named the Río Grande fish fauna (Smith and Miller, 1986). Hence, it was a welcome surprise to collect a new and distinctive species of the lepida species group in the Río Nazas-Laguna de Mayrán basin. It is outstanding in that it inhabits a relatively well-explored area of northern México, known to one of us (SCB) since 1963. Once the new species was recognized, we found a few young specimens confused with Codoma ornata or Cyprinella garmani, in several former collections dating back to 1952 (one specimen) and 1968, always very scarce. This species provides further evidence that a portion of the Río Nazas basin fauna has been derived from Río Grande fish fauna.

Methods
Counts and measurements are as described by Hubbs and Lagler (1964), except the following: scales around body and caudal peduncle,
taken as indicated in Chernoff and Miller (1982); predorsal scales were counted as rows crossing a line from the upper insertion of the gill cover to the dorsal-fin origin, not including single scales (Contreras-Balderas, 1975). In circumferential scale counts, the most common count is reported as $x - 2 - x$, with the first number for the scales above lateral line, the second for the lateral-line scales, and the third for the scales below lateral line; and the total is their sum. Gillraker count refers to the total on first arch. Institutional acronyms follow Leviton et al. (1985) and Leviton and Gibbs (1988). We use the terms tubercles for the larger pearl organs, tuberclets for those about half former, and spinelets to tiny ones on fins and scale margins. Under Material Examined, CS means cleared and stained.

*Cyprinella alvarezdavillleri* n. sp.
Sardinita bronze del Nasas.
Figures 1–4.
Tables 1–4.

*Cyprinella* sp., Sardinita Nasas, Williams et al., 1986:4 (survival status); Espinoza et al., 1992 (copied).

**Holotype.**—UANL 8302 (39.6 mm SL), tuberculate male, coll. at Balneario La Concha, 9 km SW Peñón Blanco, Durango, Mexico; S. Contreras-Balderas and FCB group (SCB 88-58; 21-V-88).

**Paratypes.**—UANL 8303 (276:13.4–43.8 mm SL) and UANL 11131 (2; 32.6–36.5 mm SL: CS); same data as holotype; from this series, paratypes are deposited at AMNH 47834 (4); UNAM (IBCML-P) 3239 (4); UMMZ 214693 (8); and CAS (4, in transit). UANL 8310 (192: 21.4–56.0 mm SL); from Arroyo en Balneario Belém, 7 km. SE Peñón Blanco; same colls. and date (from this series four paratypes each are at BMNH (in transit), IPN P4436, TU 157269, TNHC 17459, USNM 308111, and UAL 9115.01. Other paratypes: UANL 8315 (12: 23.2–56.5 mm SL); Arroyo 3.1 km SW Peñón Blanco; S. Contreras-Balderas and FCB group (SCB 81-25; 29-VIII-81). UANL 8316 (1; 33.5 mm SL); Arroyo 1 km. SE Peñón Blanco; S. Contreras-Balderas and FCB group (SCB 68–65: 17-VII-68). UANL 8266 (1:35.4 mm SL); Balneario La Concha; M. L. Lozano-Vilano and FCB group (MLLV 88-8; 6-V-88). CAS 54426 (1: 34.3 mm SL); Rio del Peñón de Covadonga at La Concha; S. Weitzman and A. Solórzano (SW VIII: 01:52-1).

**Diagnosis.**—A dwarf species *Cyprinella* (maximum SL 43.8 mm); a member of the *lepidota* species group characterized by eye diameter larger than snout length; naked breast; very oblique mouth; heavy tuberculation especially on central dorsum of pectoral fins of breeding males, on chin, and spinelets on lips. Mature breeding males with bronze underparts including fins; anal and paired fins with white borders; body dark, including venter, with large, sparse melanophores, most noticeable in mature males; both sexes with lateral band as wide or wider than eye, especially around midlines in females.

**Description.**—Physognomy of *Cyprinella alvarezdavillleri* n. sp. appears in Figure 1. It is a relatively dwarfed form, maximum SL 43.8 mm, usually less than 36.0 mm; SL of mature males from 25.0 mm. Body strongly compressed, especially males, tapering to a relatively slender caudal peduncle. Dorsal profile more convex than ventral one, a body form that suggests a near-bottom swimmer. Dorsal origin nearly midway between nostrils and caudal base. Head rather robust, occupying more than half of predorsal length, and subequal to body depth in females and young males; head length tends to become relatively shorter as males grow and mature. Snout convex, not protruding over upper lip. Eye diameter longer than snout length (Fig. 2). Mouth terminal, very oblique; upper lip scarcely including lower lip, anteriorly below lower level of eye, and ending under a vertical less than midway between anterior margin of orbit and pupil. Body measurements appear in Table 1.

Lateral line complete, rarely with pores missing on 1–2 scales; line strongly curved behind opercle, leveling back about mideye level, and rising toward middle of the caudal peduncle from a point above anus. Cephalic lateral-line components highly variable. Supratemporal canal often missing on one or both sides, usually interrupted at midline, with 0–3 pores; supraorbital canal pores variable, 6–10, often not connected to cephalic laterals; infraorbital canal usually interrupted behind eye or not connected to lateralis, with 9–15 pores; preopercular canal 5–11 pores, with several interruptions, especially in the jaw area; mandibular segment not connected through symphysis, 5–5 pores; at least one specimen with the infraorbital and preopercular canals fused behind eyes; sometimes canals with blind branches. Scales thin, moderately imbricate, slightly crowded in predorsal area, reduced in size toward naked breast; scales generally oval, their exposed fields with characteristic higher-
than-wide diamond shape, enhanced by pigmen-
tation.

Intestine simple S-shape, Type I of Kafuku (1958). Gillrakers on first arch short to rudimen-
tary; counts in 20 paratypes 7 (4), 8 (8), 9 (5),
and 10 (3), $\bar{x} = 8.4$; pharyngeal teeth 4-4, the
upper three with strong hooks, masticatory sur-
faces relatively long and narrow; the lower tooth
pointed, with no flat area. In older specimens, the
masticatory surface tends to erode and leave
weak points. The full arch is relatively short
and wide.

Scale counts on 31 or 21 specimens, both
including holotype (marked by *), are as fol-
 lows: lateral-line scales 31 (1), 33 (15), *34 (12),
35 (2), or 37 (1), $\bar{x} = 33.6$; circumferential scales
above lateral line 12 (1), *13 (11), 14 (5), or 15
(4), $\bar{x} = 14.6$; circumferential scales below lat-
eral line 10 (4), *11 (16), or 12 (1), $\bar{x} = 10.6$;
total circumferential scales 25 (2), *26 (8), 28
(8), or 29 (3), $\bar{x} = 27.1$; most common count
*13-2-11. Caudal peduncle scales above lateral
line 5 (1), or *7 (20), $\bar{x} = 6.9$; caudal peduncle
scales below lateral line *5 (21); total caudal
peduncle scales, *14 (26), or 15 (5), $\bar{x} = 14.2$;
most common count *7-2-5. Scales between
dorsal-fin origin and lateral line 6 (3), or *7 (28),
$\bar{x} = 6.9$; between anal fin and lateral line 3 (3),
*4 (15), or 5 (13), $\bar{x} = 4.3$; between lateral line
and pelvic fin origin 3 (2), or *4 (29), $\bar{x} = 3.9$.

Fin-ray counts are as follows: dorsal-fin rays
*8 (30), or 9 (1), $\bar{x} = 8.05$; anal-fin rays *8 (31);
caudal-fin rays 18 (3), or *19 (28), $\bar{x} = 18.9$;
pectoral-fin rays 11 (25) or *12 (37), $\bar{x} = 11.6$;
pelvic-fin rays 7 (12) or *8 (50), $\bar{x} = 7.8$.

Some osteological characters are as follows,
with numbers as in Mayden (1989): (1) Frontals
slightly broadened; (2) junction of sphenotic
and frontals not moved anteriorly; (3) cerato-
branchial two with a long and thin neck; (4)
vomer not extending beyond posterior edge of
lateral ethmoid; (5) infraorbitals two or three
entire or may be broken into two or three seg-
m ents (one specimen had the IO 2 subdivided
in two on one side and three on the other side);
(6) dermopterotic side nearly vertical; (7) cor-
onoid process of dentary narrow and elongate;
(8) retroarticular L-shaped; (9) retroarticular
long; (10) lateral margin of pharyngobranchial
2-3 expanded into small shelf; (11) uroforeal
3 short, except one specimen had it long. Other
characters are as follows: no autotropical spine,
vomer with deep anterior notch, with a short
anterior basihyal ligament; temporal with a
downward spine.

Males of this species are highly tuberculate
Table 1. Morphometry of Cyprinella alvarezdelval-
lar i n. sp., from Rio Nasas, Durango, México. Mea-
surements in parts per thousand of SL. Averages in
parentheses.

<table>
<thead>
<tr>
<th></th>
<th>Holotype</th>
<th>Paratypes</th>
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<tr>
<td>Standard length (mm)</td>
<td>39.6</td>
<td>26.6–38.3</td>
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<td>Predorsal length</td>
<td>526</td>
<td>554 (554) 580</td>
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<td>Body depth</td>
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<td>287 (291) 358</td>
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<tr>
<td>Caudal peduncle depth</td>
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<td>100 (111) 128</td>
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<tr>
<td>Lateral line to</td>
<td></td>
<td></td>
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<tr>
<td>Dorsal-fin origin</td>
<td>215</td>
<td>165 (185) 223</td>
</tr>
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<td>Pelvic-fin origin</td>
<td>111</td>
<td>89 (106) 123</td>
</tr>
<tr>
<td>Head measurements</td>
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<tr>
<td>Head length</td>
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<td>263 (250) 295</td>
</tr>
<tr>
<td>Head depth</td>
<td>238</td>
<td>206 (221) 239</td>
</tr>
<tr>
<td>Head width</td>
<td>157</td>
<td>138 (149) 164</td>
</tr>
<tr>
<td>Mouth width</td>
<td>61</td>
<td>51 (57) 63</td>
</tr>
<tr>
<td>Interorbital</td>
<td>101</td>
<td>100 (104) 113</td>
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<tr>
<td>Snout length</td>
<td>78</td>
<td>72 (79) 87</td>
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<tr>
<td>Eye diameter</td>
<td>83</td>
<td>80 (87) 102</td>
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<td>Suborbital</td>
<td>40</td>
<td>38 (45) 58</td>
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<tr>
<td>Upper jaw length</td>
<td>73</td>
<td>70 (77) 84</td>
</tr>
<tr>
<td>Lower jaw length</td>
<td>83</td>
<td>79 (97) 109</td>
</tr>
<tr>
<td>Fin measurements</td>
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<td></td>
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<tr>
<td>Depressed dorsal</td>
<td>273</td>
<td>216 (253) 284</td>
</tr>
<tr>
<td>Pectoral length</td>
<td>202</td>
<td>158 (190) 228</td>
</tr>
</tbody>
</table>

Fig. 2. Scatter plot of eye diameter compared to
snout length in Cyprinella sp., Rio Lasas (eye larger); ▼ C. rutila, Rio
San Juan; ▲ Cyprinella sp., Rio Salado; □ C. proserpina,
Rio Pecos and associated small drainages; ● C. san-
thaera, Cuatro Cienegas; ● C. panarca, Rio Conchos.
Measurements in millimeters of standard length. Hol-
low star = holotype. Solid stars = paratypes.

at breeding season. Mature males nearly cov-
ered by tubercles. Those on top of head large,
usually anterose to nearly straight, swollen ba-
sally, in 2–6 irregular longitudinal rows, and
surrounded by spinules over entire surface; a
close series of preorbital and supraorbital, 1–
2 rows of supralabials; a hiatus between them
and rostrals; lachrymal with some spinules on
all fields; predorsal tubercle patch from nape to
a point that may reach the dorsal origin, usually
shorter, but may reflect a difference in matur-
ity; body scales with a marginal row of spin-
ules; caudal peduncle with tubercles all around,
including a few spinules on miodorsal scale row;
a patch of tubercles along the ventral area, cov-
ering 1–2.5 scales above midventral, or up to
three scale rows above midanal base. No tu-
bercles posterior and below from eye. Lips with
irregular rows of tubercles. Chin with tu-
bercles, larger ones near symphysis, smaller at sides
and back to the isthmus. Some details of head
tuberculation may be seen on Figure 1 and on
pectoral-fin rays in Figure 3. Dorsal, anal, and
caudal fins with abundant and scattered spin-
ules, in single row on first ray and two per seg-
ment, followed by 4–5 rays densely tuberculate
especially around central area; pectorals simi-
lar, with spinules being on dorsal surface, es-
pecially near middle of fin, where there may be
3–8 per segment, larger near the center of patch
and anteriorly on each segment; pelvics usually
with two spinules per segment, in one row per
ray. Females similarly tuberculate but more
sparse and composed only of spinules, tending
to have few or none on fins.

Melanophore pigmentation is characteristic
for this species, because most of the fish is cov-
ered by large melanophores, especially on males,
providing them a sooty to spotty appearance
superimposed upon the deeper basic pattern of
dark head and dorsum. Body pigmentation in
females is similar, but less marked, rarely with
melanophores under lateral line, giving a black-
and-white aspect. The typical diamond pattern
on scale pockets is most strongly marked near
midbody and obsolete on breast, where only
large and sparse melanophores remain. Both
sexes with jet black lateral band, as wide (fe-
male) or wider (male) than eye, especially near
midbody; band may not be obscured in sooty males; band starts just behind opercle origin and extends to caudal base. Humeral bar present, diffuse or poorly marked, fused to lateral band, obsolete in young fish. Fin pigmentation as follows: all fin rays with melanophores, especially dense and dark on first rays (split and first principal ray); males with comet caudal (upper and lower undivided rays darker); interradial membranes usually clear or with some scattered large melanophores, except dorsal fin of mature males, where melanophores tend to form a postdorsal blotch. The few ventral large melanophores are concentrated in gular region, interpelvic area, around anus, and along anal base.

Live color.—Nuptial males with an outstanding bright orange-bronze color, including fins; underside of head and breast brighter; pectoral, pelvic, and anal fins with a pure white border almost as wide as pupil. Maturity is accompanied by a general blackening; at peak breeding condition adult males look almost black. Females drab dark green above, with whitish undersides.

Etymology.—The specific epithet is genitive, to honor the late José Alvarez del Villar, founder of modern Mexican ichthyology, who trained many generations of ichthyologists at Instituto Politécnico Nacional. He was an example to follow. We dedicate this species to him in memory of his teaching, his friendship, and his many contributions to our understanding of Mexican freshwater fishes.

Comparison.—We assign Cyprinella alvarezdelvillari to the lepida species group on the basis of 10 of the 12 characters defined by Mayden (1989); the characters that are not present in the new species are a vomer that does not extend beyond posterior edge of lateral ethmoids and apparent absence of the purplish shade on breeding males, which may be unnoticed because they turn dark to black over orange yellow. Also, they present the following characters in common: whitish pigmentation on fins, eight anal rays (except lepida, that has nine), long dark gular streak reaching brachioseptal membranes (except lepida, with short gular bar), 4-4 pharyngeal teeth, diamond shaped exposed scale fields, scapular bar behind opercle and above pectoral fins, and usually yellow to orange-bronze under parts. Also, dorsal head tubercles large, erect or slightly antrorse, caudal peduncle scales above and below lateral line with small edge spinelets, those under caudal peduncle with scattered central tuberclets in a shagreen patch extending 1-2.5 (up to 3) scale rows above midventral row, extending from anal base to caudal base, and a scalloped edge of preopercle.

This species appears closer to the proserpina species pair, especially to C. panarcys, sharing with it the subdivisions of infraorbitalts (IO) 2-3 ranging from IO 2 not subdivided to IO 3 divided in 2-3 (one specimen had two on one side, three on the other), a vomer with a deep anterior notch, and no autotrophic spine; although it shares some characters with the rutila species pair (hiatus between labial and interorbital tubercles and deep body). From the lepida species group, it differs in apparently not having purplish hues and in being orange-bronze (often reddish) rather than yellow, although it shares with C. lepida the anterior basihyal ligament but incomplete rather than complete. From both the rutila and proserpina species pairs, it differs in having some marginal spinelets on dorsalmost scale row of caudal peduncle, agreeing with C. sandhacra in having up to three tuberculate scale rows above the lower-most caudal peduncle scale row.

Cyprinella alvarezdelvillari diverges from the rutila species pair in having at least a few tubercles on the lachrymal and large central tubercles on caudal peduncle scales; frequently submarginal or edge tubercles are the larger. It differs from the proserpina species pair in having the supralabial hiatus in tuberculation. It is close to C. panarcys in characters shown in Table 2, plus having the deep anterior notch in vomer in the irregular subdivision of infraorbitalts (from 0-3 subdivisions) and in the absence of the autotrophic spine.

All the numbered features possessed by C. alvarezdelvillari, except white fin borders, were considered by Mayden (1989) as primitive or
Table 2. Diagnostic Characters for Species of the Genus *Cyprinella*, *lepidota* Species Group, from the Rio Grande Basin and Range.

<table>
<thead>
<tr>
<th>Characters</th>
<th>C. alvarezi delvallei a. sp.</th>
<th>C. panayray</th>
<th>C. pruerepis</th>
<th>C. sp.</th>
<th>C. salmorena</th>
<th>C. rubia</th>
<th>C. lepidota</th>
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<tbody>
<tr>
<td>Anal-fin rays</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>9</td>
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<tr>
<td>Eye/Snout</td>
<td>1.03–1.57</td>
<td>0.71–0.96</td>
<td>0.77–0.94</td>
<td>0.68–1.04</td>
<td>0.80–0.96</td>
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<td>&lt;Snout</td>
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<tr>
<td>Breast</td>
<td>Naked</td>
<td>Scaly</td>
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<tr>
<td>Band width</td>
<td>&gt;Eye</td>
<td>&lt;Pupil</td>
<td>=Pupil</td>
<td>=Pupil</td>
<td>=Pupil</td>
<td>=Eye</td>
<td>&lt;Eye</td>
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<tr>
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<td>Long</td>
<td>Long</td>
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<td></td>
<td>Edge of anal, pectoral, pelvic</td>
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<td></td>
<td>Body</td>
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<td>Terete</td>
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<td>3.7–4.5</td>
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<td></td>
<td>Caudal peduncle</td>
<td>Robust</td>
<td>Slender</td>
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<td>Very slender</td>
<td>Robust</td>
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<td>Paired and anal</td>
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<td></td>
<td>Snout hiatus</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Dorsal lacrimal</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
Table 3. Comparison of Three Shiners from Río Nazas, Mexican Central Plateau, Based Mostly on Male Characters.

<table>
<thead>
<tr>
<th></th>
<th>Cyprinella alvarezedelvillari n. sp.</th>
<th>Cyprinella garmani</th>
<th>Codoma ornata</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anal rays</td>
<td>8</td>
<td>10</td>
<td>7–8</td>
</tr>
<tr>
<td>White border (P2,A,C)</td>
<td>Yes</td>
<td>Absent</td>
<td>Yes</td>
</tr>
<tr>
<td>Lateral band</td>
<td>Present, wider than eye</td>
<td>Weak, only on peduncle</td>
<td>Narrow, pupil in young and female</td>
</tr>
<tr>
<td>Basicaudal spot</td>
<td>None</td>
<td>Weak</td>
<td>Yes</td>
</tr>
<tr>
<td>Basicaudal spot and humeral bar</td>
<td>Nondistinguishable</td>
<td>Separate</td>
<td>Nondistinguishable</td>
</tr>
<tr>
<td>Dark body bars</td>
<td>Humeral only, weak</td>
<td>Humeral only</td>
<td>6–10 (no humeral)</td>
</tr>
<tr>
<td>Spotted breast</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Melanophores on venter</td>
<td>Heavy, both sexes</td>
<td>None</td>
<td>Heavy on males</td>
</tr>
<tr>
<td>Tuberculation dorsal/caudal fins</td>
<td>Yes</td>
<td>Dorsal yes, caudal no</td>
<td>Weakly on dorsal, caudal none</td>
</tr>
<tr>
<td>P1</td>
<td>Strong, 2–5 per segment</td>
<td>Weak, one per segment</td>
<td>Weak, one per segment</td>
</tr>
<tr>
<td>Color of breeding males</td>
<td>Bronze to black, never barred</td>
<td>Blue dorsum, red underparts</td>
<td>Gray to black, barred</td>
</tr>
</tbody>
</table>

Reversals to primitive traits, an interesting observation for our new species, that is peripheral to its group, i.e., occupying Río Nazas which is not actual part of Río Grande, although it is considered detached and derived from the Pleistocene Río Grande (Mee, 1903, 1904; Farrington, 1904), all others being actual Río Grande forms, except C. lepida. We have observed several peculiarities, such as the shape of the hypural complex, to be reported elsewhere. It is not our intention to do a full osteological comparison, it should await a revisionary study of the species group, beyond the scope of this paper. Two other species referred recently to Cyprinella, C. garmani and C. ornata, are roughly sympatric and have been confused with C. alvarezedelvillari n. sp.; C. garmani is parapatric to the new species, Codoma ornata, considered by Mayden (1989) to be a Cyprinella, was regarded as a valid genus by S. Contreras-Balderas and W. L. Minkley (MS) based on gross morphology and behavior; and Contreras-Balderas (1975) suspected it not to be a Notropis, hence used the name between quotation marks. The view was held by Contreras-Balderas (1978) and Miller (1978) without further comment, and we keep this use here. A comparison with these two species appears in Table 3.

Table 4. Associated Species of Fishes and Selected Habitat Factors in Collections of Cyprinella alvarezedelvillari n. sp.

<table>
<thead>
<tr>
<th></th>
<th>La Cocora</th>
<th>Belén 29</th>
<th>Belén 39</th>
<th>Peñón Blanco</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature (C)</td>
<td>Above 32°</td>
<td>Below 32°</td>
<td></td>
<td>Below 32°</td>
</tr>
<tr>
<td>Area</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water movement</td>
<td>Spring</td>
<td>Outflow</td>
<td>Creek</td>
<td>Creek</td>
</tr>
<tr>
<td>Astyanax sp.</td>
<td>Lentoid</td>
<td>Lotic</td>
<td>Lotic</td>
<td>Lotic</td>
</tr>
<tr>
<td>C. alvarezedelvillari</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>Campostoma ornatum</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Gila c. conspicua</td>
<td>0</td>
<td>2</td>
<td>21</td>
<td>99</td>
</tr>
<tr>
<td>Codoma ornata</td>
<td>0</td>
<td>0</td>
<td>78</td>
<td>567</td>
</tr>
<tr>
<td>Cyprinodon nazaris</td>
<td>80</td>
<td>159</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Pantosteus plebeius</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Ictalurus ca. princeps</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Etheostoma patas</td>
<td>0</td>
<td>0</td>
<td>0*</td>
<td>0</td>
</tr>
<tr>
<td>Tilapia mosambica</td>
<td>0</td>
<td>138</td>
<td>129</td>
<td>0</td>
</tr>
</tbody>
</table>

* Collected in this locality in 1993.
DISTRIBUTION.—Cyprinella alvarezedetillarii n. sp. is known only from Ojo La Concha and its outlet to 8 km downstream in the Arroyo de Peñón Blanco; it has not been collected at the town of Peñón Blanco or below. The creek flows in the Rio Nazas (Fig. 4).

HABITAT AND ASSOCIATE SPECIES.—Arroyo de Peñón de Covadonga is a creek fed by thermal springs, 32 °C and warmer at the source. In Balneario La Concha, the stream gradually cools and runs over gravel and boulders (rarely over sand or mud) and is fast moving except where dammed. It has few pools, except for a large headpool widened by a dam, with a couple of swimming pools immediately downstream. Plants present, but not very abundant, are Polygonum, Bacopa, Eleucharia, Najas, and algae, all common around La Concha and scarce or absent at Belém. Cyprinella alvarezedetillarii is more common in flowing waters, away from plants, pools and mud; it avoids stagnant thermal waters near the spring pools, where it has been collected twice (one specimen each), but is abundant at a series of falls immediately below the Balneario (Table 4). The species is dominant in collections from moving water warmer than 29 °C (rare in lentic areas or at lower temperatures), sympatric with Cyprinodon naxas and the introduced Oreochromis mossambicus. It is not known to occur at temperatures lower than 25 °C, where the fish fauna is dominated by Cobia ornata, Gila c. conspersa, and Astyanax sp. (Table 4).

DISTRIBUTIONAL COMMENTS ON CYPRINELLA PROSPERINA.—The distribution of Cyprinella prosperina has been given as the Pecos, Las Moras, and San Felipe rivers in Texas, and Rio San Carlos (= Arroyos de Zorra, Lobó, Tule), in Coahuila, Mexico. It is recorded herein as inhabiting Río San Rodrigo (= Río San Diego), a minor tributary draining the Rio Grande 59.8 km SSE from Cd. Acuña and 52.8 km SSE from Río San Carlos. This area of northeastern Coahuila, comprising the Rio Morelos, Rio de Nava, the mentioned Texan rivers, and others, has a distinctive fish community shared with the Pecos River, of which this species is a member. This region of Texas has been referred to as the Balconian biotic zone (Hubbs 1957; Smith and Miller, 1980). Cyprinella prosperina is the only species in its clade to occur both north and south of the main channel Río Grande.

KEY TO THE CYPRINELLA LEPIDA SPECIES GROUP

1a. Gular bar short, usually reaching a point below mideye. Anal rays usually 9 _cyprinella_, Rio Nueces, Rio Frio
1b. Gular bar extending to edge of branchiostegal membrane. Anal rays usually 9
2a. Eye diameter larger than snout. Lateral band as wide or wider than eye. Large isolated melanophores on naked breast. _cyprinella_, Rio Nueces, Rio Frio
2b. Eye shorter than snout. Lateral band narrower or equal to eye (in males). No large melanophores on naked breast
3a. Histio absent between labial and interorbital tubercles
3b. Histio present between labial and interorbital tubercles
4a. Mouth oblique. Body high, 2.7–3.2 in SL. Pectoral, pelvic, and anal fins of mature males red, with white borders
4b. Mouth nearly horizontal. Body slender, 5.3–4.5 in SL. Pectoral, pelvic, and anal fins of mature males plain yellow to golden. _prosperina_, Río Pecos, Rio San Carlos, Río San Rodrigo (new record)
5a. Body robust, 3.1–3.6 in SL. Caudal peduncle slender, 7.1–8.5 in SL. Mouth short, 0.4–0.3 in SL. _cyprinella_, Río San Juan
5b. Body slender, 5.7–5.0 in SL. Caudal peduncle very slender, 8.3–11 in SL. Mouth subhorizontal
6a. Lateral band jet black. Head small, 3.6–3.9 in SL
6b. Lateral band well marked, not jet black. Head medium, 3.7–4.1 in SL
7a. Cyprinella sp., Rio Salado. (This species under study by R. R. Miller and the authors of this paper)

COMPARATIVE MATERIAL EXAMINED

Cyprinella lepida: Texas: TNHC 5279 (65: 53.5–64.6 mm SL); Edwards-Usuluti line, E Nueces River, United States.
Cyprinella panzeri: BURANO: UAN. 1591 (1: 3.8 mm SL), Rio Florida at Nieves, Dpto. 24-VI-64. CHIHUAHUA: UANL 2165 (251: 31.4–36.6 mm SL), Río San Pedro at Meopoa. 24-VIII-65. UANL 2250 (1: 52.5 mm SL), same location. 2-VIII-68. UANL 5571 (41: 26.9–31.9 mm SL), Rio Churcie at San Diego. 25-VII-62.
Cyprinella prosperina: TEXAS: TU 3647 (13), Independence Creek, near Sheffield. 11/VI/65. COAHUILA: UANL 1388 (9: 50.6–45.5 mm SL), Río San Diego 52.9 km N Morales (new record). 2-VII-68.
Cyprinella rualla: NUEVO LEON: UANL 152 (1: 55.7 mm SL), Ar-
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LITERATURE CITED


Meek, S. F. 1908. Distribution of the fresh-water fishes of Mexico. Amer. Nat. 73:771–784.


Minckley, W. L., and G. L. Lytle. 1969. Notropis xantithecus, a new cyprinid fish from the Cuatro Cie-