PROCEEDINGS

of the

San Diego Society of Natural History

Founded 1874

Number 1 — 1 July 1990

Revision of the Mexican Pyrgomorphidae (Orthoptera: Acridoidea) II. A reappraisal of the genus *Ichthiacris* I. Bolívar, 1905, with descriptions of three new species from Baja California, Mexico.

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ABSTRACT.- The orthopteroid genus *Ichthiacris* Bolívar (Acridoidea; Pyrgomorphidae) is endemic to NW Mexico. All but one of the species occur only in Baja California. The genus comprises two subgenera, *Ichthiacris*, sensu stricto, and *Atyphacris* Kevan, Singh, and Akbar, 1964. The latter, formerly regarded as a separate genus, is herein redefined. The genus *Ichthiacris* now includes eight species: *I.* (*I.*) *rehni* Bolívar (southern Baja California), *I.* (*I.*) *parva* n. sp. (known only from Isla Cedros off W Baja California), *I.* (*I.*) *spinifera* n. sp. (southern Baja California Sur), *I.* (*A.*) *elongata* Kevan *et al.* (Sonora and Sinaloa), *I.* (*A.*) *costulata* Bolívar (southern Baja California), *I.* (*A.*) *californica* Bolívar (southern Baja California Sur), *I.* (*A.*) *celata* n. sp. (central Cape region of Baja California Sur), and *I.* (*A.*) *aptera* Hebard (southernmost Baja California Sur). The name of the last species reverts from *Atyphacris californica* (Bruner) to the present name because of recurrent secondary homonymy. Tabular keys are provided. Biogeographic and phylogenetic relationships are discussed.

RESUMEN.- El género *Ichthiacris* Bolívar (*Orthoptera Acridoidea Pyrgomorphidae*) es endémico del noroeste de México. Todas las especies a excepción de una de se encuentran solo en Baja California. El género esta dividido en dos subgéneros, *Ichthiacris*, *sensu stricto*, y *Atyphacris* Kevan *et al.*, 1964. Este último considerado inicialmente como un género separado, es redefinido aqui. Los ocho miembros del género *Ichthiacris* ahora considerados son: *I.* (*I.*) *rehni* Bolívar (sur de Baja California), *I.* (*I.*) *parva*, n. sp. (conocida solo de Isla Cedros, en la costa del Baja California oeste), *I.* (*I.*) *spinifera*, n. sp. (del sur de Baja California Sur), *I.* (*A.*) *elongata* Kevan *et al.* (Sonora y Sinaloa), *I.* (*A.*) *costulata* Bolívar (sur de Baja California), *I.* (*A.*) *californica* Bolívar (del sur de Baja California Sur), *I.* (*A.*) *celata*, n. sp. (region central del Cabo de Baja California Sur), y *I.* (*A.*) *aptera* Hebard (de la parte mas meridional de Baja California). El nombre de la última especie, *Atyphacris californica* (Bruner), se cambia a el nombre presente por ser este un homónimo secundario recurrente. Tablas-claves son provistas. Las relaciones biogeográficas y filogenéticas son discutidos.

INTRODUCTION

In the course of studying the Pyrgomorphidae of Baja California, Mexico, preparatory to the publication of a general handbook on the orthopteroid insects of Baja California that is currently being coordinated by Dr. D. B. Weissman, I discovered three hitherto undescribed species of the genus *Ichthiacris* I. Bolívar, 1905. Two of these are from the Cape region of Baja California Sur and the other is from Isla Cedros, off the southwest coast of Baja California Norte. These and other discoveries now necessitate a critical re-examination of all species of *Ichthiacris*.

The Pyrgomorphidae occur primarily in the Old World tropics and are poorly represented in temperate regions and in the New World tropics and subtropics, where most of the known species are Mexican (see Kevan and Akbar 1964, Kevan *et al.* 1964, Kevan 1977, 1978). The most northerly range of the American species is northwestern Mexico (Sonora and Baja California south of about 29° N latitude), where a single tribe, Ichthiacridini Kevan, Singh, and Akbar, 1964, occurs.

The Pyrgomorphidae, in general, though not in northwestern Mexico, are very diverse, but they may be distinguished from all other Acridoidea by the characteristic form of the male copulatory structures and the fastigium of the vertex of the head, which has a distinct median apicodorsal furrow flanked by pair of dorsal margined depressions, ("areolae" or "foveolae"). Most (and certainly all American) species also have the upper basal lobe of the hind femur poorly developed so as not to project forward beyond the lower lobe, and a rather strongly receding frontal profile. Neither character, however, is itself diagnostic for the family. In addition, very many Pyrgomorphidae (including all New World species except for two of the four known from South America) are apterous or have extremely abbreviated vestigial scale-like wings. Again, this is not unique to the family, but, so far as Mexican genera are concerned, any Acridoidea with more than mere traces of wings belong to other families.

Three tribes of Pyrgomorphidae occur in Mexico: the Sphenariini, Ichthyotettigini, and Ichthiacridini, the last having *Ichthiacris* as its type genus. The features distinguishing these tribes are given by Kevan and Akbar (1964) and Kevan *et al.* (1964, 1971). In summary, the Sphenariini are robust and

strongly fusiform and (in the New World) confined to southern and central Mexico and to Central America; the Ichthyotettigini are cylindrical, virtually smooth, completely apterous, and found only in central and southern Mexico; the Ichthiacridini (nymphs included) are elongate, subfusiform to cylindrical, and have punctate, granulate, rugose, or somewhat striated integuments, and most species possess minute vestigial forewings (tegmina). The male genitalia of the Ichthiacridini, also, are less specialized than those of the Ichthyotettigini (see Kevan *et al.* 1964, 1971). These two tribes overlap to some extent in geographical distribution, but *Ichthiacris* is confined to northwestern Mexico (including Baja California), where the latter tribe is not found.

Prior to the present study, four genera of Ichthiacridini were recognized (for distinguishing characters, see Kevan *et al.* 1964): two from central Mexico, *Sphenacris* Bolívar, 1884, and *Calamacris* Rehn, 1904 (both monotypic), and two from the northwestern part of the country, the monotypic *Atyphacris* Kevan, Singh, and Akbar, 1964, from Baja California, and *Ichthiacris* Bolívar, 1905, with three currently recognized species (Kevan 1978), two from Baja California and one from the mainland states of Sonora and Sinaloa. Kevan (1978)—incorrectly, it now proves—synonymized a third Baja Californian species, *I. californica* Bolívar, 1905, with *I. costulata* Bolívar, 1905 (for which there are several other synonyms), so that there are really three previously recognized species of *Ichthiacris* and one of *Atyphacris* known from Baja California.

The generic and specific characters and the distribution of the Ichthiacridini, as previously known, have been outlined by Kevan and Akbar (1964), and the concealed copulatory structures have received further attention from Kevan *et al.* (1971). A bibliography for all species, complete to 1976, with the exception of an overlooked reference by Hebard (1923), was published by Kevan (1977). Kevan (1978) provided lists of the then-known localities from which the various species recognized had been recorded. Inaccuracies in these publications are corrected herein under the individual species concerned.

MATERIALS AND METHODS

The specimens studied in connection with the present systematic revision were virtually all dry-pinned and, except for those in the author's collection, were borrowed in recent years from various institutions, augmenting the material studied by Kevan *et al.* (1964) and Kevan (1978). Preceded by the abbreviations used for them in the present text, the institutions involved are as follows: ANSP, Academy of Natural Sciences of Philadelphia, Philadelphia, Pennsylvania, U.S.A.; CAS, California Academy of Sciences, San Francisco, California, U.S.A.; CSLB, Biology Department, California State University, Long Beach, California, U.S.A.; LEM, Lyman Entomological Museum, Macdonald College of McGill University, Ste-Anne-de-Bellevue, Québec, Canada (which houses the author's collection of Pyrgomorphidae); SDSNH, San Diego Society of Natural History, Natural History Museum, San Diego, California, U.S.A.; USNM, United States National Museum of Natural History, Washington, D.C., U.S.A. Unless stated otherwise, material recorded here for the first time is deposited in CAS or was handled by, and returned to, that institution.

In the following systematic account, references listed in the synonymies are limited to primary and otherwise important citations and to those not included by Kevan (1977). Except for the new species, details regarding type specimens and their repositories are given by Kevan *et al.* (1964) and not repeated here. Collection data for previously unrecorded material listed herein are, for accuracy and to facilitate individual recognition, given virtually as indicated on the labels attached to the specimens (though the sequence may sometimes be slightly altered for convenience). They are not converted to a standardized form as past experience has shown that such standardization can lead to errors of interpretation. Dates are expressed in the form "10.VII.1978," representing, in this case, "10 July 1978."

The methods of examining the concealed copulatory structures and the terminology used for these follow Kevan *et al.* (1969). Information regarding habits, life cycles, and autecology are not discussed herein as this is intended for the handbook mentioned above.

RESULTS

The genus *Ichthiacris* is here considered to comprise eight species. The four species recognized in the earlier revision of Kevan *et al.* (1964), despite the inaccuracies in that work, still stand. These are *I. californica* Bolívar, 1905, *I. costulata* Bolívar, 1905, *I. elongata* Kevan, Singh, and Akbar, 1964, and *I. rehni* Bolívar, 1905 (type species); see also Kevan (1977). The synonymy of *I. californica* under *I. costulata* (Kevan, 1978) was incorrect, and subsequent work has revealed the existence of three new species—*parva*, *spinifera*, and *celata*—bringing the total to seven. *I. celata*, however, possesses certain characters (notably the virtual or complete absence of tegminal vestiges and the form of the phallic structures) that now make it impossible to regard the hitherto monotypic *Atyphacris* as generically distinct from *Ichthiacris*. This, in turn has resulted in the recurrence of secondary homonymy. The type species of *Atyphacris* is *A. californica* (Bruner, 1906), which, on being transferred back to *Ichthiacris*, again becomes a junior homonym of *I. californica* Bolívar, 1905, so that it must revert to its previous replacement name, *I. aptera* Hebard, 1932, and is the eighth species of that genus.

The type species of *Ichthiacris*, *I. rehni*, is now seen to stand apart, more so than does *I. aptera*, from other previously described species of the genus, notably in its more rugose integument, generally broader tegminal vestiges (particularly in the female), deeper dorsal ovipositor valves, and the form of the phallic structures. Prior to the present revision, it would have indeed been plausible to transfer all other previously known species from *Ichthiacris* to *Atyphacris* and to let the latter remain a full genus. Nevertheless, though one of the newly discovered species, close to *I. rehni*, namely, *I. parva*, would support such an action, another, *I. spinifera*, possesses certain characters indicating relationship to *I. rehni* but others (narrower tegminal vestiges, shallower dorsal ovipositor valves, and the form of the aedeagus) more in keeping with those of the remaining species. Therefore I have adopted a compromise by recognizing two *subgenera*, *Ichthiacris*, sensu stricto, for *I. rehni* and the two new species just mentioned, and *I.* (*Atyphacris*) for the remaining five (including one new) species. With the exception of *I.* (*A.*)

elongata, from the northwestern Mexican mainland, all species of *Ichthiacris* are confined to the southern half of Baja California.

SYSTEMATICS

GENUS *ICHTHIACRIS* I. BOLÍVAR, 1905, SENSU LATO

Ichthiacris Bolívar, 1905: 287; Kevan, Singh, and Akbar, 1964: 234, 239.
Calamacris (*nec* Rehn); Bruner, 1906: 200.
Atyphacris Kevan, Singh, and Akbar, 1964: 233, 240; *syn. nov.* (now subgenus only).

Type species.—By subsequent designation (Kirby 1910), *Ichthiacris rehni* Bolívar, 1905.

Diagnosis.—Body elongate-fusiform to subcylindrical, usually rather slender, with distinctly punctate, granulate, pustulate, or striated integument; almost (sometimes completely) apterous; copulatory structures relatively unspecialized for the Pyrgomorphidae (see Kevan *et al.*, 1964, 1971).

Remarks.—The combination of characters noted readily distinguishes the Ichthiacridini from all other American Pyrgomorphidae. The monotypic genera *Sphenacris* and *Calamacris* differ from *Ichthiacris* in possessing more definitely elongate-fusiform bodies and more strongly pustulate integuments. There are also important genitalic differences, as indicated by Kevan *et al.* (1964, 1971). *Sphenacris* and *Calamacris* appear to be restricted to central Mexico.

Two subgenera of *Ichthiacris* are here recognized, distinguishable from each other by means of Table 1.

Subgenus *Ichthiacris* Bolívar, 1905, sensu stricto

Ichthiacris Bolívar, 1905: 287 (*partim*); here restricted.

Type species.—As for genus.

Diagnosis.—Sculpture strongly rugososstriate, usually with some tubercles; fastigium of vertex always considerably longer than basal width (Figure 1A-D, N, O); frontal profile strongly oblique, rather strongly and sinuously concave (Figure 2A-D, N, O); inferoposterior region of lateral pronotal lobe typically rugose (Figure 3A, B, I), angle sometimes with a small spine or sharp denticle (as in Figures 2C, 3B); minute tegminal vestiges present, sometimes slip-like, typically broad and lobe-like (as in Figure 3A).

Males: Abdominal terminalia dorsally as in Figure 4A, B, H; subgenital plate in lateral view fairly acute (Figure 5A, B, H); epiphallus with posterior emargination broad or shallowly U-shaped (but not deeply so nor slot-like), anterolaterally directed subterminal processes of lateral appendices prominent (Figure 6A-C, O); apical parts of aedeagal valves and sclerites relatively short (Figure 7A, B, O) or of moderate length (Figure 7C).

Females: Metathoracic epimera not expanded dorsally (Figure 3A, B, I), sometimes with tubercles (Figure 3A, I); dorsal ovipositor valves in lateral view typically deep and apically sickle-like (Figure 8A) but sometimes tapered (Figure 8B); subgenital plate dorsally with posterior margin on either side of egg-guide having short, distinct, closely set, longitudinal striations extending about half-way along margin (Figure 9A, B, H); receptacula seminis as in Figure 10A, B.

Distribution.—Baja California, Mexico, only (Figure 11).

Included species.—*I.* (*I.*) *rehni* Bolívar, 1905; *I.* (*I.*) *parva*, n. sp. (Figure 12), and *I.* (*I.*) *spinifera*, n. sp. (Figures 13A, B, 14A, B). They are separable from each other as indicated in Table 2.

Ichthiacris (*Ichthiacris*) *rehni*, Bolívar, 1905 (Figures 1A, B; 2A, B; 3A; 4A; 5A; 6A, B; 7A, B; 8A; 9A; 10A; 11)

Ichthiacris rehni Bolívar, 1905: 287, 288.
Ichthiacris rehni; Kevan, Singh, and Akbar, 1964: 236, fig. 1 (map—*partim*), 240, 241, fig. 4 (*partim*), 242 (*partim*), 243, fig. 5, 288, 289 (plate 1), figs. I–L; Kevan, 1977: 65, 665 (*partim*—by inference, referring to foregoing), 644; Kevan, 1978: 5, fig. 1 (map—*partim*), 15, 23–24 (*partim*); Kevan, 1981: [28].

Recognition.—Integument rugose, small spine or denticle on the inferoposterior angle of the lateral pronotal lobe lacking; frontal profile strongly concave and sinuous in both sexes (Figure 2A, B); tegminal vestiges (Figure 3A) broad (often as broad as long in female; at least half this in male); dorsal ovipositor valves deep and apically sickle-like (Figure 3A). Other characters are noted in Table 2.

Distribution (Figure 11).—The type specimens (including male lectotype) were described merely from "Basse Californie." The species is quite widely distributed in southern Baja California from a little north of 28°N almost to 23°30'N latitude. In addition to the types, the specimens studied are listed below. Specimens noted in earlier publications are indicated only by locality and reference; those recorded erroneously as this species are omitted here but are listed under the appropriate species.

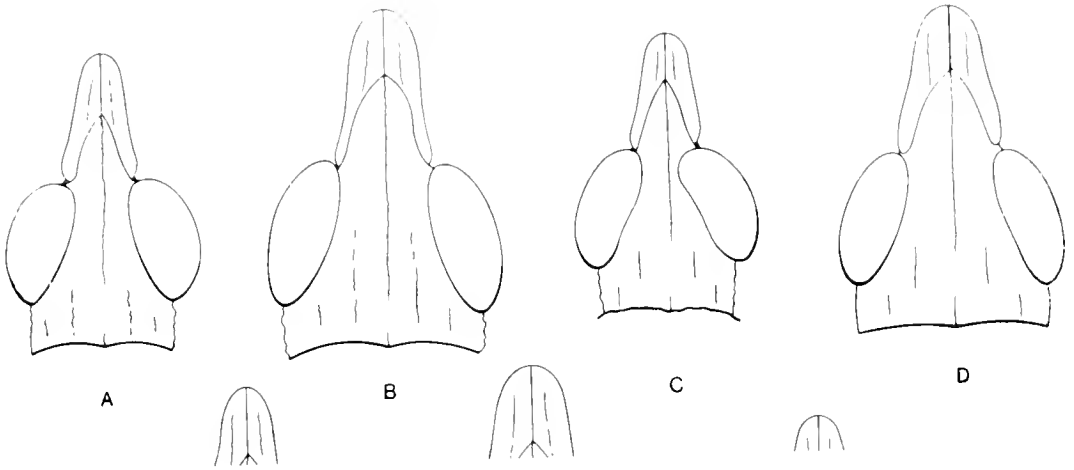
Material examined.—Baja California Norte: 7 km N of Guerrero Negro [itself just within Baja California Sur] at 0.24 km N of km 121 on Mex[ico Highway] 1, Stop 34, 10.VII.1978, D. B. Weissman and D. C. Lightfoot, 2 juvs. (♂ ♀); 68 [road] km S of [Rancho] Rosarito, 0.2 km N of km 121 on Mex[ico Highway] 1 [i.e., between Rancho Mezquital and Colonía Agrícola], 25.VII.1977, [no collector], 1 juv. (♂).

Baja California Sur: 31.0 km NW of Punta Abreojos, elev. 62 m, sand flats, *Encelia halimifolia* Cav., 21.I.1975, E. L. Sleeper, 2649/11341, 2 ♀♀ (CSLB); Arroyo Seco (Kevan *et al.* 1964, Kevan 1978); 7 rd. mi. NW, 1.1. mi. SW of El Cien [ca. 24°22'N, 110°58'W], on Santa Fé road, elev. 100 feet, 13.IX.1983, J. P. and K. E. Donahue, 1 ♀; 46 km W of Col[onía] Constitución, 19.X.1974, D. Otte, 7 ♂♂, 2 ♀♀ (ANSP except 2 ♂♂, 1 ♀ LEM); Loreto (Kevan *et al.* 1964, Kevan 1978) [adult ♀; large ♀ juvs. with same data recorded by Hebard (1923); see *I.* (*A.*) *costulata*]; Mangrove I., Magdalena Bay (dunes), 13.III.1966, C. L. Hogue, 3 ♂♂ (1 LEM); La Paz (Kevan 1978); 4–9 and 14–22.IX.1967, J. Chemsak and A. L. M. Michelbacher, 2 juvs. (♀♀); elev. 25 feet, 30.IV.1969, S. C. Williams, 1 ♀; NW of La Paz and 59 mi. NW of La Paz (Kevan 1978) (latter ♀, not ♂); 70 mi. N of La Paz, 19.VII.1974, D. Otte, 1 ♀ (ANSP); 73 km N of La Paz, elev. 320 m, 19.X.1974, M. Descamps, 1 ♂, 1 ♀ (ANSP); 12 mi. N of La Paz on road to Pichilingue (Kevan *et al.* 1964, Kevan 1978); 5 mi. SW of La Paz, 7.IX.1967, [no collector,] 1 ♀; 18 mi. W of La Paz, 7.X.1983, F. Andrews and D. K. Faulkner, 1 ♀ (SDSNH); ca. 44 km W of La Paz at 0.2 km S of km 44 on Mex. Hwy. 1, Stop 79-14, 31.XII.1978, D. B. Weissman *et al.*, 1 ♂, 1 ♀; 43.5 km W of La Paz at km 43.5 on Mex. Hwy. 1, Stop 79-30, 4.I.1978, D. B. Weissman *et al.*, 1 ♀; 3.2 km S. [Rancho] Las Pocitas at km 109 on Mex. Hwy. 1, elev. 60 m, Stop 79-211, 28.IX.1979, D. B. Weissman *et al.*, 1 ♂, 2 ♀♀, 1 juv. (♀); 3 mi.

TABLE 1. Characters distinguishing subgenera of *Ichthiacris*.

Character	*Ichthiacris* sensu stricto[a]	*Atyphacris*[b]
Known distribution	Baja California only	Baja California, Sonora, Sinaloa
Sculpture	Strongly rugosostriate, with some (sometimes rather acute) tubercles[c]	Not so strongly striate,[d] somewhat rugose, granular or punctate, tubercles feeble or lacking[c]
Head		
Fastigium of vertex (dorsal)	Always distinctly longer than basal width	Variable, sometimes little if at all longer than basal width
Vertex proper (lateral view)	Abruptly convex above eyes, at least in males	Evenly or only weakly convex
Frontal profile	Strongly concave, usually sinuously	Usually only weakly concave, seldom sinuously
Lateral pronotal lobe		
Inferoposterior region	Often rugose, angle sometimes with small spine or denticle[c]	Seldom rugose, angle without spine or denticle
Metathoracic epimera	Not expanded, sometimes tuberculate	Sometimes expanded in females, not tuberculate
Tegminal vestiges	Present, sometimes slip-like but often lobe-like,[c] particularly in females	Always narrow and slip-like or absent
Males		
Epiphallus		
Posterior emargination	Broadly excavated to shallowly U-shaped	Deeply U-shaped or slot-like
Anterolaterally directed subterminal processes of lateral appendices	Prominent to exaggerated	Not prominent
Endophallus		
Apical parts of aedeagal valves and sclerites	Rather short or length moderate	Relatively short to very long
Females		
Ovipositor		
Dorsal valves in profile	Deep and apically sickle-like,[c] or tapered	Always tapered, not deep
Subgenital plate (dorsal)		
Posterior margin on either side of egg-guide	With distinct, short, longitudinal striations extending about half-way along margin	With indistinct or weak crenulations only, extending for but a short distance along margin

[a]Figures 1A–D, N, O, 2A–D, N, O, 3A, B, I, 4A, B, H, 5A, B, H, 6A–C, O, 7A–C, O, 8A, B, F, 9A, B, I, 10A, B, 11, 12, 13A, B, 14A, B.
[b]Figures 1E–M, 2E–M, 3C–H, 4C–G, 5C–G, 6D–N, 7D–N, 8C–E, 9C–H, 10C–H, 13C, 14C, 15, 16.
[c]More obvious external feature.
[d]Young nymphs are often distinctly more striated than adults.



D. K. McE. Kevan, 1990. Proc. San Diego Soc. Nat. Hist. 1: 1-34. ERRATUM

Page 5, caption to Figure 1:

end of line 2: for "holotype; O, I." read "♀; N, I."

line 3: for "♀; N," read "♂, holotype; O," and delete "♂,"

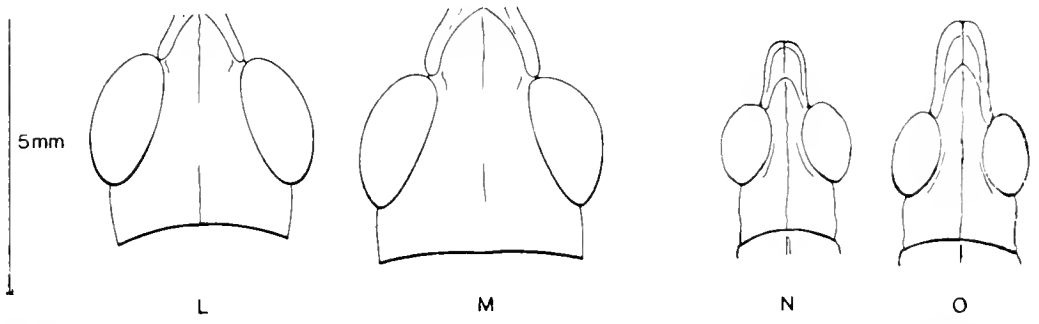


Figure 1. Dorsal view of heads of *Ichthiacris* spp. A, B, *I. (I.) rehni*, ♂, ♀; C, I *(I.) spinifera*, ♂, holotype; D, *I. (I.) spinifera*, ♀ allotype; E, F, *I. (Atyphacris) elongata*, ♂, ♀; G, H, *I. (A.) costulata*, ♂, ♀; I, J, *I. (A.) californica*, ♂, ♀; K, *I. (A.) celata*, ♂; L, M, *I. (A.) aptera*, ♂, holotype; O, *I. (I.) parva*, ♀; N, *I. (I.) parva*, ♂, ♀ (last-instar juv.).

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		[illegible] seldom sinuously
Ovipositor		
Dorsal valves in profile	Deep and apically sickle-like,[c] or tapered	Always tapered, not deep
Subgenital plate (dorsal)		
Posterior margin on either side of egg-guide	With distinct, short, longitudinal striations extending about half-way along margin	With indistinct or weak crenulations only, extending for but a short distance along margin

[a]Figures 1A–D, N, O, 2A–D, N, O, 3A, B, I, 4A, B, H, 5A, B, H, 6A–C, O, 7A–C, O, 8A, B, F, 9A, B, I, 10A, B, H, 12, 13A, B, 14A, B.
[b]Figures 1E–M, 2E–M, 3C–H, 4C–G, 5C–G, 6D–N, 7D–N, 8C–E, 9C–H, 10C–H, 13C, 14C, 15, 16.
[c]More obvious external feature.
[d]Young nymphs are often distinctly more striated than adults.

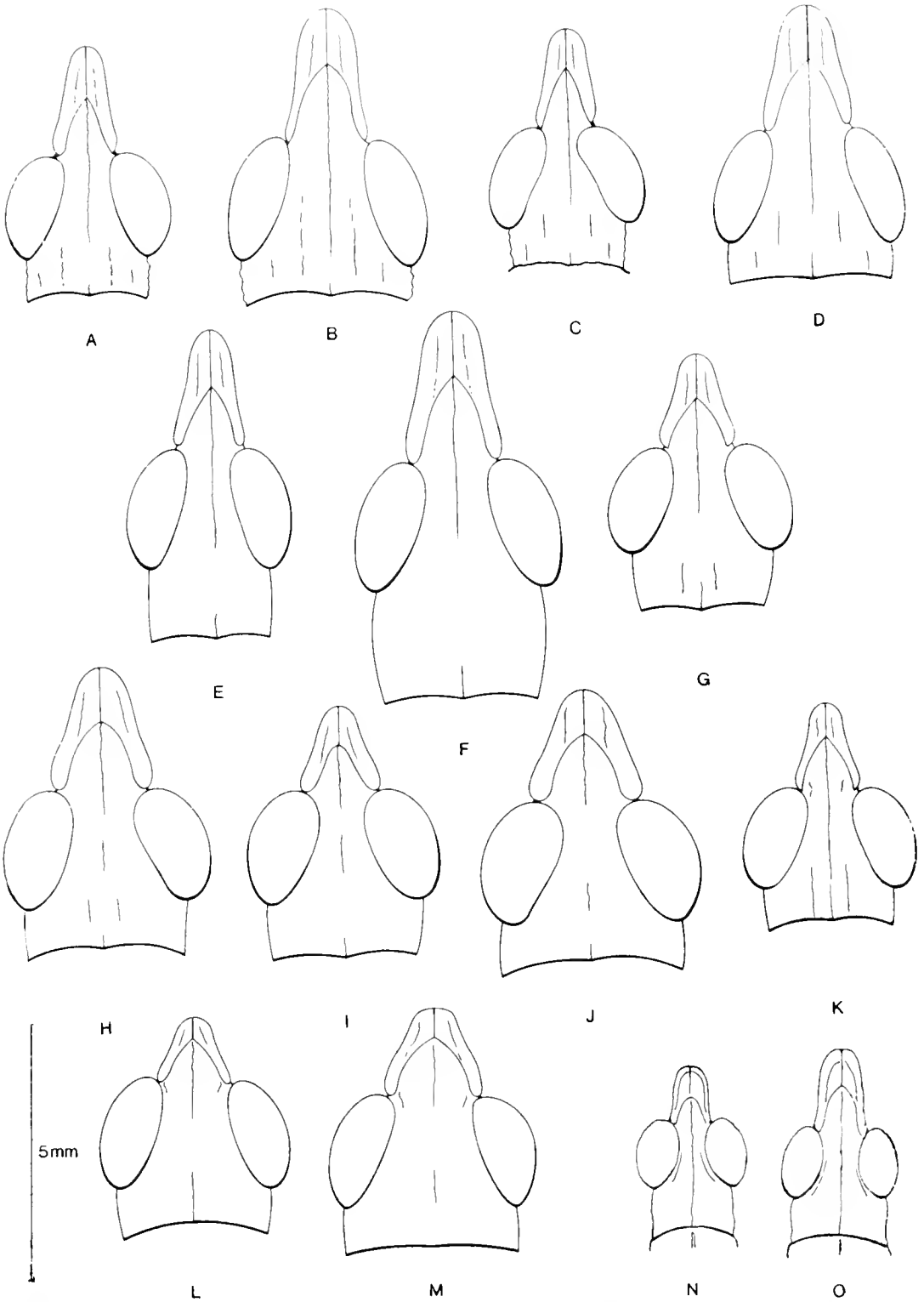

Figure 1. Dorsal view of heads of *Ichthiacris* spp. A, B, *I. (I.) rehni*, ♂, ♀; C, I. *(I.) spinifera*, ♂, holotype; D, *I. (I.) spinifera*, ♀ allotype; E, F, *I. (Atyphacris) elongata*, ♂, ♀; G, H, *I. (A.) costulata*, ♂, ♀; I, J, *I. (A.) californica*, ♂, ♀; K, *I. (A.) celata*, ♂; L, M, *I. (A.) aptera*, ♂, holotype; O, *I. (I.) parva*, ♀; N, *I. (I.) parva*, ♂, ♀ (last-instar juv.).

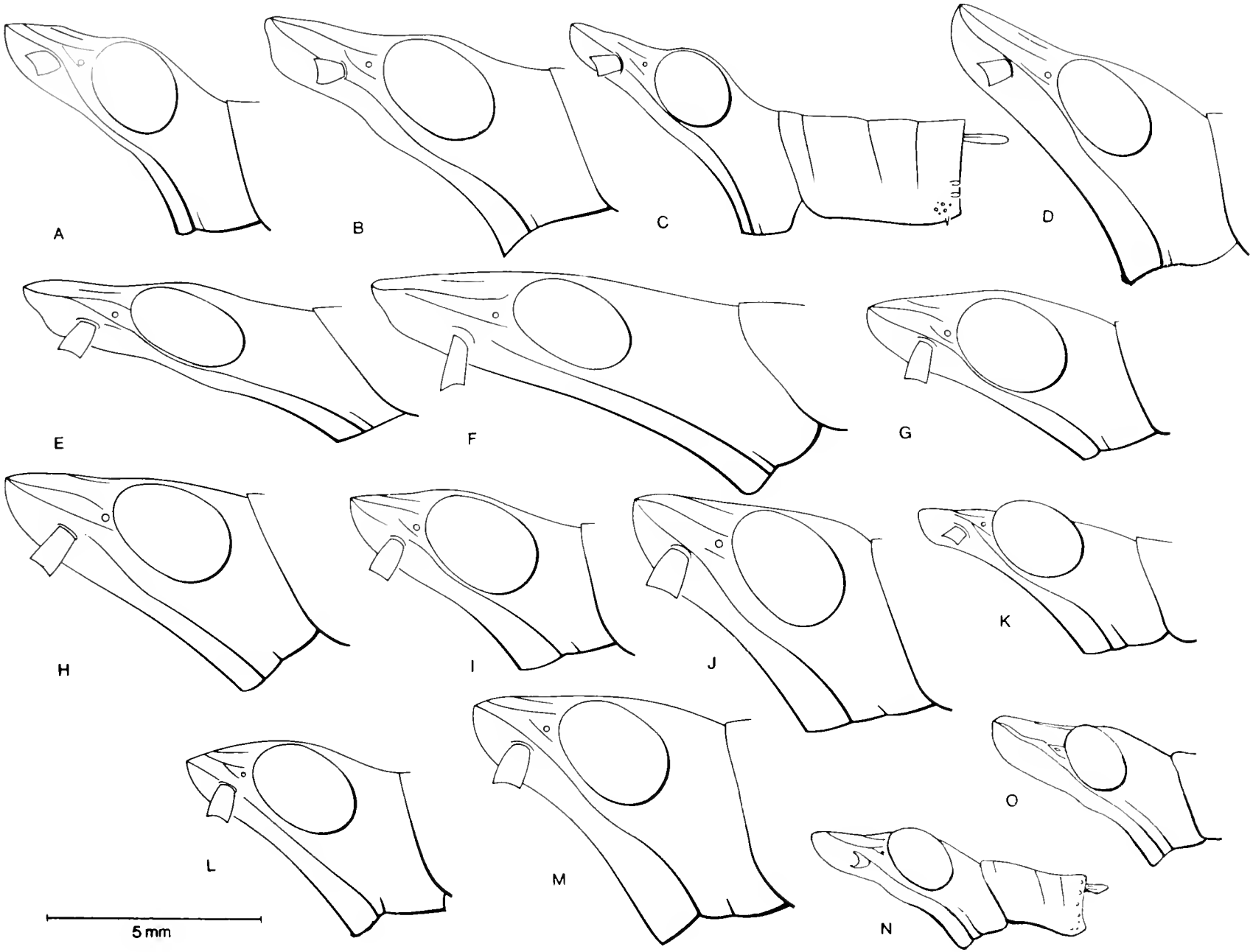

Figure 2. Lateral view of heads of *Ichthiacris* spp. A, B, *I. (I.) rehni*, ♂, ♀; C, *I. (I.) spinifera*, ♂ holotype, with pronotum (showing spine at interoposterior angle of lateral pronotal lobe) and tegmen (forewing) vestige; D, *I. (I.) spinifera*, ♀ allotype; E, F, *I. (Atyphacris) elongata*, ♂, ♀; G, H, *I. (A.) costulata*, ♂, ♀; I, J, *I. (A.) californica*, ♂, ♀; K, *I. (A.) celata*, ♂ paratype, LEM KPY-22-02-P1; in the holotype the frontal profile is scarcely sinuous and the fastigium of the frons is less rectangular); L, M, *I. (A.) aptera*, ♂, ♀; N, *I. (I.) parva*, ♂ holotype, with pronotum and tegmen vestige; O, *I. (I.) parva*, ♀ (last-instar juv.)

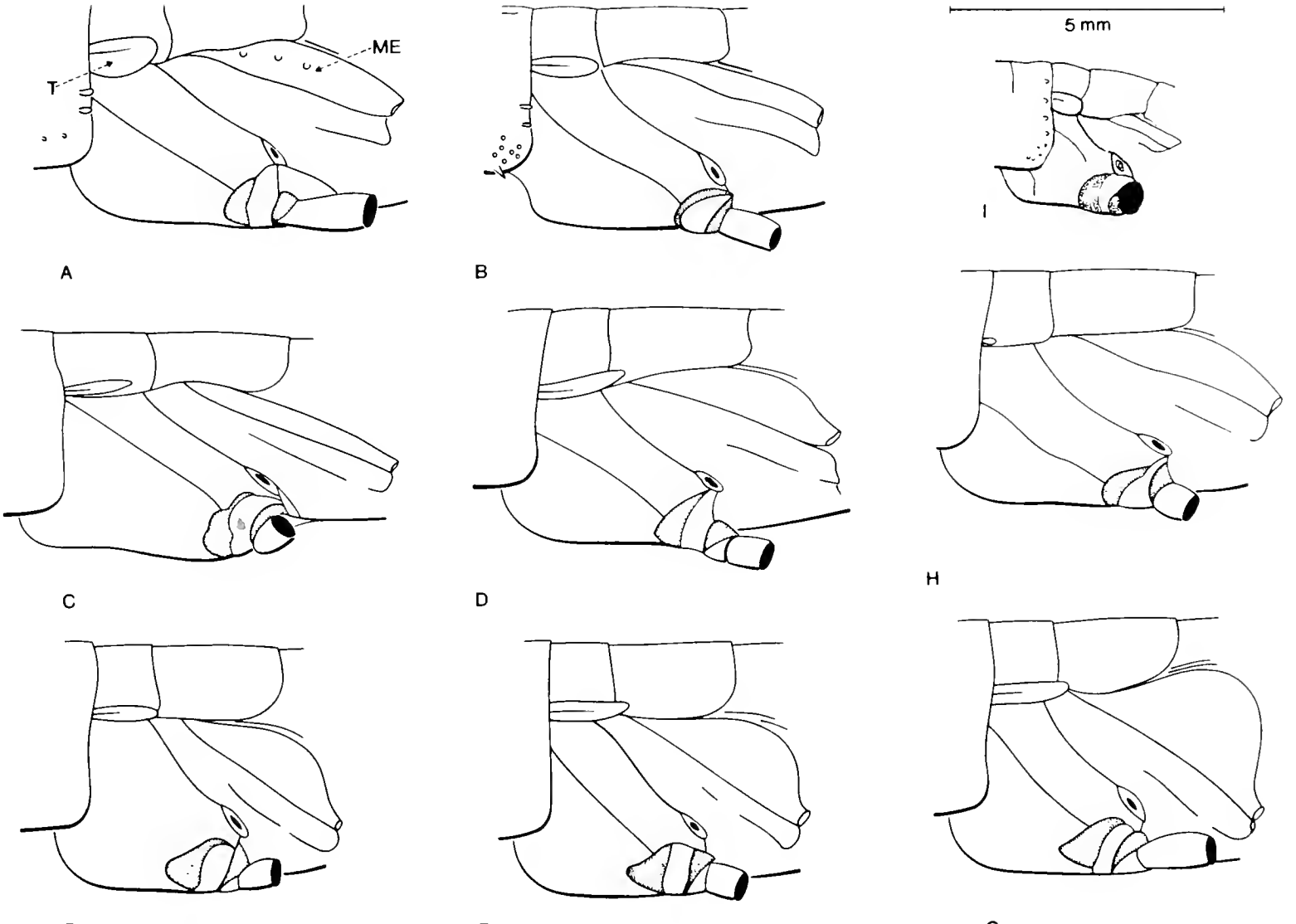

Figure 3. Lateral view of meso- and metathoracic regions of ♀ *Ichthiacris* spp., showing metathoracic epimeron (ME) and tegmen (forewing) vestige (T). A, *I.* (*I.*) *rehni*; B, *I.* (*I.*) *spinifera*, showing also spine on inferoposterior angle of lateral pronotal lobe; C, *I.* (*Atyphacris*) *elongata*; D, *I.* (*A.*) *costulata*, showing a narrower form of metathoracic epimeron; E, the same, showing wider form; F, *I.* (*A.*) *californica*, showing expanded form of metathoracic epimeron; G, the same, showing greatly expanded form; H, *I.* (*A.*) *aptera*; I, *I.* (*I.*) *parva* (last-instar juv.).

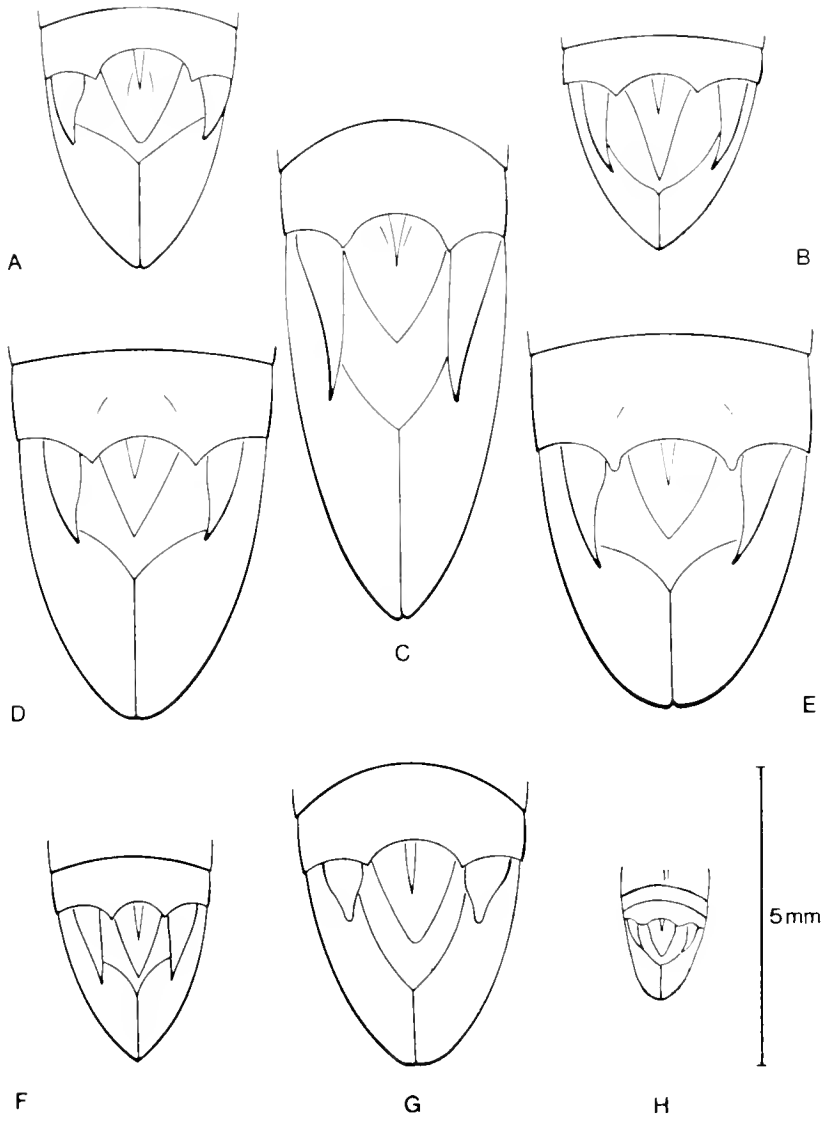

Figure 4. Dorsal view of abdominal terminalia of ♂ *Ichthiaeris* spp. A, *I.* (*I.*) *rehni*; B, *I.* (*I.*) *spinifera*; C, *I.* (*Atyphaeris*) *elongata*; D, *I.* (*A.*) *costulata*; E, *I.* (*A.*) *californica*; F, *I.* (*A.*) *celata*; G, *I.* (*A.*) *aptera*; H, *I.* (*I.*) *parva*.

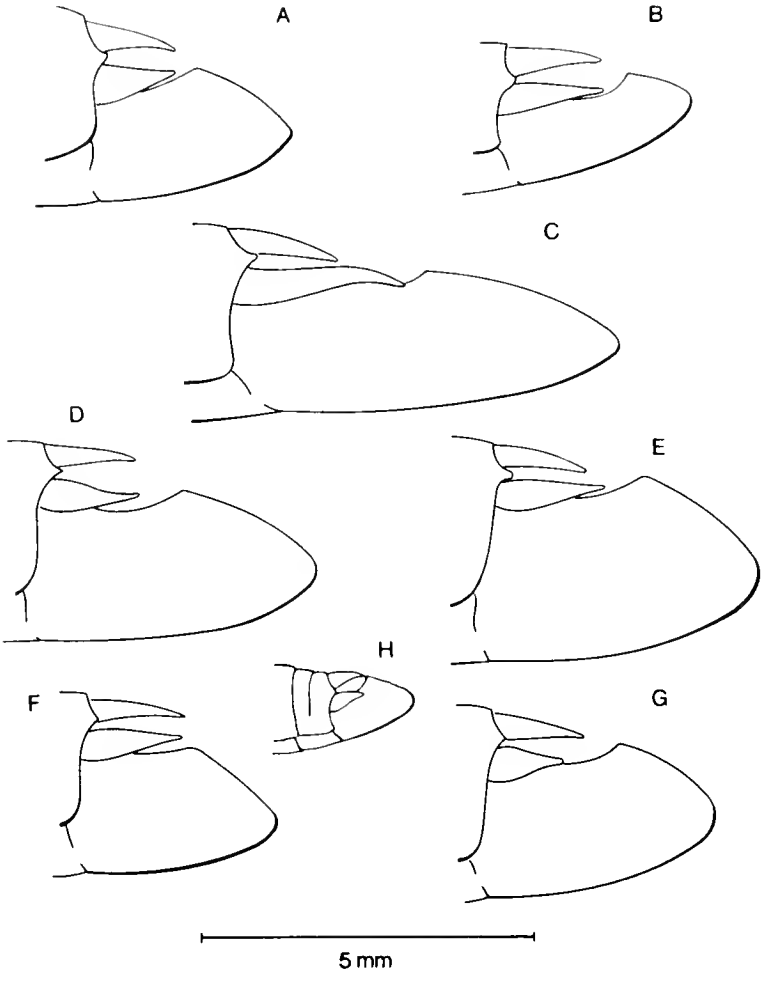

Figure 5. Lateral view of abdominal terminalia of ♂ *Ichthiacris* spp. A, *I.* (*I.*) *rehni*; B, *I.* (*I.*) *spinifera* (the angle of viewing makes the subgenital plate appear proportionately shorter than it really is); C, *I.* (*Atyphacris*) *elongata*; D, *I.* (*A.*) *costulata*; E, *I.* (*A.*) *californica*; F, *I.* (*A.*) *celata*; G, *I.* (*A.*) *aptera*; H, *I.* (*I.*) *parva*.

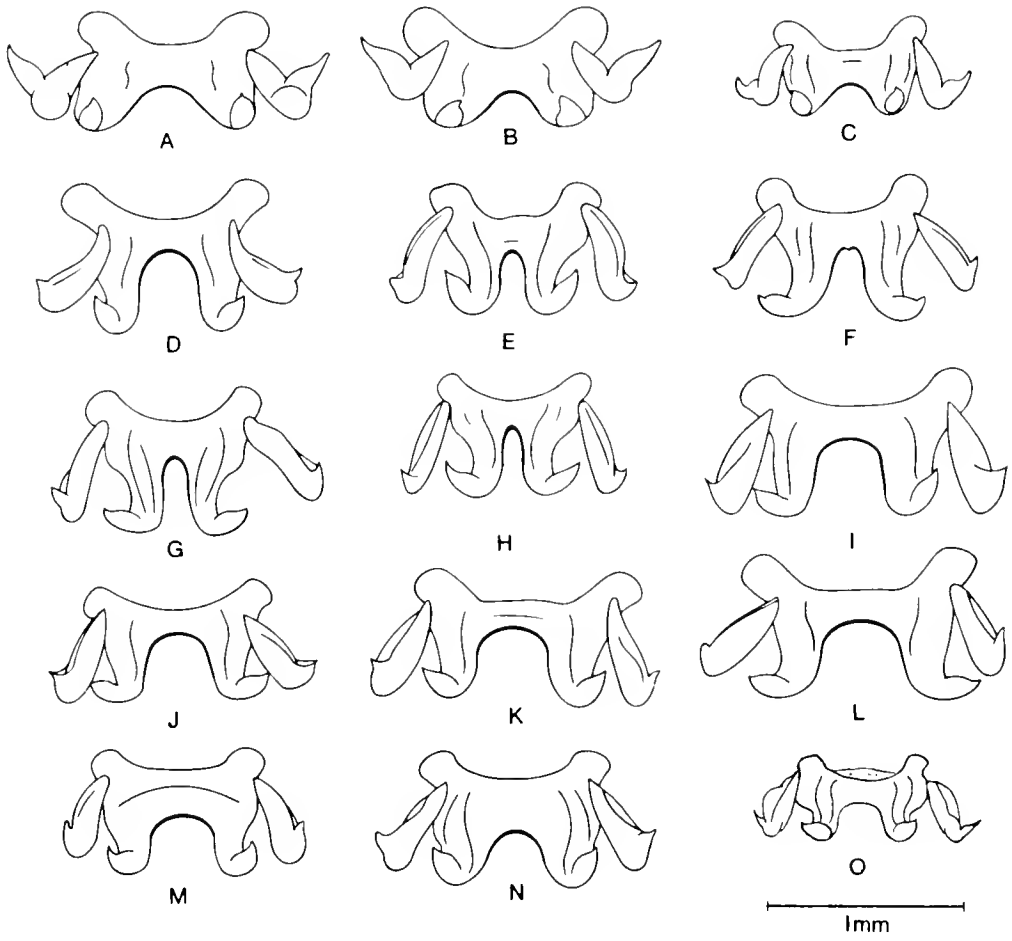

Figure 6. Epiphalli of ♂ *Ichthiacris* spp. A, B, *I.* (*I.*) *rehni* (A, 44 km W of La Paz; B, Arroyo Seco); C, *I.* (*I.*) *spinifera*, holotype; D, *I.* (*Atyphacris*) *elongata*, paratype, CAS; E–H, *I.* (*A.*) *costulata* (E, El Arco; F, road to La Burrera; G, 10 km S of San Pedro; H, 44 km W of La Paz); I–L, *I.* (*A.*) *californica* (I, El Triunfo; J, 4.3 km SE of Valle Perdido; K, La Burrera; L, 11.2 km S of Todos Santos); M, *I.* (*A.*) *celata*, holotype; N, *I.* (*A.*) *aptera*, paralectotype; O, *I.* (*I.*) *parva*, paratype, LEM KPY-21-05-P4.

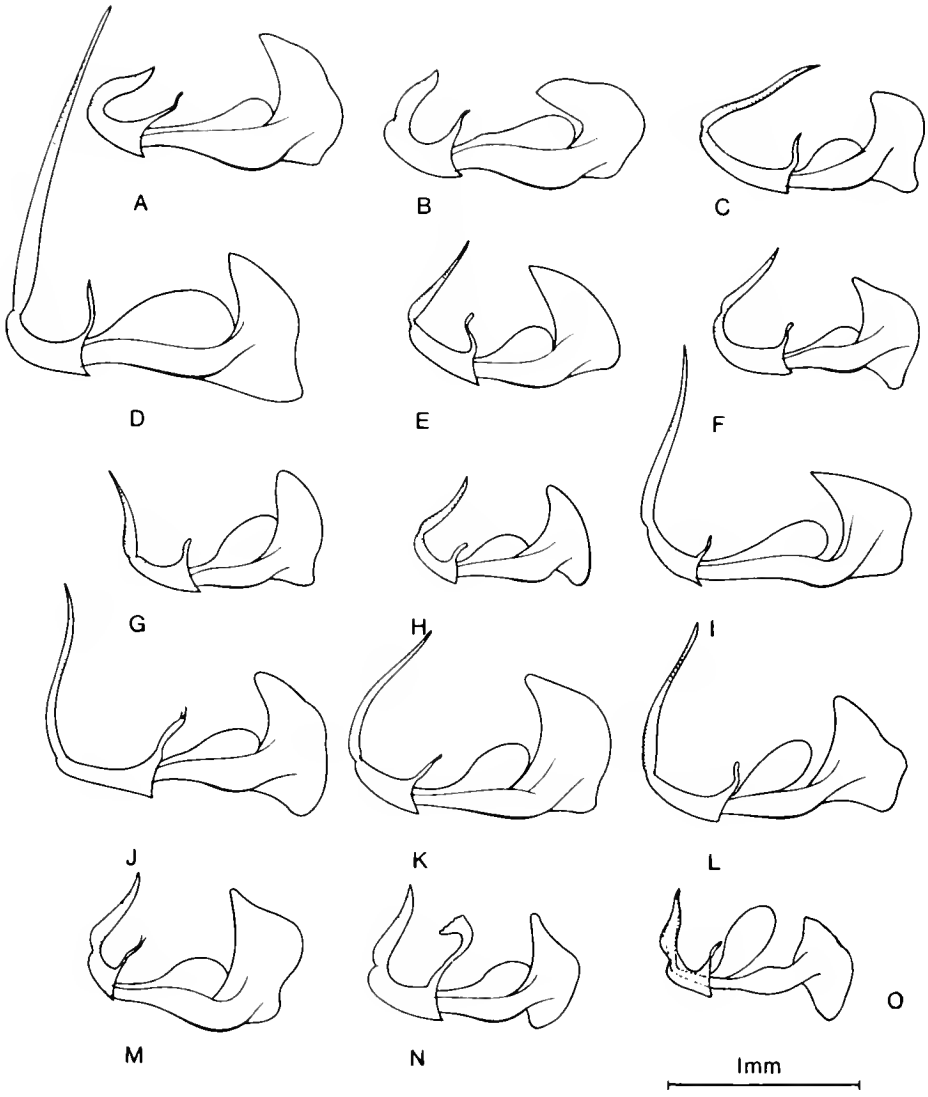

Figure 7. Aedeagi of ♂ *Ichthiacris* spp. . A, B, *I.* (*I.*) *rehni* (A, 44 km W of La Paz; B, Arroyo Seco); C, *I.* (*I.*) *spinifera*, holotype; D, *I.* (*Atyphacris*) *elongata*, paratype, CAS; E–H, *I.* (*A.*) *costulata* (E, El Arco; F, Puerto Escondido; G, road to La Burrera; H, 44 km W of La Paz); I–L, *I.* (*A.*) *californica* (I, El Triunfo; J, 4.3 km SE of Valle Perdido; K, La Burrera; L, 11.2 km S of Todos Santos); M, *I.* (*A.*) *celata*, holotype; N, *I.* (*A.*) *aptera*, paralectotype; O, *I.* (*I.*) *parva*, paratype, LEM KPY-21-05-P4.

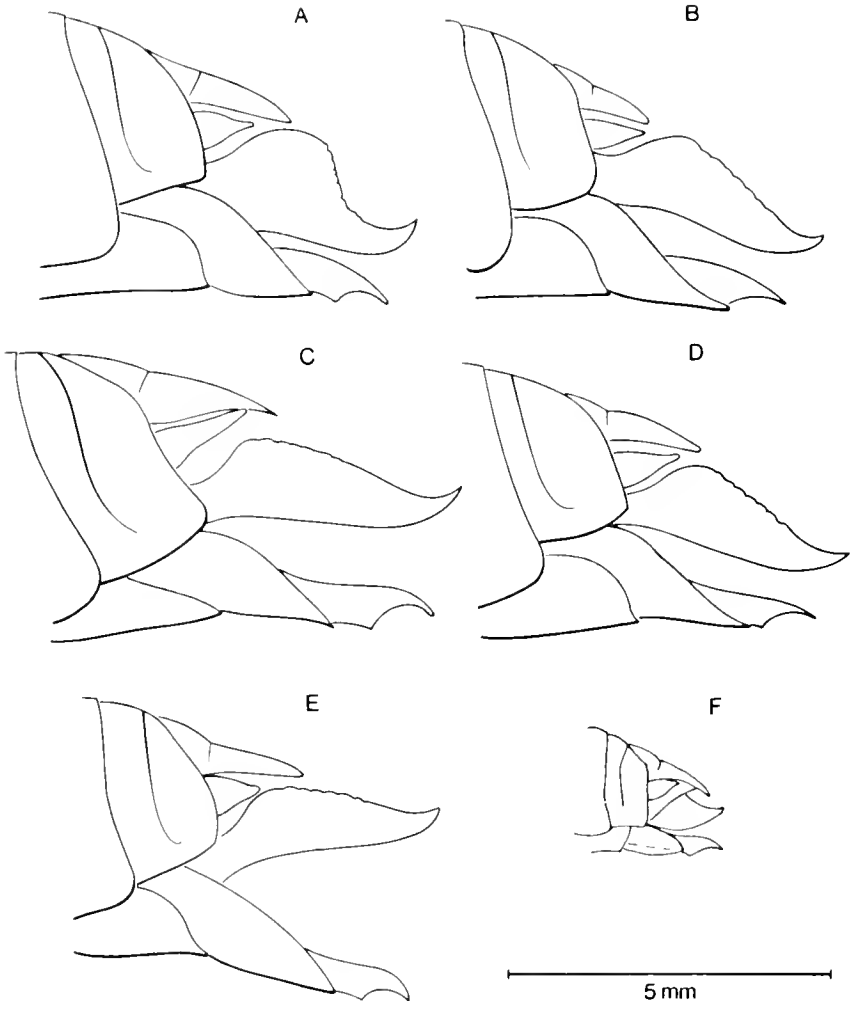

Figure 8. Lateral view of abdominal terminalia of ♀ *Ichthiacris* spp., showing ovipositor. A, *I.* (*I.*) *rehni*; B, *I.* (*I.*) *spinifera*; C, *I.* (*Atyphacris*) *elongata*; D, *I.* (*A.*) *costulata* [*I.* (*A.*) *californica* similar]; E, *I.* (*A.*) *aptera*; F, *I.* (*I.*) *parva* (last-instar juv.).

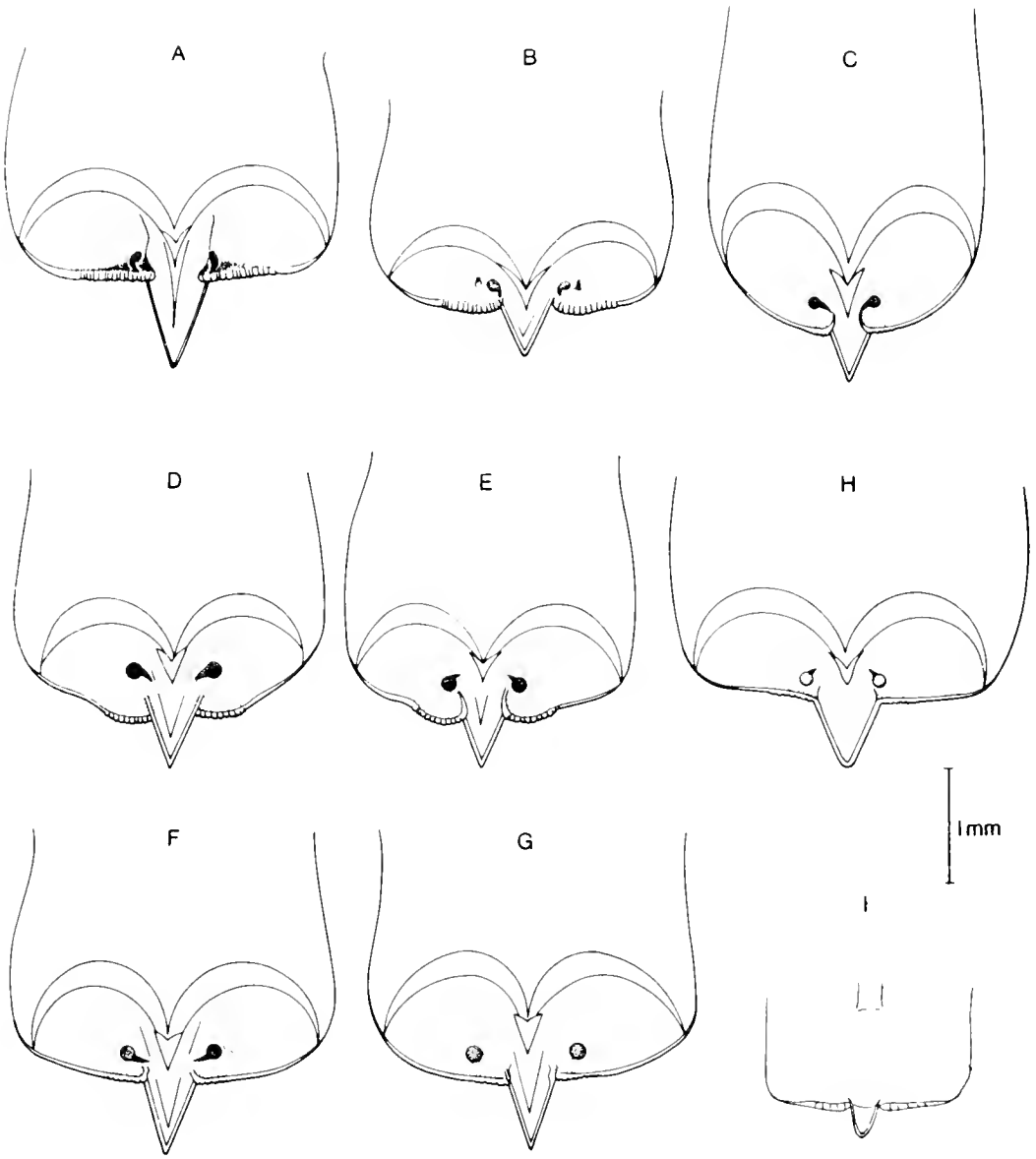

Figure 9. Dorsal view of subgenital plates of ♀ *Ichthiacris* spp. A, *I.* (*I.*) *rehni* (43.5 km W of La Paz); B, *I.* (*I.*) *spinifera*, paratype, LEM KPY-21-06-P3; C, *I.* (*Atyphacris*) *elongata*, paratype, LEM KPY-21-03-P3; D, E, *I.* (*A.*) *costulata* (D, Puerto Escondido; E, 25 km S of San Ignacio); F, G, *I.* (*A.*) *californica* (F, La Burrera; G, El Triunfo); H, *I.* (*A.*) *aptera* (La Burrera); I, *I.* (*I.*) *parva*, last-instar juv. (allotype)

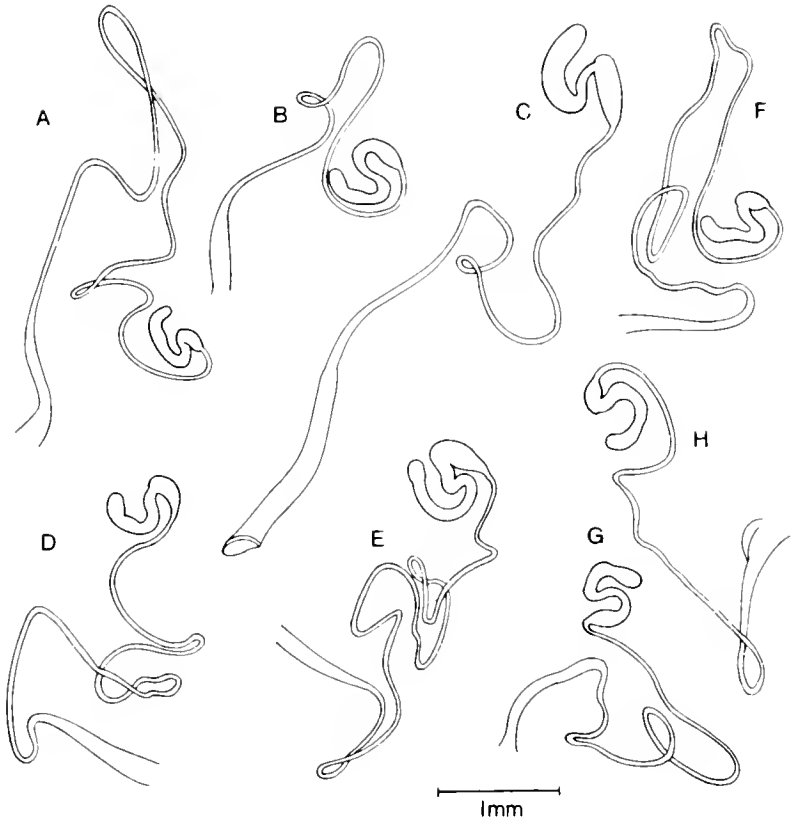

Figure 10. Receptacula seminis of ♀ *Ichthiacris* spp. A, *I.* (*I.*) *rehni* (43.5 km W of La Paz); B, *I.* (*I.*) *spinifera*, paratype, LEM KPY-21-06-P3; C, *I.* (*Atyphacris*) *elongata*, paratype, LEM KPY-21-03-P3; D, E, *I.* (*A.*) *costulata* (same specimens as in Figure 9); F, G, *I.* (*A.*) *californica* (same specimens as in Figure 9); H, *I.* (*A.*) *aptera* (La Burrera).

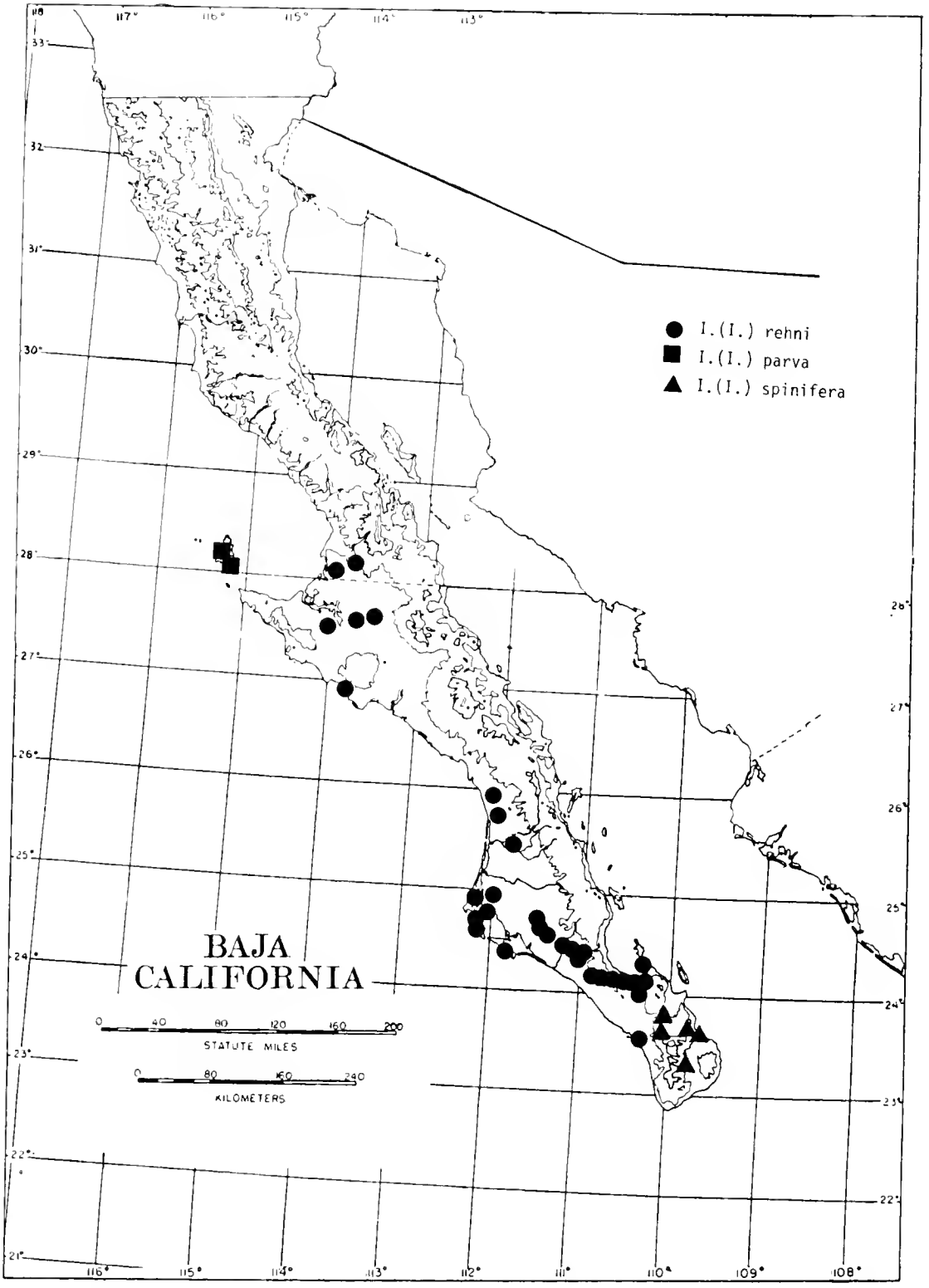

Figure 11. Known distribution of *Ichthiacris*, sensu stricto. Circles, *I. (I.) rehni*; squares, *I. (I.) parva*; triangles, *I. (I.) spinifera*.

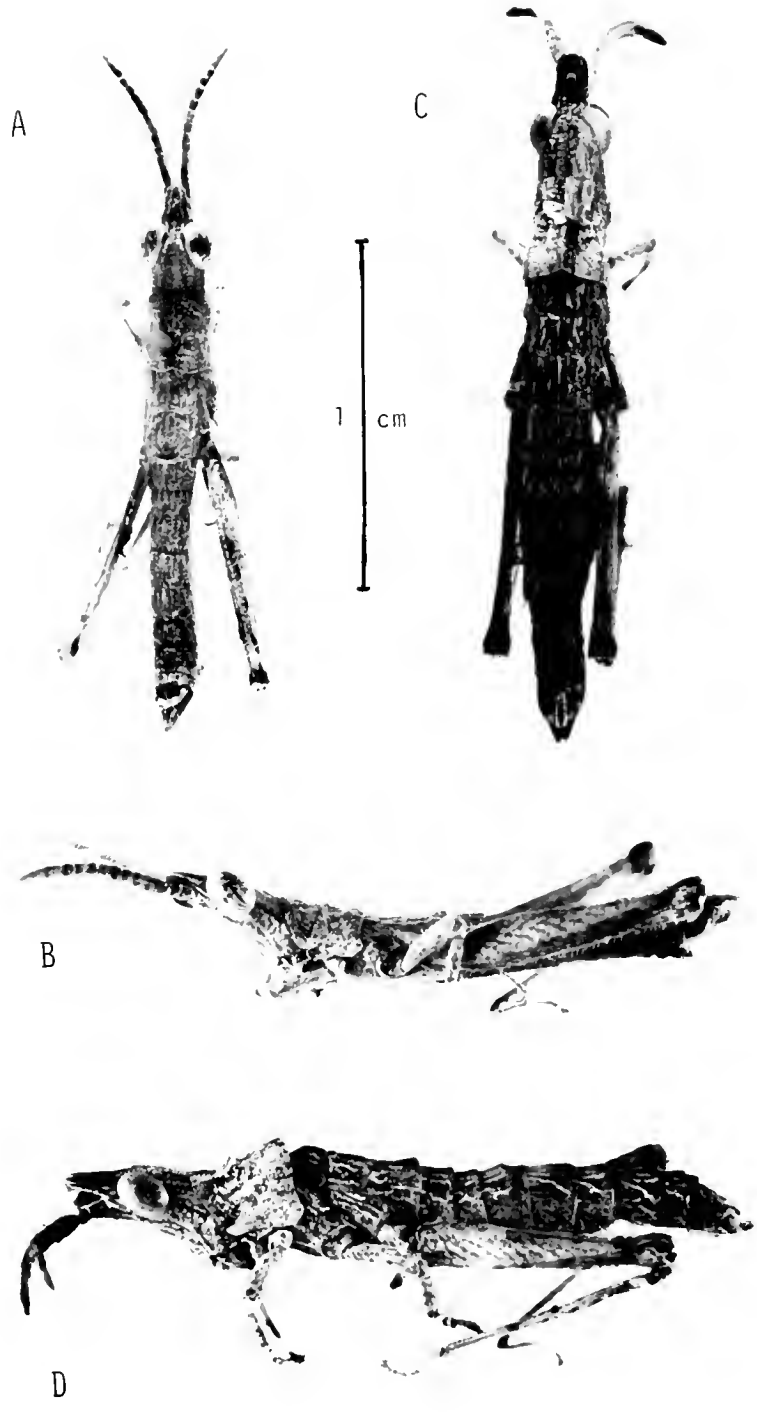

Figure 12. *Ichthiacris (I.) parva*, n. sp., type specimens. A, ♂ holotype, dorsal view; B, the same, lateral view; C, last-instar ♀ nymph, allotype, dorsal view; D, the same, lateral view.

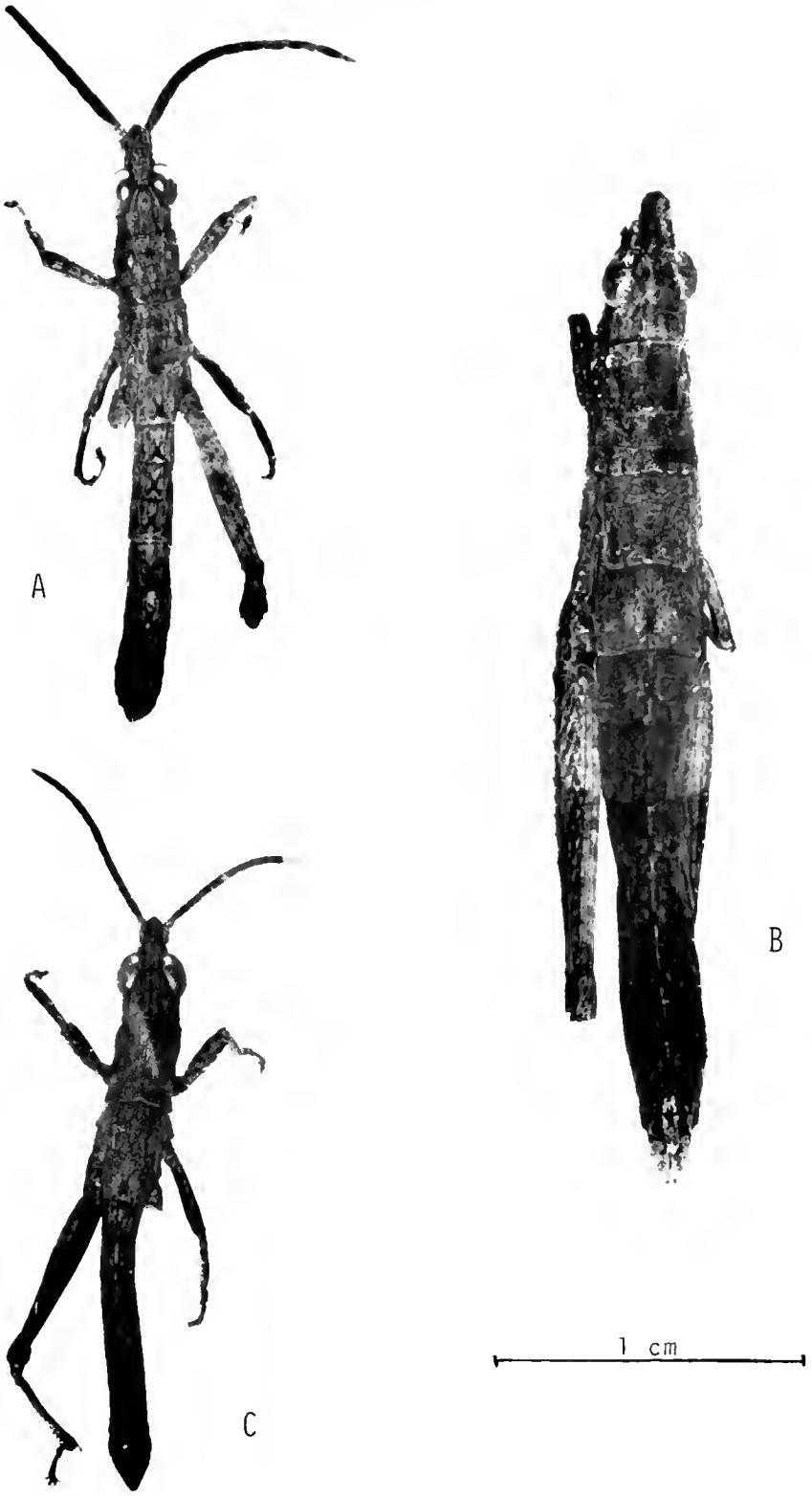

Figure 13. *Ichthiacris* n. spp., type specimens, dorsal view. A, *I.* (*I.*) *spinifera*, ♂ holotype; B, the same, ♀ allotype; C, *I.* (*Atyphacris*) *celata*, ♂ holotype.

TABLE 2. Characters distinguishing species of *Ichthiacris* sensu stricto.

Character	*I.(I.) rehni*[a]	*I. (I.) parva*[b]	*I. (I.) spinifera*[c]
Known distribution	Baja California from a little N of 28°N to almost 23 1/2°N	Isla Cedros, SW Baja California Norte, only	Baja California Sur S of 24°N only
Size (mm body length)	Averaging larger: ♂ 18.5–25; ♀ 26.5–45	Very small: ♂ 14.5–15.8; ♀ < 25[d]	Moderate: ♂ 18.5–23; ♀ 29–33
Sculpture (striation)	Strong, usually with prominent irregularly arranged tubercles[d]	Moderately strong, with pustular tubercles (Fig. 12)	Less strong, with few tubercles (Figs. 13 and 14A, B)
Frontal profile	Sinuous in both sexes (Fig. 2A, B)	Sinuous in both sexes (Fig. 2N, O)	Sinuous in males, less or scarcely so in females (Fig. 2C, D)
Inferoposterior region of lateral pronotal lobe	Usually without prominent granules or tubercles; angle without spine or denticle (Figure 3A).	Usually with indications of tubercles[d]; angle without spine or denticle (Fig. 2N, O)	Usually with small, granular tubercles; with small spine or denticle (Figs. 2C and 3B)[d]
Tegminal vestiges	Generally broad (often as broad as long) in females; usually at least half as broad as long in males (Fig. 3A)	Generally broad in females (so far as known); narrow and scale-like in males (Figs. 2N and 3I)	Narrow and slip-like in both sexes, less than half as broad as long (Figs. 2C and 3B)
Males			
10th abdominal tergum (dorsal)			
Posterior dorsolateral projections	Pointed, sometimes inwardly directed (Fig. 4A)	Broadly triangular (Fig. 4H)	Rather broadly triangular (Fig. 4B)
Cerci	Relatively robust, little incurved (Figs. 4A and 5A)	Relatively robust, little incurved (Figs. 4H and 5H)	Slender, distinctly incurved (Figs. 4B and 5B)
Epiphallus	Relatively large (Fig. 6A, B)	Small (Fig. 6O)	Moderate-sized (Fig. 6C)
Anterolaterally directed subterminal processes of lateral appendices	Very large and prominent (Fig. 6A, B)	Small, acute (Fig. 6O)	Moderate-sized (Fig. 6C)
Endophallus	Relatively large (Fig. 7A, B)	Small (Fig. 7O)	Moderate-sized (Fig. 7C)
Apical in relation to basal pairs of aedeagal valves	Shorter (Fig. 7A, B)	Shorter (Fig. 7O)	At least as long (Fig. 7C)
Females			
Ovipositor			
Dorsal valves in profile	Deep, apically sickle-like (Fig. 8A)[d]	Apparently rather deep (known only for last-instar nymph, Fig. 8F)	Relatively more slender and tapering, not apically sickle-like (Fig. 8B)[d]
Subgenital plate (dorsal)			
Sclerotized areas on either side of egg-guide	Transversely elongate-triangular (Fig. 9A)	[Unknown (nymph, Fig. 9I)]	Irregularly subquadrate (Fig. 9B)

[a]Figures 1A, B, 2A, B, 3A, 4A, 5A, 6A, B, 7A, B, 8A, 9A, 10A, 11.
[b]Figures 1N, O, 2N, O, 3I, 4H, 5H, 6O, 7O, 8F, 9I, 11, 12.
[c]Figures 1C, D, 2C, D, 3B, 4B, 5B, 6C, 7C, 8B, 9B, 10B, 11, 13A, B, 14A, B.
[d]More obvious external feature

SE of Pozo Grande (Kevan 1978); Isla Magdalena, Howland's Lagoon, sand dunes, Stop 83-93, 8.VII.1983, D. B. Weissman and V. F. Lee, 8 ♂♂ (mostly rather small), 13 ♀♀ (generally rather small to very small), 1 ♂ juv. (?2nd instar), 1 ♀ juv. (last instar) (3 ♂♂, 4 ♀♀ LEM); Isla Magdalena, canyon 1 km NW of Puerto [Bahía] Magdalena, Stop 83-94, 8.VII.1983, [D. B. Weissman], D. K. Faulkner and D. C. Lightfoot, 1 ♀ (rather small) (SDSNH); [Puerto] San Carlos, Magdalena Bay, 25.IX.1981, D. Faulkner, 1 ♂, 1 ♀ (SDSNH); 12 mi. S of La Purisima [as "Colonía Puerissima"], 5.X.1967, G. A. Marsh, 1 ♀ (very large) (LEM); 19 mi. SW of San Miguel Comondú (Kevan 1978); Isla Santa Margarita, 3 km SW of Puerto Cortes, sand dunes, Stop 83-92, 7.VII.1983, D. B. Weissman and D. C. Lightfoot, 3 ♂♂ (rather small), 2 ♀♀ (rather small), 2 ♀juvs. (1 last instar; 1 small, ?2nd instar); Santa [as "San"] Rita (Kevan 1978); 2 mi. SE of Santa Rita (Kevan 1978); 13.5 km N of Todos Santos, elev. 46 m, Cape thorn forest, beaten from *Hymenoclea monogyra* Torr. and Gray, 7–8.I.1981, E. L. Sleeper, 2333/10948, 1 ♂, 1 ♂ juv. (last instar) (CSLB); [Ejido] Vizcaíno, 69.5 km SE of Guerrero Negro, elev. 121 m, wash, on *Hymenocle monogyra*, 22.XI.1980, E. L. Sleeper, 2742/11325, 1 ♀ (CSLB); 21.0 km W of Ejido Vizcaíno, elev. 90 m, disturbed sand dune, *Encelia* sp., taken at 1600 hrs, 11.I.1980, E. L. Sleeper, 2740/11340, 1 ♂ (CSLB); 68.0 km W of Ejido Vizcaíno, elev. 30 m, high stable sand dune with typical climax vegetation, *Encelia laciniata* Vasey and Rose, 11–12.8.1989, E. L. Sleeper, 2730/11355, 2 ♂♂, 2 ♀♀ (CSLB).

Remarks.—Because of a paucity of specimens in collections, there has been some confusion in the literature between this and other species of *Ichthiacris*. The female specimens recorded from "Mesquital" [presumably Rancho Mezquital in the extreme south of Baja California Norte—but see distribution of *I.* (A.) *costulata*], from 20 mi. S of El Arco, from Loreto, and from [El] Triunfo by Kevan *et al.* (1964) and repeated by Kevan (1978) belong, in fact, to *I.* (*A.*) *costulata* (and from the last two localities the specimens are last-instar nymphs and not adult females!). The same would seem to be the case also with the nymphs recorded as *I. rehni* by Kevan *et al.* (1964) from the Sierra de San Lazaro [now Sierra de la Victoria], as already noticed by Kevan (1978), from the islands of Coronados, Danzante, and San Marcos, and from 1.3 mi. NW of El Triunfo (all repeated, uncorrected, by Kevan 1978). The nymph recorded from [2.7 mi. SE of] Valle Perdido by Kevan (1978) now proves to belong to the new species *I.* (*I.*) *spinifera*.

The inclusion by Kevan *et al.* (1964) of the females mentioned above under *I. rehni* was unfortunate as it resulted in the misrepresentation of this species in some of the line illustrations in their figure 4 (p. 241). The lateral view of the female's head should be more like that of the male's, in which the sinuous outline of the frontal profile is more strongly indicated. In addition, the ovipositor valves in the lateral view are shown as being tapered, whereas, in *I.* (*I.*) *rehni*, they are deeper and apically sickle-shaped. The lateral views of the meso- and metathoracic regions, alleged to be of *I.* (*I.*) *rehni* by Kevan *et al.* 1964, fig. 4E), are quite typical for some females of *I.* (*A.*) *costulata*, not for *I.* (*I.*) *rehni*. This is because the metathoracic epimeron (narrower than in most specimens of the former species) is distinctly convex instead of being rather straight dorsally. In *I.* (*A.*) *costulata* the metathoracic epimeron is quite variable in shape, usually being intermediate between the condition indicated by Kevan *et al.* (1964: 241, fig. 4E), allegedly for *I.* (*I.*) *rehni*, and that illustrated by them for *I.* (*A.*) *costulata* (their p. 246, fig. 6E). Kevan (1978) noted that the metathoracic epimera of *I. costulata* are wider and more "flared" than in *I. rehni*, but he did not comment on the erroneous nature of the figure referred to above. With regard to the shape of the tegminal vestiges, Kevan (1978) stated that a narrow form is unusual in *I. rehni*. In fact, the tegminal vestiges of female *I. rehni* are less than twice as long as wide and never as narrow as in the illustration of Kevan *et al.* (1964: 241, fig. 4E). Even in males they are at least a little wider than shown. In referring to their illustration of a female paralectotype of *I. rehni*, Kevan *et al.* (1964: 288, caption to plate 1) also suggested that its strongly rugosotuberculate integument was the less common condition of the species. Later, Kevan (1978) indicated the reverse to be the case. All less rugose specimens having narrow slip-like tegminal vestiges have proved to belong to *I.* (*A.*) *costulata*.

Ichthiacris (*Ichthiacris*) *parva*, new species
(Figures 1N, O; 2N, O; 3I; 4H; 5H; 6O; 7O; 8F; 9I; 11; 12)

Holotype.—Figure 12 A, B. CAS, type no. 15710, Mexico: Baja California Norte, Isla Cedros, Bahía del Sur, "Playa Playon," 28.IX.1984. Leafless shrubs bordering sandy dunes ca. 100 m from ocean; at night. D. B. Weissman and V. F. Lee, Stop 84-63, ♂.

Allotype.—Figure 12C, D. CAS, type no. 15710, Mexico: same data as holotype. Last-instar nymphal ♀.

Paratypes.—CAS, 2 ♂♂; LEM, type no. KPY-21-05-P4, 1 ♂, Mexico: same data as holotype.

Recognition.—Similar in most features to *I.* (*I.*) *rehni*, but size much smaller (♂ < 16, ♀ < 25 mm) and phallic structures differing as indicated (compare Figures 6O and 7O with Figures 6A, B and 7A, B). Other characters as indicated in Table 2.

Etymology.—Small, referring to the diminutive size.

Description of holotype.—Body moderately elongate and rather slender, coarsely rugosostriate throughout, with some scattered pustular tubercles on head and thorax; hairs of frons, sternum, legs, and end of abdomen neither long nor dense.

Antennae about as long as head and pronotum together, with 12 articles in addition to scape and pedicel, terminal article conical, about three times as long as wide, other articles, except scape, subquadrate; articulation between two basal articles of flagellum indistinct.

Head (Figures 1N and 2N) twice as long as basal width, a little longer than pronotum; eyes large and prominent, elliptical, depth about two-thirds of length, interocular space at narrowest about half greatest dorsal width of an eye; fastigium of vertex bluntly elongate-triangular with slightly sinuous margins, about 1.75 times as long as basal width, with a pair of strong, rather irregular, mediolateral longitudinal ridges; median sulcus between dorsal areolae extending backward for nearly one-third of length of fastigium before giving way to a distinct medial carinula that extends backward as a strong, raised ridge between eyes, becoming obsolescent in the occipital region; vertex proper abruptly convex in lateral view; eyes margined dorsally by rather strong oblique ridges; frontal profile very strongly oblique, concave and somewhat sinuous; fastigium of frons almost straight below and nearly parallel to dorsum of fastigium of vertex, which

it meets apically at a moderately acute angle (as in Figure 2N); frontal ridge very prominent above antennal bases, strongly and narrowly sulcate below it to the median ocellus, beneath which it is less prominent as far as clypeus; lateral frontal carinae, in lateral view, strong and sinuous, passing close to ventral margins of eyes, in frontal view also moderately sinuous.

Thorax (Figure 2N): Pronotum subcylindrical; disk with median carina well defined in front of, but weaker behind, median transverse sulcus; lateral carinae virtually obsolete, anterior margin subtruncate, posterior margin weakly biarcuate; posterior transverse sulcus almost straight, crossing pronotal disk at about four-fifths of pronotal length; median transverse sulcus also almost straight, crossing disk distinctly behind its middle; lateral pronotal lobe considerably longer than deep, its anterior margin oblique, almost straight, its inferior margin strongly sinuous and its posterior margin almost vertical but concave and with prominently protruding ends to longitudinal ridges of lobe; inferoposterior angle obliquely truncate and with a rugose area immediately anterior to it, lacking a spine or denticle (Figure 2N). Mesonotum transverse, distinctly shorter than either metazona or mesozona (region between median and posterior sulci) of pronotum. Metanotum about 1.5 times as wide as long; metathoracic epimera very narrow; prosternal tubercle stout, broadly conical, rounded apically, flattened anteriorly; mesosternal lobes almost twice as long as wide, their interspace considerably wider than a lobe.

Wings: Tegminal vestiges (Figure 2N) very small, parallel-sided, blunt apically, extending only slightly beyond posterior margin of mesonotum; hindwing vestiges (if any) not visible.

Legs: Front femora barely as long as pronotum, weakly incrassate and feebly carinate dorsally; middle femora similar to front femora, but more flattened than incrassate; hind femora moderately slender, about 4.6 times as long as greatest width, at rest not quite reaching apex of abdomen.

Abdomen: Median dorsal carina on terga I–VII strong, well defined, that on tergum I exaggerated toward posterior margin; tympana lacking; terminalia as in Figures 4H and 5H; tergum X with posterior emargination shallow, of moderate width, concave; dorsolateral processes bluntly triangular; epiproct broadly triangular, not much longer than basal width; cerci comparatively short and stout, barely reaching apex of epiproct; subgenital plate acute in lateral view.

Phallic structures (from LEM paratype, not extracted from holotype; Figures 6O, 7O): Epiphallus small with comparatively narrow bridge; lateral plates broadly expanded basally; posterior margin broadly and shallowly U-shaped; lophi short and dorsolaterally directed; lateral appendices stout, of characteristic, irregular form with subterminal processes prominent, pointed, and much smaller than in other species of subgenus *Ichthiacris* (compare Figure 6O with Figures 6A–C); endophallus small with apical parts of aedeagal sclerites and valves short and blade-like (Figure 7O), much as in *I.* (*I.*) *rehni* (Figure 7A, B).

Coloration grayish, body mottled fuscous with many blackish pustular tubercles; cheeks margined by blackish above; inferior regions of lateral pronotal lobes and of genicular lobes of hind femora all somewhat paler; eyes pale brown with six curved blackish stripes; tegminal vestiges with dorsal (posterior) margins reddish; hind femora with carinae of outer faces flecked with elongate blackish maculations, inner faces rather uniform grayish; hind tibiae blackish-gray above.

Measurements (mm): Length of body 15.8; antenna 5.0; head 3.0; pronotum (mid-dorsal) 2.1; tegmen vestige 0.65; hind femur 6.9; maximum width of hind femur 1.4.

Description of Allotype.—[No adult female is available, but in this genus last-instar nymphs resemble adults sufficiently closely for valid description.] The specimen agrees in general with the description of the holotype but differs in its slightly larger size, in its abdominal terminalia, and in the following:

Antennae more ensiform, considerably shorter than head and pronotum together, with short, strongly transverse articles. [In an adult female, the antennae would have slightly longer articles than in this allotype.]

Head (Figures 1O and 2O) relatively shorter, very little longer than pronotum; eyes less prominent, greatest depth less than two-thirds of length; interocular space at narrowest about as wide as greatest dorsal width of an eye [in an adult female the space would doubtless be a little wider still]; vertex proper, in lateral view, not so strongly convex between eyes; frontal profile a little less oblique, not quite so sinuous.

Thorax (Figure 3I): Pronotum, in dorsal view, slightly divergent posteriorly, lateral carinae indicated in prozona, lateral lobe with inferior margin nearly straight, posterior margin less concave and inferoposterior angle less truncate than in holotype; mesonotum a little less transverse and prosternal tubercle a little more transverse than in holotype; mesosternal lobes not quite so long as wide, their interspace with concave margins, least width of latter greater than the greatest width of a mesosternal lobe.

Wings: Buds of tegminal vestiges (Figure 3I) broad and lobe-like (that of left being wider and more oval than that of right), not extending beyond posterior margin of mesonotum. [In an adult female the tegminal vestiges would be similar but perhaps a little larger in proportion.]

Legs: Front femora shorter than pronotum and not incrassate.

Abdomen: Medial dorsal carina not exaggerated on tergum I; terminalia as in Figure 8F; epiproct a little broader and blunter than in male; cerci short, stout, conical, not half so long as epiproct; ovipositor (Figure 8F) with dorsal valves moderately deep in lateral view but smooth, in accord with nymphal status; subgenital plate in dorsal view (Figure 9I) with egg-guide short and bluntly triangular [in an adult female it would doubtless be a little longer and more acute], posterior margin on either side with short longitudinal striae sparse but extending for about half width of margin [in an adult female they would presumably be denser], columellae and associated sclerotized patches undeveloped; spermatheca lacking, in accord with nymphal status.

Coloration same as that of holotype.

Measurements (mm): Length of body 18.2; antennae ca. 4 (curved); head 3.8; pronotum 2.8; tegminal vestige bud 0.9; hind femur 7.0; maximum width of hind femur 1.5. [An adult female would presumably not exceed 25 mm in body length.]

Paratypes.—These agree quite closely with the holotype, though two (CAS) are even smaller, the smaller of these being only 14.5 mm in body length; another (LEM) has tegminal vestiges proportionately even smaller than those of the holotype, though in all specimens these are distinctly longer than wide. The coloration does not vary significantly, though it is a little darker (presumably because of postmortem discoloration) in two specimens.

Distribution (Figure 11).—Known only by the type series from Isla Cedros, off the southwestern coast of Baja California Norte.

Cytology.—I am informed by D. B. Weissman (*in litt.*, 1984) that the karyotype of this new species differs from that of other species of *Ichthiacris* examined by him in that, although $2n♂ = 19$, as is usual for Pyrgomorphidae, "there is only 1 small chromosome pair versus the normal 2; there are the normal 2 large bivalents during meiotic metaphase I, but [there are] 6 medium-sized bivalents versus the usual 5." Two specimens in anaphase II were checked to rule out the possibility of a heterozygous supernumerary segment.

Remarks.—This species would seem to be an insular derivative of the more widely distributed *I.* (*I.*) *rehni* and to have evolved in isolation. The epiphallus is anomalous, exhibiting, in comparison with other species of *Ichthiacris*, certain more primitive features. These include the divergent lophi characteristic of the subgenus *Atyphacris*, the more U-shaped posterior margin characteristic of *I.* (*A.*) *californica* [but with basally widened lateral plates, as in some *I.* (*A.*) *costulata*], and a curious, derived form of the lateral appendices (accompanied by a reduction in the size of their subterminal processes).

Ichthiacris (*Ichthiacris*) *spinifera*, new species
(Figures 1C, D; 2C, D; 3B; 4B; 5B; 6C; 7C; 8B; 9B; 10B; 13A, B; 14A, B)

Ichthiacris rehni (*nec* Bolívar); Kevan, 1978: 23 (*partim*—1 juv., [2.7 mi. SE] Valle Perdido, only).

Holotype.—Figures 13A, 14A. LEM, type no. KPY-21-06-H, Mexico: Baja Calif[ornia Sur], Arroyo [de] San Bartolo, 1 mi. SE San Bartolo, 20.I.1959, [no collector,]. ♂.

Allotype.—Figures 13B, 14B. CAS, type no. 15176. Mexico: Baja California Sur, first wash on road to Miraflores off Mex[ico] H[igh]w[a]y 1, 24.IV.1979, D. B. Weissman [= Stop 19] 79-95. ♀.

Paratypes.—CAS; LEM, type no. KPY-21-06-P3, Mexico: same data as allotype, 2 ♀♀; SDSNH, Mexico: Baja California Sur, 5.2 mi. W of Hwy. 1, road to Coro [or Coron, just S of Los Bariles and N of Buena Vista], 23.III.1986. D. K. Faulkner and N. Bloomfield. ♂.

Recognition.—Small spine or sharp denticle present on the inferoposterior angle of each lateral pronotal lobe (Figure 2C, 3B); integument only moderately, not strongly, rugose; tegminal vestiges narrow; dorsal ovipositor valves tapered.

Etymology.—Bearing spines, referring to the spine or sharp denticle on the inferoposterior angle of each lateral pronotal lobe.

Description of holotype.—Body moderately elongate and rather slender; integument coarsely rugosostriate throughout, with a few, small, scattered, pustular tubercles on head and pronotum; hairs of frons, sternum, legs, and ends of abdomen neither long nor dense.

Antennae comparatively long for the genus, i.e., distinctly longer than head and pronotum together, with 13 articles in addition to scape and pedicel; each article, except for basal ones, about twice as long as wide.

Head (Figures 1C, 2C) twice as long as basal width, distinctly longer than pronotum; eyes large and prominent, oval, depth about two-thirds of length; interocular space at narrowest about two-thirds of greatest dorsal width of an eye; fastigium of vertex bluntly elongate-triangular with almost straight margins, about 1.7 times as long as basal width, with a pair of strong mediolateral longitudinal ridges; median sulcus between dorsal areolae extending backward for more than one-third of length of fastigium; vertex proper rather abruptly convex between eyes; median carinula distinct only in front of narrowest part of interocular space, obsolescent behind this, a pair of strongly raised ridges margining the posterior two-thirds of eyes; frontal profile strongly oblique, concave and distinctly sinuous; fastigium of frons slightly sinuous in outline, meeting fastigium of vertex at a somewhat acute angle; frontal ridge very prominent above antennal bases, less strong below and narrowly sulcate to clypeus; lateral frontal carinae distinct, sinuous, passing very close to ventral margins of eyes, subparallel in anterior view.

Thorax (Figure 2C): Pronotum subcylindrical; disk with median carina weak and interrupted in front of median transverse sulcus, obsolescent behind it; lateral carinae obsolescent in front of median sulcus, obsolete behind it; anterior margin subtruncate, weakly concave in the middle; posterior margin weakly biarcuate; posterior transverse sulcus weakly biarcuate, crossing disk at about four-fifths of pronotal length; median transverse sulcus almost straight, crossing disk behind its middle; lateral pronotal lobe considerably longer than deep with almost straight margins; anterior margin oblique; posterior margin vertical but very slightly concave, bearing in its lower parts a pair of prominent low elongate tubercles; inferoposterior angle almost a right angle, bearing ventrally a sharp spine-like denticle. Mesonotum transverse, about as long as distance between median and posterior transverse sulci of pronotal disk. Metanotum quadrate; metathoracic epimera very narrow, elongate, tapered anteriorly (rather similar to, but narrower than, condition shown for female in Figure 5B): prosternal tubercle stout, broadly conical, rounded apically, flattened anteriorly; mesosternal lobes almost twice as long as wide, their interspace narrow but distinct, less than half width of a mesosternal lobe.

Wings (Figure 2C): Tegminal vestiges very small, narrowly elongate, not extending beyond posterior margin of mesonotum; hindwing vestiges absent or, if present, not visible beyond posterior margin of pronotum.

Legs: Front femora barely as long as pronotum, weakly incrassate and feebly carinate; middle femora shorter, slightly carinate; hind femora slender, a little more than five times as long as greatest width, not quite extending to apex of abdomen.

Abdomen: Median dorsal carina strong near posterior margins of segments, weaker in front of these; tympana lacking; terminalia as in Figures 4B and 5B; tergum X with posterior emargination of moderate width, concave, dorsolateral processes triangular; epiproct rather narrowly triangular, distinctly longer than wide; cerci somewhat incurved, rather slender, extending as far as apex of epiproct; subgenital plate in lateral view acute.

Phallic structures (Figures 6C, 7C): Epiphallus small, with comparatively narrow bridge but broad lateral plates; posterior emargination broadly and deeply concave; lophi short and dorsally directed; lateral appendices comparatively short and stout, their subterminal processes prominent but distinctly shorter than rest of appendices; endophallus relatively small, with apical parts of aedeagal valves and sclerites moderately elongate and slender, somewhat awl-like, a little longer than basal parts of

valves.

Coloration more or less uniformly grayish brown but with frons in region of median ocellus, most prominent parts of median dorsal carinae of head, abdomen, posterior (inner) faces of middle legs, and anterior (ventral) margins of tegminal vestiges blackish; rest of tegminal vestiges, ventral regions, and inner faces of hind femora pale, more or less testaceous; outer faces of hind tibiae brownish; genae and lower parts of lateral pronotal lobes without a pale stripe.

Measurements (mm): Length of body 18.5; antenna 7.5; head 3.3; pronotum (mid-dorsal) 2.6; hind femur 10.3; maximum width of hind femur 1.9.

Description of Allotype.—This specimen agrees in general with the holotype but differs in its larger size and somewhat more robust build and in the abdominal terminalia. Other differences are as follows:

Body with more numerous pustular tubercles.

Antennae: More ensiform, about equal in length to head and pronotum together, with distinctly broader and relatively shorter articles.

Head (Figures 1D and 2D) a little shorter in relation to width, about 1.7 times as long as basal width, very little longer than pronotum; eyes less prominently and more elongately oval, greatest depth less than two-thirds of length; interocular space, at narrowest, considerably wider than greatest dorsal width of an eye; fastigium of vertex relatively broader, only about 1.25 times as long as basal width; vertex proper only weakly convex between eyes; frontal profile slightly less oblique and scarcely sinuous; lateral frontal carinae a little more divergent in anterior view.

Thorax: Pronotum slightly divergent posteriorly in dorsal view, anterior margin of disk straight in middle; spine-like denticle of inferoposterior angle of lateral pronotal lobe longer and forming a more definite spine on left side; metanotum slightly transverse; metathoracic epimera slightly wider (Figure 3B); prosternal tubercle a little more transverse and less conical; mesosternal lobes not twice as long as wide, their interspace distinctly more than half the width of a lobe.

Wings: Tegminal vestiges extending slightly beyond posterior margin of mesonotum. (Figure 3B is of a paratype with shorter tegmina).

Legs: Front femora shorter than pronotum and not incrassate; hind femora barely surpassing abdominal tergum VI.

Abdomen: Median dorsal carina strong throughout; terminalia as in Figure 8B; epiproct a little broader than in male; cerci short, conical, ovipositor with dorsal valves tapering in lateral view (Figure 8B).

[Concealed copulatory structures (from LEM paratype KPY-21-06-P3): Subgenital plate dorsally (Figure 9B) with egg-guide acute, triangular, posterior margin on either side of it with short longitudinal striae extending for about half width of margin; columellae comma-shaped, not very heavily sclerotized; weakly sclerotized patches associated with them subquadrate; spermatheca as in Figure 10B.]

Coloration generally tawny brown (including hind tibiae) with some mottling, notably on outer faces of hind femora; portions of sculpture flecked with sepia; tegminal vestiges with anterior (ventral) margins black and posterior (dorsal) margins red.

Measurements (mm): Length of body 33.0; antenna 9.8; head 5.0; pronotum (mid-dorsal) 4.6; hind femur 12.8; maximum width of hind femur 2.2.

Paratypes.—These agree quite closely with the holotype and allotype, but the male (SDSNH—in better condition than the holotype, but examined too late to be so designated) has slightly less prominent denticle and tubercles on the inferoposterior angle of the left lateral pronotal lobe. It is also larger, with the following measurements (mm): length of body 23.0; antenna 10.0; head 4.0; pronotum (mid-dorsal) 3.1; hind femur 10.6; maximum width of hind femur 2.0. One female paratype (LEM) is 29 mm and the other (CAS) 32.5 mm long. The latter is distinctly darker and more heavily mottled with the posterior margins of the first four abdominal terga suffused pinkish; the inferoposterior angles of both lateral pronotal lobes bear longer spines. The LEM paratype is colored much as the allotype, but the anterior (inferior) margins of the tegminal vestiges (particularly the left one) are less black; the right lateral pronotal lobe bears a distinct spine on its inferoposterior angle, but the left one has only a sharp denticle. In both, the tegminal vestiges are a little shorter than in the allotype, not surpassing the posterior margin of the mesonotum (Figure 3B).

Distribution (Figure 11).—This species has been found so far only in the southernmost part of Baja California Sur, south of 24° N latitude. In addition to the type series, there are also two female nymphs (about one-third grown) that clearly belong to this species on account of their strongly striated bodies and the distinct spines on the inferoposterior angles of the lateral pronotal lobes. They are not regarded as paratypes. One bears the data "2.7 mi. SE Valle Perdido, El. 1800', 27–29.XI.1968, E. L. Sleeper" (LEM *ex* CSLB); the other is labeled "2 mi. S of El Triunfo, 17.XI.1974," D. Otte (ANSP).

Subgenus *Atyphacris* Kevan, Singh, and Akbar, 1964, stat. nov.

Atyphacris Kevan, Singh, and Akbar, 1964: 233–236, 240; Kevan 1977: 66 [all previous literature cited, including that for synonyms *Calamacris* Rehn (*partim*), *Icthiacris* (*sic*, *partim*), *Atyphoscirtus* Bruner (*nomen nudum*), and *Atyphoscirtula* Kevan, Singh, and Akbar (*nomen nudum*)]; Kevan 1978: 15.

Type species.—By original monotypy, *Calamacris californica* Bruner, 1906, *nec* (I. Bolívar) = *Ic[h]thiacris aptera* Hebard, 1932 (replacement name).

Redescription.—Sculpture weakly striate, somewhat rugose, granular or punctate, but tubercles feeble or lacking; fastigium of vertex variable, sometimes long, sometimes no longer than basal width (Figure 1E–M); vertex proper evenly or only weakly convex dorsally (Figure 2E–M); frontal profile strongly oblique or not, seldom strongly or sinuously concave (Figure 2E–M); inferoposterior region of lateral pronotal lobe not rugose, angle region lacking a tubercle, denticle, or spine; tegminal vestiges narrow and slip-like (Figure 3C–G) or virtually if not completely lacking (Figure 3H).

Males: Abdominal terminalia dorsally as in Figure 4C–G; subgenital plate in lateral view acute to blunt (Figure 5C–G); epiphallus with posterior margin deeply U-shaped or slot-like, anterolaterally directed subterminal process of lateral appendices not prominent (Figure 6D–N); apical parts of aedeagal valves and sclerites rather short to very long and slender (Figure 7D–N).

Females: Metathoracic epimera expanded dorsally or not, without tubercles (Figure 3C–H); dorsal ovipositor valves in

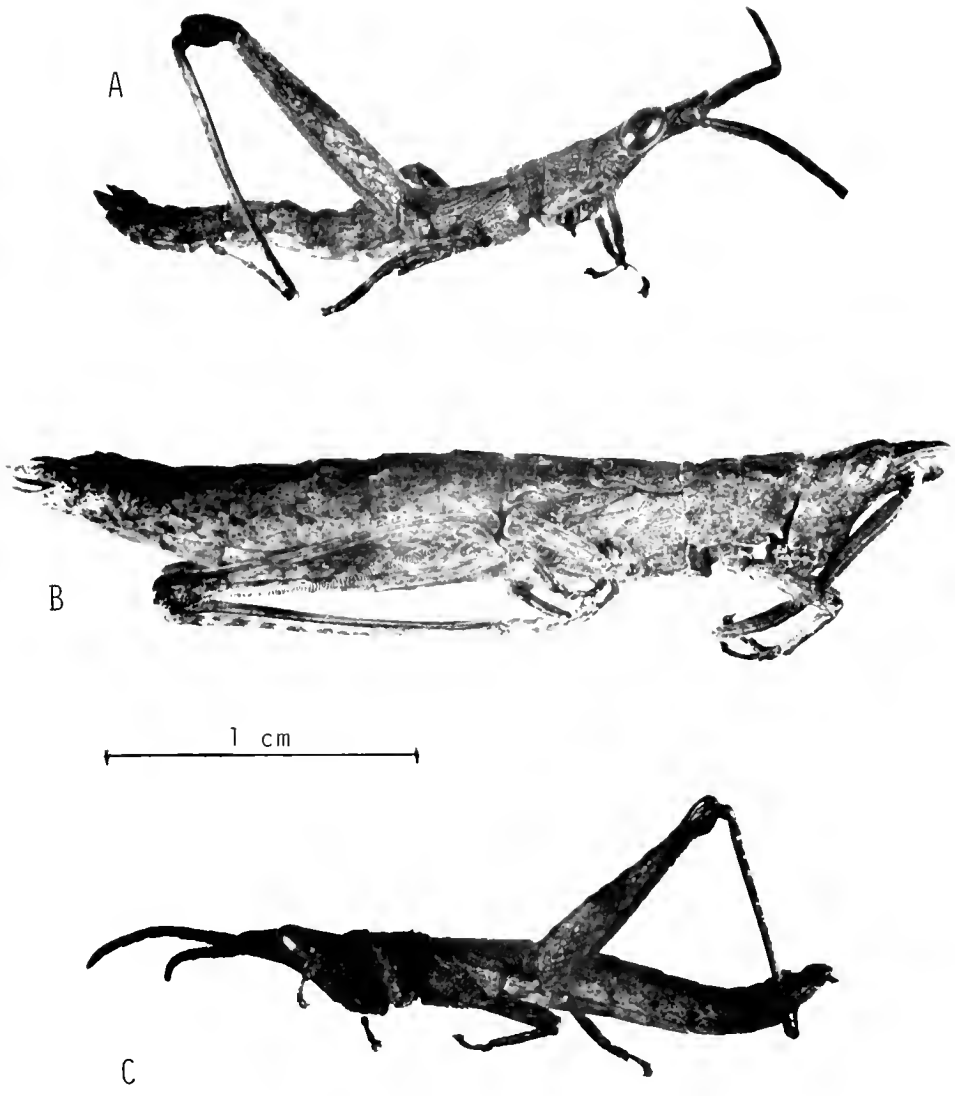

Figure 14. *Ichthiacris* n. spp., type specimens, lateral view. A, *I.* (*I.*) *spinifera*, ♂ holotype; B, the same, ♀ allotype; C, *I.* (*Atyphacris*) *celata*, ♂ holotype.

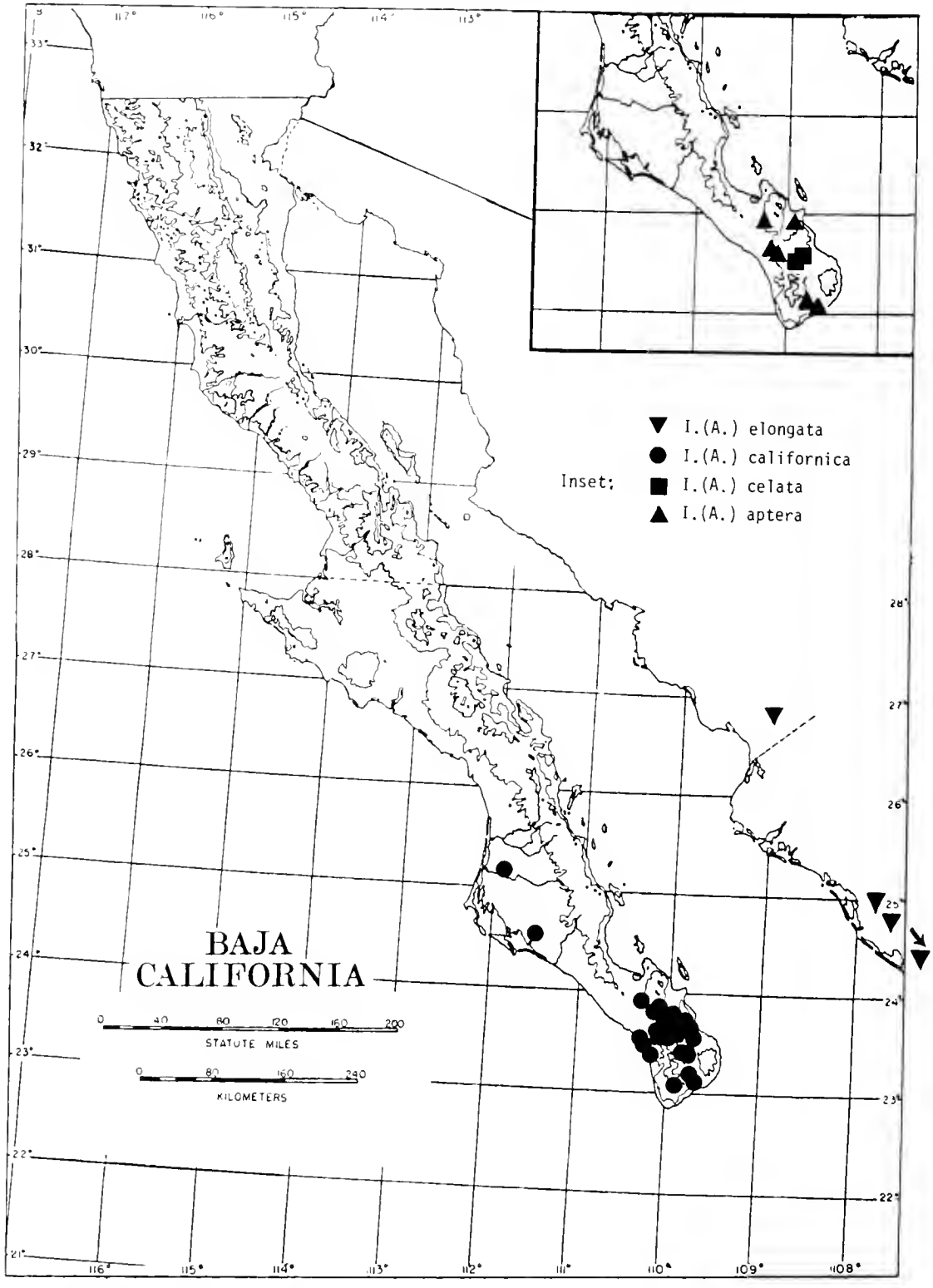

Figure 15. Known general distribution of *Ichthiacris*, subgenus *Atyphacris*, species other than *I.* (*A.*) *costulata*. Inverted triangles, *I.* (*A.*) *elongata*; circles, *I.* (*A.*) *californica*; squares (inset), *I.* (*A.*) *celata*; upright triangles (inset), *I.* (*A.*) *aptera*.

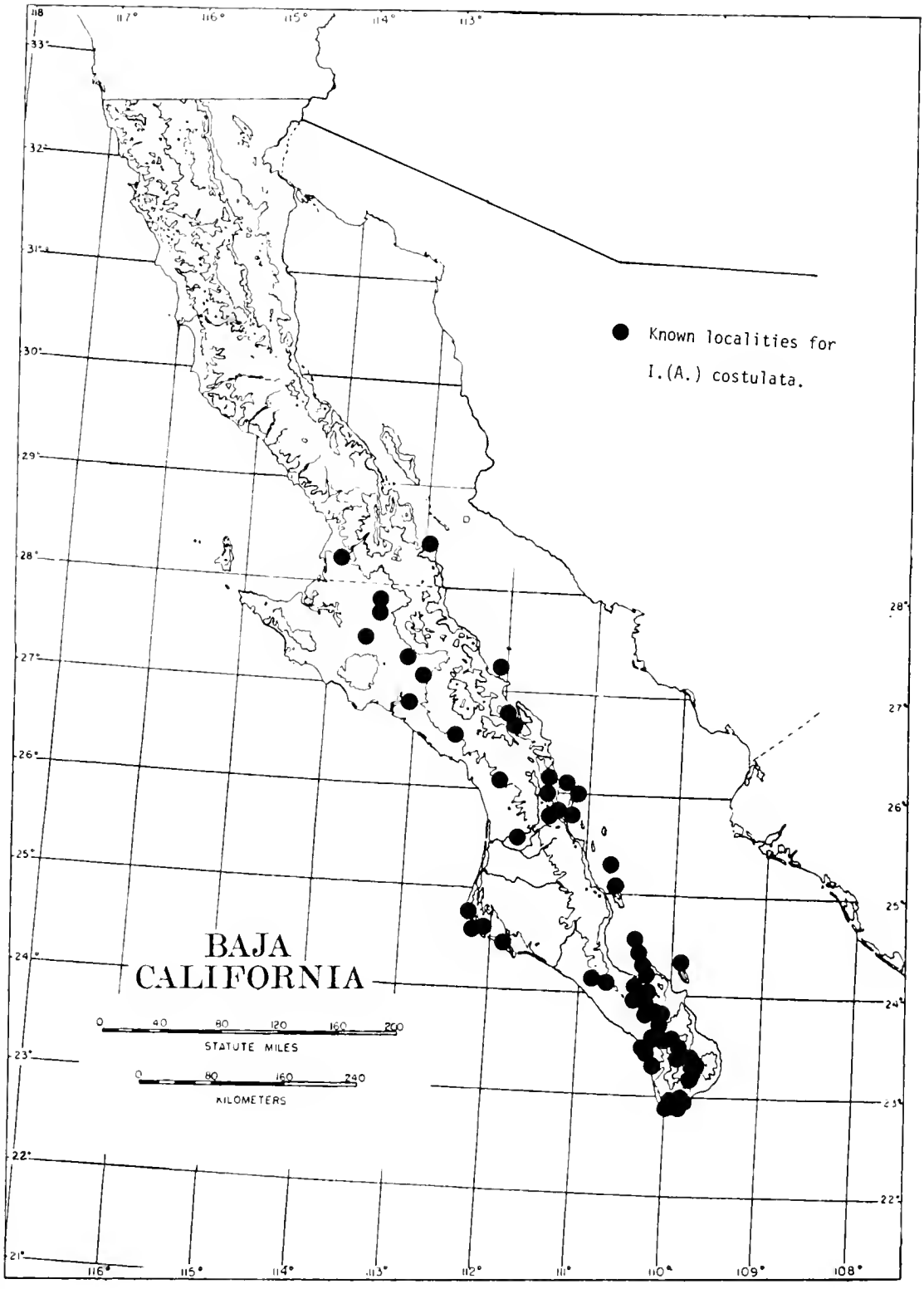

Figure 16. Known distribution of *Ichthiacris* (*Atyphacris*) *costulata* (circles).

TABLE 3. Characters distinguishing species of *Ichthiacris* (*Atyphacris*).

Character	*I.* (*A.*) *elongata*[a]	*I.* (*A.*) *costulata*[b]
Known distribution	NW Mexican mainland (Sonora, Sinaloa)	Baja California, southern tip to a little N of 28°N
Body form	Extremely elongate[f]	Elongate
Fastigium of vertex	Much longer than wide (Fig. 1E, F)[f]	Usually distinctly longer than wide (Fig. 1G, H)
Frontal profile	Extremely oblique (Fig. 2E, F)[f]	Usually rather strongly oblique (Fig. 2G, H)
Tegminal vestiges	Slip-like, very narrow (Fig. 3C)	Slip-like (Fig. 3D, E) (occasionally very minute)
Males		
10th abdominal tergum (dorsal)		
Posterior emargination	Rather deep (Fig. 4C)	Relatively narrow, not deep (Fig. 4D)
Posterior dorsolateral projections	Triangular, rather blunt (Fig. 4C)	Not prominent, pointed (Fig. 4D)
Cerci	Very elongate, extending well beyond apex of epiproct (Figs. 4C and 5C)[f]	Elongate-conical, fairly robust (Figs. 4D and 5D)
Subgenital plate (lateralview)	Very acute (Fig. 5C)[f]	Moderately acute (Fig. 5D)
Epiphallus		
Posterior emargination	Narrowly U-shaped (Fig. 6D)	Slot-like (Fig. 6E–H)
Endophallus (lateral)		
Apical in relation to basal parts of aedeagal valves	Very much longer (longer than rest of endophallus), very slender (Fig. 7D)	Little if any longer, slender (Fig. 7E–H)
Females		
Metathoracic epimera	Not expanded, long and narrow (Fig. 3C)[f]	Slightly expanded (Fig. 3D, E)
Subgenital plate (dorsal)		
Sclerotized areas on either side of egg-guide	Broadly crescentic (Fig. 9C)	Large, subquadrate or rectangular (Fig. 9D, E)
Columellae	Moderatly strong, rather distant from posterior margin (Fig. 9C)	Strong, rather distant from posterior margin (Fig. 9D, E)
Posterior margin on either side of egg-guide	Convex, weakly crenulate (Fig. 9C)	Somewhat biarcuate, quite distinctly crenulate (Fig. 9D, E)
Spermatheca and appendix (size)	Large for genus (Fig. 10C)	Average for genus or slightly larger (Fig. 10D, E)

[a]Figures 1E, F, 2E, F, 3C, 4C, 5C, 6D, 7D, 8C, 9C, 10C, 16.
[b]Figures 1G, H, 2G, H, 3D, E, 4D, 5D, 6E–H, 7E–H, 8D, 9D, E, 10D, E, 15.
[c]Figures 1I, J, 2I, J, 3F, G, 4E, 5E, 6I–L, 7I–L, 8D, 9F, G, 10F, G, 16.
[d]Figures 1K, 2K, 4F, 5F, 6M, 7M, 13C, 14C, 16.
[e]Figures 1L, M, 2L, M, 3H, 4G, 5G, 6N, 7N, 8E, 9H, 10H, 16.
[f]More obvious external feature.

I. (*A.*) *californica*[c]	*I.* (*A.*) *celata*[d]	*I.* (*A.*) *aptera*[e]
Baja California, southern tip to a little N of 25° N	Baja California, far S; known only from Sierra de La Laguna	Baja California S of 24° N only
Elongate	Not elongate for genus[f]	Not elongate for genus[f]
Usually little longer than wide (Fig. 1I, J)	Distinctly longer than wide (Fig. 1K)	No longer than wide (Fig. 1L, M)[f]
Usually less strongly oblique (Fig. 2I, J)	Rather strongly oblique (Fig. 2K)	Not very oblique (Fig. 2L, M)[f]
Slip-like (Fig. 3F, G)	Virtually (cf. Fig. 3H) or completely absent[f]	Virtually (Fig. 3H) or completely absent
Usually relatively wide and rather shallow (Fig. 4E)	Relatively narrow, not deep (Fig. 4F)	Relatively narrow, not deep (Fig. 4G)
Usually prominent, bluntly triangular or lobe-like (Fig. 4E)	Not prominent, pointed (Fig. 4F)	Not prominent, pointed (Fig. 4G)
Moderately elongate, fairly robust (Figs. 4E and 5E)	Elongate-conical, rather slender (Figs. 4F and 5F)	Conical, robust (Figs. 4G and 5G)[f]
Rather blunt (Fig. 5E)	Acute (Fig. 5F)	Blunt (Fig. 5G)[f]
U-shaped (Fig. 6I–L)	Broadly U-shaped (Fig. 6M)	Broadly U-shaped (Fig. 6N)
Much longer, slender (Fig. 7I–L)	A little longer, rather robust (Fig. 7M)	Not longer, rather robust (Fig. 7N)
Distinctly, if quite moderately, to very strongly expanded (Fig 3F, G)[f]	[? not expanded]	Slightly expanded (Fig. 3H)
Smaller, rhomboid, wider anteriorly (Fig. 9F, G)	?	Indistinct, triangular (Fig. 9H)
Strong, not very distant from posterior margin (Fig. 9F, G)	?	Weak, not very distant from posterior margin (Fig. 9H)
Slightly convex, rather less crenulate (Fig. 9F, G)	?	Rather straight, weakly crenulate (Fig. 9H)
Average for genus (Fig 10F, G)	?	Average for genus (Fig. 10H)

lateral view always tapering (Figure 8C–E); subgenital plate dorsally with posterior margin on either side of egg-guide lacking longitudinal striae, crenulate at most and for only a short distance along margin (Figure 9C–H); receptacula seminis as in Figure 10C–H.

Distribution:—Southern Baja California and northwestern Mexican mainland (Figures 15 and 16).

Included species.—*I.* (*A.*) *elongata* Kevan, Singh, and Akbar, 1964, *I.* (*A.*) *costulata* Bolívar, 1905, *I.* (*A.*) *californica* Bolívar, 1905, *I.* (*A.*) *celata*, n. sp. (Figures 13C and 14C), and *I.* (*A.*) *aptera* Hebard, 1932. They may be distinguished from one another as indicated in Table 3.

Ichthiacris (*Atyphacris*) *elongata* Kevan, Singh and Akbar, 1964
(Figures 1E, F; 2E, F; 3C; 4C; 5C; 6D; 7D; 8C; 9C; 10C; 15)

Ichthiacris elongata Kevan, Singh, and Akbar, 1964: 136, fig. 1 (map) 240, 247, 248, fig. 7, 249, 292, 293 (plate III), figs. A–D; Rentz, 1965: 60 [*Icthiacris* (*sic*)]; Kevan, Akbar, and Chang, 1971: 132, figs. 9 A, B, 134; Kevan, 1977: 65; Kevan, 1978: 5, fig. 1 (map), 15, 25; Kevan, 1981: [28].

Recognition.—Form extremely elongate, including head (Figures 1E, F; 2E, F), subgenital plate (both sexes) (Figures 4C; 5C; 9C), and male cerci (Figures 4C; 5C); female cerci also long (see Figure 8C); receptaculum seminis diagnostic, the spermatheca and its appendix considerably larger than in other members of the genus (compare Figure 10C with 10A, B, and D–G). Other distinguishing features are indicated in Table 3.

Distribution (Figure 15).—Known only by a few specimens from the northwestern Mexican states of Sinaloa and Sonora. Sinaloa: 26 mi. N of Pericos [type locality (Kevan *et al.* 1964); Rentz 1965; Kevan 1978)]; 5 and 30 mi. N of Calicán (Kevan 1978). Sonora. Alamos [allotype locality (Kevan *et al.* 1964; Rentz 1965; Kevan 1978)].

Ichthiacris (*Atyphacris*) *costulata* Bolívar, 1905
(Figures 1G, H; 2G, H; 3D, E; 4D; 5D; 6E–H; 7E–H; 8D; 9D, E; 10D, E; 16)

Ichthiacris costulata Bolívar, 1905: 287, 288; Kevan, Singh, and Akbar, 1964: 236, fig. 1 (map—*partim*), 240, 244, 245 (*partim*), 246, fig. 6, 247, 249, 290, 291 (plate II), fig. A–L; Kevan, 1977: 65, 644 (both *partim*) [this work cites all previous references under this name and its synonyms, except for Hebard (1923) below]; Kevan, 1978: 5, fig. 1 (map), 15, 24 (all *partim*); 1981: [28] (*partim*).

Calamacris mexicana Bruner, 1906: 200, 201 [for other relevant references including synonymous combinations, except for Hebard (1923), see Kevan (1977)]; Hebard, 1923: 326 [*mexicanus*(*sic*)]; Otte, 1978: 29 (type catalogue).

Calamacris palmeri Bruner, 1906: 200, 202 [for other relevant references, see Kevan (1977)]; Otte, 1978: 29 (type catalogue).

Calamacris oculata Bruner, 1906: 200, 202 (for other relevant references, see Kevan (1977)]; Otte, 1978: 29 (type catalogue).

Ichthiacris mexicana: Hebard, 1932: 268 (*partim*).

Ichthiacris rehni (*nec* Bolívar); Kevan, Singh, and Akbar, 1964: 236, fig. 1 (map), 241, fig. 4, 242 only (all *partim*); Kevan, 1977: 44 only (*partim*—by inference, citing foregoing); Kevan, 1978: 5, fig. 1 (map), 23, 24 (all *partim*).

Ichthiacris spp.: Descamps, 1976: 294 (*partim*).

Recognition.—This species (the most widely distributed in Baja California) is somewhat variable and can be confused with others, but its more elongate form and the presence of small slip-like tegminal vestiges distinguish it from *I.* (*A.*) *celata* and *I.* (*A.*) *aptera* (the latter also has a distinctly shorter fastigium of the vertex and less strongly oblique frontal profile). *I.* (*A.*) *costulata* lacks the rugose striations and particularly the spine or denticle on the inferoposterior angle of the lateral pronotal lobe found in *I.* (*I.*) *spinifera*. *I.* (*I.*) *rehni* differs from *I.* (*A.*) *costulata* not only in its more rugose appearance but also in its more strongly excavated and sinuous frontal profile and more abruptly convex vertex, particularly of the males (see Figure 2). Females of *I.* (*I.*) *rehni* also have proportionately much wider tegminal vestiges (see Figure 3), deeper, apically sickle-like dorsal ovipositor valves (see Figure 8), and more or less straight, not convex, dorsal margins to the metathoracic epimera (see Figure 3). *I.* (*A.*) *costulata* and *I.* (*A.*) *californica* (the latter known only from the southern third of Baja California Sur) are the species most likely to be confused with each other. Their concealed copulatory structures are quite different (compare the two species in Figures 6 and 7), but, in general, *I.* (*A.*) *costulata* seems to average a little smaller in size (though this is difficult to quantify) and usually has a slightly longer fastigium of the vertex and more oblique frontal profile (Figures 1 and 2). Males usually have less elongate median antennal articles, a more acute subgenital plate as seen in lateral view (Figure 5D), less prominent dorsolateral processes on the posterior margin of abdominal tergum X, and slightly shorter cerci (Figure 4D). In females, the metathoracic epimera are not less than four times as long as wide (Figure 3D, E) and not broadly expanded as in *I.* (*A.*) *californica* (Figure 3F, G).

Distribution (Figure 16).—The unique female holotype of *I. costulata* was described as being from "Basse Californie," without more precise locality. The locality erroneously ascribed to the unique male holotype of *Calamacris oculata* was "(extreme southern) Arizona," though "probably secured by G. Eisen [and certainly] in southern Lower California" (Hebard 1932). *I.* (*A.*) *costulata* is widely distributed throughout southern Baja California, where it occurs from the extreme tip to nearly 28°30'N latitude and from sea level to well above 1200 m elevation. It was known previously from some of the Gulf islands and is recorded from some Pacific coast islands. More precise localities for material studied are given below, including those for the unique holotypes of the two other synonymous nominal species (*mexicana* Bruner and *palmeri* Bruner). Previously published records are indicated by the locality and references only.

Material examined.—Baja California Norte: "Mesquital" (presumably meaning Rancho Mezquital, though there is a possibility that the record might refer to El Mezquital, an abandoned American "colony" of the 1860s, about 40 km WNW of Santa Rosalía in Baja California Sur) [recorded as *I. rehni* by Kevan *et al.* (1964) and Kevan (1978)]; San Francisquito Bay [large juvenile recorded as *Calamacris mexicanus* (*sic*) by Hebard (1923) but not noted in subsequent literature; ANSP].

Baja California Sur: [Rancho] Los Angeles, arroyo, 0.5 km S of km 123 S of Guerrero Negro on Mex[ico] H[igh]w[a]y 1, Stop 39, 11.VII.1978, D. B. Weissman and D. C. Lightfoot, 1 ♀; 14 mi. S of El Arco (Kevan 1978); 20 mi. S of El Arco [recorded as *I. rehni* by Kevan *et al.* (1964) and Kevan (1978)]; Arroyo Arco (as "Arce") 0.64 km S of km 96 N[W] of Santa Rosalía on Mex.

Hwy. 1, Stop 40, 11.VII.1978, D. B. Weissman and D. C. Lightfoot, 1 ♂, 2 ♀♀; La Burrera, wash, Stop 79-209, 22.IX.1979, D. B. Weissman *et al.*, 1 ♂; 14 km E of Mex. Hwy. 1 on road to La Burrera, elev. 304 m, Stop 79-87, 22.IV.1979, D. B. Weissman, 1 ♂, 1 juv. (small ♀, probably this species); Cabo Falso, 7 km W of Cabo San Lucas, 1.I.1979, P. A. Rude, 1 ♂; Cabo San [as "Cape St."] Lucas [holotype of *Calamacris palmeri*, see Bruner (1906), Rehn and Hebard (1912), Hebard (1932), Kevan *et al.* (1964), Kevan (1978), Otte (1978)]; Cabo [as "Cape"] San Lucas [recorded as *Calamacris mexicana* by Hebard (1931)]; Cabo San Lucas, Hotel Finisterra, 8–14.IX.1978, J. P. and K. E. Donahue, 3 ♀♀; 7.8 km E of Cabo San Lucas at km 7.8 on Mex. Hwy. 1, Stop 79-91, 23.IV.1979, D. B. Weissman, 1 ♂, 1 ♀, 4 juvs (♀♀, 2 very small); 2 mi. SW of Caduaño [as "Cuduaño"], 26.VIII.1982, D. K. Faulkner and J. Brown, 1 ♀ (SDSNH); ca. 24 km. S of El Cien [near Rancho El Hilario] at km 76 on Mex. Hwy. 1, 29.VII.1977, D. B. Weissman, 1 ♀; Comondú [recorded as *I. mexicana* by Hebard (1932)]; Coronados Island, sweeping vegetation, 16.XII.1983, N. S. Cobb, 1 ♀, 4 1st-instar juvs. (♀♀); Coronados I. and Danzante I. [recorded as juv. *Calamacris mexicanus* (*sic*) by Hebard (1923) and as juv. *I. rehni* by Kevan *et al.* (1964) and Kevan (1978); seem to be present species]; 2.5 km SE of La Huerta [about halfway between La Paz and Punta de la Ventana] (Kevan 1978); trail from La Laguna to La Burerra, elev. 1219–1828 m, Stop 75, 22.VII.1978, D. B. Weissman and D. C. Lightfoot, 1 ♂, 1 ♀ (both very small); 22.0 km N of Loreto, elev. 30 m, dry thorn forest, wash, taken on low sunflower-like composite not mature enough to be identified, 21–22.XI.1980, E. L. Sleeper, 2612/11325, 1 ♀ (CSLB); Loreto [recorded as large ♀juvs. of *Calamacris mexicanus* (*sic*) by Hebard (1923) and as adult ♀ of *I. rehni* with same data by Kevan *et al.* (1964) and Kevan (1978)]; Loreto, 24.X.1974, M. Descamps, 1 ♀ (ANSP); Isla Magdalena, Bahía Santa María, ca. 1.5 km N of Punta Hughes at Smart Peak, Stop 83-95, 9.VII.1983, D. B. Weissman and V. F. Lee, 1 ♂, 1 ♀; Isla Magdalena, canyon 1 km NW of Puerto [Bahía] Magdalena, Stop 83-95, 8.VII.1983, [D. B. Weissman,] D. K. Faulkner, D. C. Lightfoot, 3 ♂♂, 2 ♀♀; Isla Magdalena, path from Smart Peak to Laguna Santa María, Stop 83-96, 9.VII.1983, [D. B. Weissman,] D. K. Faulkner, and D. C. Lightfoot, 2 juvs. (♂, ♀, half grown); San Marcos Island [juvs. recorded a *I. rehni* by Kevan *et al.* (1964) and Kevan (1978)]; Miraflores, in palm grove, 22.VII.1971, H. G. Real and R. E. Main, 1 ♀; 0.8 km W of Mex. Hwy. 1 on road to Miraflores, elev. 210 m, Stop 79-206, 26.IX.1979, D. B. Weissman *et al.*, 1 ♀ [very small and nymph-like; taken with *I.* (*A.*) *californica*]; 5.0 km SW of Miraflores, elev. 520 m, Cape thorn forest, 2–3.I.1981, E. L. and K. W. Sleeper, 2321/10948, 1 ♂ (CSLB); 34.5 km S of Mulegé, elev. 90 m, Gulf Coast desert, on *Encelia farinosa* ssp.?, E. L. and K. W. Sleeper, 2641/11155, 1 ♀ (CSLB); 40 km S of Mulegé at 0.5 km N of km 93 on Mex. Hwy. 1, Stop 79-76, 19.IV.1979, D. B. Weissman, 1 ♂, 1 juv. (♀, seems to be this sp.); Patrocinio [ca. 55 km S of San Ignacio; type of *Calamacris mexicana*, see Bruner (1906), Rehn and Hebard, (1912), Hebard (1923, 1931), Kevan *et al.* (1964), Kevan (1978), Otte (1978)]; 44 km W of La Paz at 0.2 km S of km 44 on Mex. Hwy. 1, Stop 79-14, 31.XII.1978, D. B. Weissman *et al.*, 1 ♀ (taken as juv. and reared; labeled "adult 30.V.1979"); as last but 0.16 km S, Stop 79-83, 21.IV.1979, D. B. Weissman, 1 ♂; 26 mi. W of La Paz, black/white light, 11.VIII.1976, J. Chemsak, J. Doyen, and J. Powell, 1 ♂; 8 km W of La Paz at 0.5 km N of km 8 on Mex. Hwy. 1, Stop 79-84, 21.IV.1979, D. B. Weissman, 2 ♀♀, 1 juv. (♀); 7 mi. SW of La Paz, at light, 6.VIII.1966, E. and J. Lindley and P. D. Head, 1 ♂; 23.0 km SW of La Paz, Cape thorn forest (Kevan 1978); 12 mi. [almost due] N of La Paz on road to Pichilingue (Kevan *et al.* 1964, Kevan 1978) [2 ♀♀, 1 atypical —see Kevan *et al.* (1964: plate II, figs. K, L), but subgenital plate confirms this species]; near Pichilingue (Kevan *et al.* 1964; omitted by Kevan 1978); Playa Lobos near Todos Santos, on bushes (mainly *Hymenoclea*) at night; 10.XII.1979, P. A. Rude, 1 ♂ [with *I.* (*A.*) *californica*]; Puerto Escondido [coast opposite S end of Isla del Carmen], Stop 79-96, 25.IV.1979, D. B. Weissman, 1 ♂, 1 ♀, 1 juv. (♀); 0.5 km along road to Puerto Escondido off Mex. Hwy. 1, 28.VII.1977, D. B. Weissman, 1 juv. (♀, ?last instar); 18 km W of San Ignacio [along Mex. Hwy. 1 at] km 90, 24.III.1980, J. Pinto, 1 ♂; 25 km S of San Ignacio, wash at km 49 on Mex. Hwy. 1, elev. 213 m, Stop 79-73, 18.IV.1979, D. B. Weissman, 4 ♀♀; 12 km N of San Pedro at km 203 on Mex. Hwy. 1, 31.VII.1977, D. B. Weissman, 1 ♂, 1 ♀; 10 km S of San Pedro at km 183.7 on Mex. Hwy. 1, 31.VII.1977, D. B. Weissman, 3 ♂♂, 1 ♀(rather small, teneral), 2 juvs. (♀♀); [Sierra] San Lázaro [now Sierra Victoria, probably not far NW of San José del Cabo; young juvs. recorded as *I. rehni* by Kevan *et al.* (1964), corrected to present species by Kevan (1978); might be *I.* (*A.*) *californica*, but probably not]; 17.5 km N of Santa Anita turnoff at km 64 from San José del Cabo on Mex. [Hwy.] 1, Stop 67, 19.VII.1978, D. B. Weissman and D. C. Lightfoot, 1 ♂; 27.7 mi. NE of Arroyo [de] San Miguel [ca. 26°40'N, 112°30'W], 1.IV.1985, N. Bloomfield and D. K. Faulkner, 1 ♀ (atypically narrow fastigium of vertex) (SDSNH); 5 km N of Santa Anita at km 53 on Mex. Hwy. 1, 1.VIII.1977, D. B. Weissman, 1 ♂; Isla Santa Margarita, washes immediately SW of Puerto Alcatráz, Stop 83-91, 7.VII.1983, D. B. Weissman, 2 ♂♂ (one with karyotype no. T 83-41, became adult 28.VIII.1983), 1 ♀ (small, with maturation date of 17.IX.1983); Todos Santos, garden area, Stop 76, 22.VII.1978, D. B. Weissman and D. C. Lightfoot, 1 ♂ [with *I.* (*A.*) *californica*]; 11.2 km S of Todos Santos, Stop 79-208, 27.IX.1979, D. B. Weissman *et al.*, 1 ♂ [with *I.* (*A.*) *californica*]; [El] Triunfo and 1.3 mi. NW of El Triunfo [recorded as *I. rehni* by Kevan *et al.* (1964) and Kevan (1978); former recorded as adult ♀♀ but are actually last-instar juvs.; latter are small juvs. but seem to be present species]; 7.5 km W of El Triunfo (Kevan 1978).

In addition to the foregoing specimens, I have more recently examined, through the courtesy of Dr. D. B. Weissman, numerous specimens collected from various islands in the Gulf of California. They are listed here separately to avoid repetition of collectors' names and explanation of code numbers. Specimens dated 1984 were all collected by D. B. Weissman and D. C. Lightfoot; those dated 1985 indicate D. K. Faulkner as a third member of the team. Code numbers, where given, relate to life-history and cytological studies. A, molt to adult stage; K, date killed after being reared from nymph. The dates following these letters on the data labels of the specimens are (or were) entirely in Arabic numerals with the month before the day; they are given here with day before month, the latter in Roman numerals, to avoid confusion. T + number, testis sample.

Isla Danzante, Stop 84-31, 16.VII.1984, 3 ♂♂ (A8/5, T-84/59; A9/5; A7/30, T-84/60), 6 ♀♀ (A8/2; A9/1; A9/6; A9/25; 2

uncoded); Isla del Carmen, first major canyon S of Punta Cholla, 18.VII.1984, S[top] 84-35, 1 ♂, 1 ♀, 1 juv. (♀) (all uncoded); Isla Partida, 9.VII.1985, Stop 85-77, 5 ♂♂ (A8/31, T-85/78; A9/11, T-85/80; A9/14, T-85/81; A9/15, T-85/82; A9/25, T-85/83), 9 ♀♀ (2 × A8/31; A9/27; 2 × K11/4; 4 uncoded); Isla Santa Cruz, 10.VII.1985, Stop 85-78, 2 ♂♂ (T-85/45; A9/2, T-85-76), 2 ♀♀ (uncoded); Isla Cerralvo, canyon on west side near Punta el Limón, 15.VII.1985, Stop 85-85, 6 ♂♂ (T-85/46; T-85/47; A8/2, T-85/73; 3 uncoded), 5 ♀♀ (K8/27; K11/4; 3 uncoded); Isla San José, north end, Stop 85-80, 2.VII.1985, 1 ♂ (unusually large; A10/24, T-85/86), 3 ♀♀ (A9/21; 2 uncoded); Isla San Marcos, Stop 85-87, 17.VII.1985, 4 ♂♂ (T-85/40; T-85/41 [very small]; T-85/71 [very small]; T-85/72), 6 ♀♀ (all very small, uncoded), 1 juv. (♀, uncoded); Isla del Espíritu Santo, Stop 85-75, 1.VII.1985, 1 ♀ (A9/10).

Remarks.—Kevan (1977) suggested that *I. californica* might prove to be synonymous with *I. costulata*, a suggestion also put forward by Hebard (1932), who considered the two to be "uncomfortably close." Kevan (1978) formally, but erroneously, synonymized the species under the latter name, stating that the phallic structures of the lectotype of *I. californica* are like those of *I. costulata*. In fact, the two species are consistently different in this respect (compare Figures 6E–H and 7E–H with 6I–L and 7I–L), not only in the greater overall size and longer aedeagal valves and sclerites of the latter species, but also in the form of the posterior excavation of the epiphallus, which is wide and U-shaped in *californica*, narrow and slot-like in *costulata*. The erroneous synonymy resulted from a lack of male specimens for dissection when Kevan *et al.* (1964) prepared their revision of *Ichthiacris*. Their figure 6N (p. 246) shows the posterior emargination of the epiphallus of *I. costulata* as being considerably wider than it actually is (though not as wide as in *I. californica*). Re-examination of the specimen from which the figure was prepared revealed that the bridge of the epiphallus had been broken across the middle, and that when the two halves were rejoined in preparation for illustration, too generous a distance was left between them. In the resulting figure, the posterior emargination of the bridge appeared almost U-shaped, even if rather narrowly so.

The difference between the two species in the form of the metathoracic epimera of the females was not previously indicated, but the specimen illustrated by Kevan *et al.* (1964: 246, fig. 6E) shows something approaching the widest condition found in *I.* (*A.*) *costulata* (cf. Figure 3E herein), which is only a little narrower than the narrowest condition found in *I.* (*A.*) *californica* (cf. Figure 3F herein). In *I.* (*A.*) *costulata* the epimeron may be as wide as indicated in Figure 3E herein or as narrow as in the alleged "*I. relicti*" illustrated by Kevan *et al.* (1964: 241, fig. 4E) and already discussed (cf. also Figure 3D herein). In *I.* (*A.*) *californica*, the female's metathoracic epimeron may be nearly (but not quite) as narrow as shown by Kevan *et al.* (1964: 246, fig. 6E, see above; also Figure 3F herein), but it is usually considerably wider and may be almost semicircular dorsally (i.e., D-shaped; cf. Figure 3G herein).

There now seems to be no overlap between *I.* (*A.*) *costulata* and *I.* (*A.*) *californica* in the width of the female's metathoracic epimeron or in the form of the posterior emargination of the male's epiphallus, but because of previous lack of appreciation of the differences between the species, certain records of *I.* (*A.*) *costulata* given by Kevan *et al.* (1964) and Kevan (1978) are inaccurate. The specimens reported as *I. costulata* from the following localities belong instead to *I.* (*A.*) *californica*: 3.5 mi. W of Los Barriles; 3 mi. E of La Burrera; Corral de Piedra (Sierra de la Taste); San José del Cabo; Santa Rita; 15 km E of Colonia [F. de la] Toba (now Villa Insurgentes); 0.5 mi. NW of El Triunfo; 2.7 mi. SE of Valle Perdido.

Ichthiacris (*Atyphacris*) *californica* Bolívar, 1905
(Figures 1I, J; 2I, J; 3F, G; 4E; 5E; 6I–L; 7I–L; cf. 8D; 9F, G; 10F, G; 15)

Ichthiacris californica Bolívar, 1905: 287, 289; Kevan, Singh, and Akbar, 1964: 240, 288, 289 (plate 1), fig. E–H; Kevan, 1977: 64 [all previous references cited]; Kevan, 1978: 15, 24 [incorrectly indicated as synonym of *I. costulata*].

Icthiacris [*sic*] *mexicana* [*nec* (Bruner)]; Hebard 1932: 268 (*partim*).

Ichthiacris costulata (*nec* Bolívar); Kevan, Singh, and Akbar, 1964: 261, fig. 1 (map), 245 (only—both *partim*); Kevan, 1977: 65 (by implication), 644 (both *partim*, latter referring to Descamps, 1976, below); Kevan, 1978: 5, fig. 1 (map), 15, 24, 25 (all *partim*); 1981: [28] (*partim*).

Ichthiacris spp.; Descamps, 1976: 244 (*partim*).

Recognition.—The differences between *I.* (*A.*) *californica* and *I.* (*A.*) *costulata* have been indicated under that species. The present species also resembles *I.* (*A.*) *aptera* when the fastigium of the vertex is particularly short, the frontal profile thus being even less oblique than usual. The latter species is, however, less elongate, virtually or completely without tegminal vestiges, and has short conical cerci in the male (as in Figures 4E and 5E) and narrower metathoracic epimera in the female (as in Figure 3H). The most peculiar feature of *I.* (*A.*) *californica* is the expansion and "flaring" of the female's metathoracic epimera (Figure 3F, G). This character is much more pronounced in some individuals than in others.

Distribution (Figure 15).—The male holotype and female allotype (the only type specimens) were described as being from "Basse Californie" without closer indication of locality. The species occurs only in the southernmost third of Baja California Sur from a little N of 25°N latitude to the southern tip, from near sea level to above 1200 m elevation. It is not yet known from any of the offshore islands. More precise localities for the specimens studied (other than the types) are given below. Previously published records are indicated only by locality and reference. As already noted, *I.* (*A.*) *californica* has sometimes been incorrectly recorded in the past as *I. costulata*, but the converse is not the case.

Material examined.—Baja California Sur: 3.5 km W of Los Barriles [recorded as *I. costulata* by Kevan (1978)]; 3 mi. E of La Burrera [as last]; La Burrera, wash, Stop 79-209, 27.IX.1979, D. B. Weissman *et al.*, 2 ♂♂, 1 ♀, 1 juv. (♀, ?last instar) [with *I.* (*A.*) *costulata*]; 1 km W of La Burrera on road to La Burrera, Stop 79-20, 2.I.1979, D. B. Weissman *et al.*, 1 ♀; Corral de Piedra, Sierra de la Taste [recorded by Hebard (1964) as *I. mexicana* and "El Taste," and by Kevan *et al.* (1964) and Kevan (1978) as *I. costulata*]; trail from La Laguna to La Burrera, 1219–1828 m, Stop 73, 21.VII.1978, D. B. Weissman and D. C. Lightfoot, 1 ♀ (very small but unmistakably this species); first wash on road to Miraflores off Mex[ico] H[igh]w[a]y, Stop 79-27, 3.I.1979, D. B.

Weissman *et al.*, 1 ♀; as last, but Stop 79-95, 24.IV.1979, D. B. Weissman, 2 juvs. (♂,♀, very small, ?this species); 0.8 km W of Mex. Hwy. 1 on road to Miraflores, elev. 210 m, Stop 79-206, 26.IX.1979, D. B. Weissman *et al.*, 1 ♂, 4 juvs. (seem to be this species; 1 ♂ appearing virtually adult except for undeveloped tegminal vestiges and phallic structures, abdominal terminalia more or less as adult; 3 ♀♀) [with *I.* (*A.*) *costulata*]; Playa Lobos near Todos Santos on bushes (mainly *Hymenoclea*), at night, 10.XII.1972, P. A. Rude, 2 ♀♀ (1 small, 1 very small with rather oblique frontal profile though metathoracic epimera widely expanded) [with *I.* (*A.*) *costulata*]; Ramal de San Antonio, 5 mi. E of [Mex.] Hwy. 1, 7 mi. S of San Antonio, 12.X.1983, F. Andrews and D. K. Faulkner, 5 ♂♂, 6 ♀♀ (4 of latter at "black light") (SDSNH); 2–3 mi. SW of San Bartolo, 1.X.1981, F. Andrews and D. Faulkner, 2 ♀♀ (SDSNH); San José de Cabo [recorded as *I. costulata* by Kevan *et al.* (1964) and Kevan (1978)]; 6 km S of San Pedro at km 184 on Mex. Hwy. 1, Stop 79-29, 4.I.1979, D. B. Weissman *et al.*, 1 ♂, 2 juvs. (♂, ♀, very small, presumably this species); Santa Anita, cultivated area (milpa), Stop 79-26, 3.I.1979, D. B. Weissman *et al.*, 1 ♂, 1 ♀, Santa Rita (just N of La Salada) [recorded by Kevan (1978) as *I. costulata*; small but undoubtedly this species]; 9 km N of Santiago turnoff at km 94 on Mex. Hwy. 1, Stop 79-203, 26.IX.1979, D. B. Weissman *et al.*, 2 ♂♂; Todos Santos, garden area, Stop 76, 22.VII.1978, D. B. Weissman and D. C. Lightfoot, 1 ♀ (very small but with extra-wide metathoracic epimera) [with *I.* (*A.*) *costulata*]; 11.2 km S of Todos Santos, Stop 79-208, 27.IX,1979, D. B. Weissman *et al.*, 1 ♂, 1 ♀ [with *I.* (*A.*) *costulata*]; El Triunfo between Cabo San Lucas and La Paz, elev. 580 m, 16.X.1974, M. Descamps, 1 ♂; El Triunfo, 3.X.1981, F. Andrews and D. K. Faulkner, 4 ♂♂, 4 ♀♀ (all rather large; 1 ♀ has right metathoracic epimeron more expanded than left); 0.5 mi. NW of El Triunfo [recorded as *I.* (*A.*) *costulata* by Kevan (1978)]; 2 mi. S of El Triunfo, 17.IX.1974, D. Otte, 1 ♂, 1 ♀ [with juv. *I.* (*I.*) *spinifera*]; the same, but 19 [road] miles "S" [i.e., ca. 15 km due S], 1 ♀ (rather large); the same, but 29 [road] miles "S" [i.e., ca. 25 km ESE], 1 ♀; 2.7 mi. SE of Valle Perdido [recorded as *I. costulata* by Kevan (1978)]; Villa Insurgentes [as Colonía (F. de la) Toba; as last].

Remarks.—The erroneous synonymy of *I.* (*A.*) *californica* under *I. costulata* and the incorrect records for the latter have already been discussed under that species. The curious, flared expansion of the female's metathoracic epimera *I. californica* is a unique development, the function of which is unknown.

Ichthiacris (*Atyphacris*) *celata*, new species
(Figures 1K; 2K; 4F; 5F; 6M; 7M; 13C; 14C; 15)

Holotype.—Figures 12C, 13C. CAS, type no. 15175, Mexico: Baja California Sur, Sierra [de] La Laguna, [elev.] 1770–1850 m, 28–31.VIII.1977, E. Fisher and R. Westcott. ♂.

Paratypes.—LEM, type no. KPY-22-02-P1, Mexico: same data as holotype, but 31.VIII.1977 and 1.IX.1977, respectively. 2 ♂♂.

Recognition.—Though known only from males and immatures, *I.* (*A.*) *celata* is distinguishable from *Ichthiacris* species other than *I.* (*A.*) *aptera* by its comparatively short body and virtual to complete lack of tegminal vestiges. From the latter species it differs in its stronger sculpture, longer fastigium of the vertex (Figure 1K), and strongly oblique frontal profile (Figure 2K). Certain small specimens of *I.* (*A.*) *costulata* sometimes resemble *I.* (*A.*) *celata* but have clearly visible, even if minute, tegminal vestiges, and their phallic structures (notably the epiphallus) are quite different (Figures 6 and 7). So far as is known, males of *I. celata* lack the pale stripe across the genae and inferior parts of the lateral pronotal lobes, which are rarely absent in males of other species of the subgenus *Atyphacris*. *I.* (*A.*) *celata* also has rather dense longish hair, particularly on the legs and end of the abdomen.

Etymology.—Hidden or concealed; alluding to the species' having hitherto eluded detection.

Description of holotype.—Body not very elongate for genus, though relatively slender, coarsely rugosopunctate throughout; hairs of frons, sternum, legs, and end of abdomen rather long and dense.

Antennae rather long, slightly longer than head and pronotum together, with 13 articles in addition to scape and pedicel; except for the basal ones, the articles are more or less alternately longer and shorter; the longer articles (including the terminal one) at least twice as long as wide, the shorter ones a little shorter than this.

Head (Figures 1K and 2K) not quite twice as long as its basal width, barely longer than pronotum; eyes large and prominent, oval, greatest depth about five-sixths of length; interocular space at narrowest about equal to greatest dorsal width of an eye; fastigium of vertex bluntly elongate-triangular with slightly concave margins, about 1.2 times as long as basal width, with a pair of strong mediolateral longitudinal ridges; median sulcus between dorsal areolae extending backward for about one-third of length of fastigium; vertex proper rather weakly and evenly convex; median carinula strong, extending back to pronotum; a pair of short, strongly raised ridges margining posterior halves of eyes; frontal profile quite strongly oblique, distinctly concave and very slightly sinuous; fastigium of frons almost rectangular in outline, meeting fastigium of vertex at nearly a right angle; frontal ridge very prominent above antennal bases, less strong below and narrowly sulcate to clypeus; lateral frontal carinae weak but distinct, somewhat sinuous, subparallel in anterior view.

Thorax: Pronotum subcylindrical; disk with median carina weak but distinct throughout; lateral carinae obsolescent, subparallel; anterior margin slightly convex; posterior emargination broad and obtuse-angular; posterior transverse sulcus nearly straight, crossing disk at about four-fifths of pronotal length; median transverse sulcus slightly angulate, crossing disk at about its middle; lateral pronotal lobe considerably longer than deep, with almost straight margins; anterior margin oblique, posterior margin almost vertical but slightly concave; inferoposterior angle slightly rounded and a little less than a right angle, bearing a few weak pustular tubercles. Mesonotum transverse, a little longer than metazona of pronotum and about half as long as quadrate metanotum. Metathoracic epimera narrow, elongate, tapered anteriorly (rather similar to condition shown in Figure 3B). Prosternal tubercle stout, broadly conical, rounded apically, flattened and emarginate anteriorly; mesosternal lobes about twice as long as wide, their interspace narrow but distinct, considerably less than the width of mesosternal lobe.

Wings: Tegminal vestiges virtually lacking, represented only by extremely minute, very narrow pads fused with basal two-

thirds of lateral margins of mesonotum.

Legs: Front femora about as long as pronotum, slightly incrassate; middle femora shorter, slightly carinate; hind femora moderately slender, not quite five times as long as greatest width, reaching to about end of abdomen.

Abdomen with a strong medial dorsal carina; tympana lacking; terminalia as in Figures 4F and 5F; tergum X with posterior emargination fairly narrow, concave; dorsolateral processes pointed; epiproct triangular, slightly longer than wide; cerci fairly straight and slender, reaching to near apex of epiproct; subgenital plate in lateral view acute.

Phallic structures (Figures 6M and 7M): Epiphallus with broad bridge and broadly U-shaped posterior emargination; lophi rather short and almost dorsally directed; lateral appendices rather short and stout, their subterminal processes short; endophallus with apical parts of aedeagal valves and sclerites relatively short, somewhat blade-like, but a little distinctly longer than basal parts of valves.

Coloration uniformly mottled grayish brown (including genae, entire lateral pronotal lobes, and hind tibiae) except for red inner faces of inner femora.

Measurements (mm): Length of body 20.0; antenna 7.0; head 3.1; pronotum (mid-dorsal) 2.6; hind femur 9.0 × 2.0 mm.

Paratypes.—These agree very well with the holotype, though they are a little smaller (19.5 and 19.0 mm long). The LEM paratype has a slightly more sinuous frontal profile (as in Figure 2K) and lacks even a trace of a tegminal vestige on the left side; that on the right is less than half the length of the mesonotum. The tegminal development of the CAS paratype is similar, but it is the right side that is completely apterous.

Distribution (Figure 16).—Known only by the type series and a few nymphs (discussed below) from the Sierra de La Laguna in the center of the Cape region of Baja California Sur at altitudes of between 1770 and 2000 m.

Remarks.—In addition to the type series, there are, in CAS, three nymphs (not regarded as paratypes). They are as follows: 1 (♂, last instar), same data as holotype; 2 (1 ♂, very small, ?2nd instar; 1 ♀, more than one third grown), Sierra de La Laguna, La Laguna, 17 air mi. ENE of Todos Santos, elev. 6000 feet, 12–18.XII.1979, P. A. Rude collector.

The female nymph, though relatively small, indicates that the unknown adult female of this species would conform quite closely to the description of the male. It would, however, have relatively shorter antennae, a slightly wider fastigium of the vertex, and a head shorter in proportion to the pronotum. There is not the slightest indication of any vestigial tegmen, as there is in comparable nymphs of the other species [except *I.* (*A.*) *aptera*]. Though this nymph is too young for one to be certain, it would seem to indicate that, in the adult female, the metathoracic epimera, though wider than in the male, do not become appreciably expanded dorsally and are probably similar to those of *I.* (*A.*) *aptera*, as in Figure 3H. The beginnings of such expansion are quite apparent in nymphs of *I.* (*A.*) *californica* at a comparable developmental stage. This nymph also shows that the ovipositor is almost certainly of the usual, rather slender, tapered form. Even in quite young female nymphs of *I.* (*I.*) *rehni*, the stoutness and depth of the dorsal valves begins to be apparent.

Ichthiacris (*Atyphacris*) *aptera* Hebard, 1932
(Figures 1L, M; 2L, M; 3H; 4G; 5H; 6N; 7N; 8E; 9H; 10H; 15)

Calamacris californica Bruner, 1906: 200, 201; Otte, 1978: 29 (type catalogue).

Atyphoscirtus [*nomen nudum*] *californicus* Bruner, 1908: plate 4, figs. 24, 25a.

Ichthiacris [*sic*] *aptera*, *nom. nov.* [to avoid secondary homonymy with *I. californica* Bolivar, 1905] Hebard, 1932: 267.

Atyphacris californica [reverting to Bruner's specific name with elimination of secondary homonymy, now recurrent]: Kevan, Singh, and Akbar, 1964: 235, 236, fig. 1 (map), 237, fig. 2, 238, fig. 3, 288, 289 (plate 1), figs. A–D; Kevan, 1977: 66 [citing all previous references including synonymous combinations]; Kevan, 1978: 5, fig. 1 (map), 15, 25; Kevan, 1981: [28].

Recognition.—*I.* (*A.*) *aptera* is readily separated from other species by its comparatively short body and virtually apterous condition [shared only with *I.* (*A.*) *celata*], combined with a short fastigium of the vertex, less oblique frontal profile (Figures 1L, M; 2L, M) and short conical male cerci (Figures 4G, 5G). The egg-guide (Figure 9H) is less acutely pointed than in other species of the subgenus *Atyphacris* (Figures 9C–G) [except possibly for *I.* (*A.*) *celata*, of which no adult female is known].

Distribution (Figure 15).—*I.* (*A.*) *aptera* is positively known only from the Cape region of Baja California Sur, south of 24°N latitude, from at or near sea level to at least 550 m elevation. There is, however, a questionable, more northerly record (see below under Remarks). Localities from which specimens have been examined are given below. Previously published records are given by locality and reference only.

Material examined.—Baja California Sur: La Burrera, 12 air mi. ENE of Todos Santos, elev. 1700 feet, II.XII.1979, P. A. Rude, 1 ♂, 2 ♀♀ (1 *copulating* with ♂); 3 mi. E of La Burrera (Kevan 1978); San José del Cabo [type locality] (Bruner 1906, Rehn and Hebard 1912, Hebard 1931, 1932, Kevan *et al.* 1964, Kevan 1978, Otte 1978); (Sierra) San Lázaro (now Sierra de la Victoria), probably not far NW of previous locality (Kevan *et al.* 1964, Kevan 1978); ?San Pedro (Kevan *et al.* 1964, Kevan 1978—see Remarks below).

Remarks.—Although *I.* (*A.*) *aptera* can be completely apterous, it usually has minute traces of tegminal vestiges fused with the mesonotum and partially or wholly masked by the posterior margin of the pronotum.

There is no satisfactory evidence that this species occurs farther north than is indicated above, but there is a questionable record from San Pedro Mártir. This was taken by Kevan *et al.* (1964) to be mislabeled or confused with San Pedro in southern Baja California Sur. San Pedro Mártir is the name of a mountain range and a well-known mission in central Baja California Norte, apparently much too far north for this species. Kevan (1978) suggested that this locality should not be ruled out altogether, but no member of the Ichthiacridini (nor any other pyrgomorphid) has been discovered as far north as 29°N, even after recent extensive collecting throughout Baja California. The southern locality is, therefore, tentatively accepted here, although even that may prove to be too far north.

DISCUSSION

Judged by the present degree of tribal and generic diversity (not necessarily by the richness of species) in southeastern Asia and Madagascar, the Pyrgomorphidae probably had their origins in eastern Gondwanaland. The Ichthiacridini are perhaps the most primitive of the New World members of the family because the apical parts of the aedeagal sclerites and valves are joined to the main part of the endophallus by a constricted "flexure" (see Figure 7). This is a plesiomorphic character, as it is found in a wide range of Acridoidea, but has been lost in most other Pyrgomorphidae, except for a few Oriental and Malagasy genera. The other New World tribes do not possess this character, but, like them, the Ichthiacridini probably reached the Americas from the Orient by a northern route, as, it is believed, did members of some other groups of organisms. This would have occurred, from an educated guess, no later than the Cretaceous Period.

As noted in the Introduction, the Ichthiacridini include, in addition to *Ichthiacris*, the monotypic genera *Sphenacris*, from central and east-central Mexico, and *Calamacris*, from central and west-central Mexico. In both, the body is more fusiform than in *Ichthiacris* and is beset with fine, more regular, pustule-like tubercles. If the Pyrgomorphidae are considered as a whole, these characters appear to be more primitive than those of *Ichthiacris*. In *Sphenacris*, the tubercles are dense and tegminal vestiges are lacking; in *Calamacris*, the former are sparser and the latter are present. Of the Ichthiacridini, so far as is known, *Calamacris* is geographically the most central genus.

The forebears of *Calamacris* may well have given rise to *Sphenacris* to the east, and to *Ichthiacris* ancestors to the northwest. *Sphenacris* might be deemed to have diverged from *Calamacris* by developing a more densely and regularly pustulate integument, by losing the tegminal vestiges completely, by a narrowing of the posterior emargination of the epiphallus [very similar to what is found in *Ichthiacris* (*Atyphacris*) *costulata*], and by some reduction in the apical parts of the aedeagus.

In *Ichthiacris*, the integument has not the pustulate appearance found in *Calamacris* or *Sphenacris* but is more striated and irregularly rugose (*Ichthiacris*, sensu stricto) or less strongly sculptured, accompanied by a more cylindrical body (subgenus *Atyphacris*). The vestigial tegmina, as in *Calamacris*, have, however, been retained in most, though virtually or completely lost in *I.* (*A.*) *celata* and *I.* (*A.*) *aptera*. In *I.* (*I.*) *rehni* and *I.* (*I.*) *parva*, the tegminal vestiges, at least in females, are broader than in other species. This might be construed as a plesiomorphic character. Two species of *Ichthiacris* (subgenus *Atyphacris*) have developed a peculiar, undoubtedly apomorphic character in the female: the expansion of the metathoracic epimera, to a moderate degree in *I.* (*A.*) *costulata*, exaggeratedly in *I.* (*A.*) *californica*. The function of this morphological modification is unknown. *I.* (*I.*) *spinifera* is also peculiar in its development of a small projecting spine or denticle on the inferoposterior angle of the lateral pronotal lobe. The significance of this, too, is unknown.

The generally U-shaped form of the posterior emargination of the epiphallus of *Calamacris* is found in the majority of species of *Ichthiacris*, but the emargination has become slot-like (much as in *Sphenacris*) in *I.* (*A.*) *costulata* and broader and shallower in *I.* (*I.*) *rehni* and *I.* (*I.*) *spinifera*, though not in the closely related *I.* (*I.*) *parva*. In these last three species (*Ichthiacris*, sensu stricto), but especially in *I.* (*I.*) *rehni*, the anterolaterally directed subterminal processes of the lateral epiphallic appendices have become enlarged or exaggerated. In the Sonoran–Sinaloan *I.* (*A.*) *elongata*, the posterior emargination of the epiphallus is narrower than in *Calamacris* and most species of *Ichthiacris*, but it is not slot-like. In all species of *Ichthiacris*, the apical parts of the aedeagus, referred to above, are longer than in *Calamacris*, least so in *I.* (*I.*) *rehni* and *I.* (*I.*) *parva*, exaggeratedly so in *I.* (*A.*) *californica* and, particularly, *I.* (*A.*) *elongata*. *I.* (*I.*) *rehni* and, it seems, *I.* (*I.*) *parva*, have a peculiar female reproductive character: the ovipositor, instead of being comparatively slender and tapered in lateral view, as in all other species of the Ichthiacridini, is stout with the dorsal valves deep and apically somewhat sickle-shaped. This may be apomorphic and correlated with the type of oviposition site, though this is not established.

It can be postulated that *Ichthiacris* is derived either from a less regularly pustulate, *Calamacris*-like ancestor that invaded the Cape region of Baja California from the Mexican mainland, or that both genera are descendants from such an ancestor of southeastern Asiatic origin, which came from farther to the north, but for the existence of which there is no tangible evidence. (No American or Asiatic fossil pyrgomorphid is known.) Whichever is the case, *Ichthiacris* has speciated in southern Baja California.

Ichthiacris, sensu stricto, has retained a slightly more elongate-fusiform body form and a greater degree of rugosity than has the subgenus *Atyphacris*, while the epiphallus has become modified in two of the three species. Each has developed its own peculiar characters, such as the stout sickle-like dorsal ovipositor valves of *I.* (*I.*) *rehni* and *I.* (*I.*) *parva*, the diminutive size of the latter, and the spine or denticle on the inferoposterior angle of the lateral pronotal lobe of *I.* (*I.*) *spinifera*.

The subgenus *Atyphacris* would seem to have diverged by becoming less strongly sculptured and more cylindrical with a tendency toward a shorter fastigium of the vertex and a less oblique frontal profile, as in *I.* (*A.*) *californica* and, more particularly, in *I.* (*A.*) *aptera*. Other modifications must also have occurred. The latter species and *I.* (*A.*) *celata* appear to have become shorter, and they have virtually (or completely) lost all trace of wing vestiges. *I.* (*A.*) *costulata*, and particularly *I.* (*A.*) *californica*, in the female, have developed expanded metathoracic epimera and, in the male of the former species only, a very narrow slot-like posterior emargination of the epiphallus. It would also appear that this subgenus later (before or shortly after the opening of the Gulf of California) reached the Mexican (Sonoran–Sinaloan) mainland (rather than vice versa), where it is represented only by the specialized, greatly elongate *I.* (*A.*) *elongata*. The appearance of this species suggests that it may have become adapted to living on grasses instead of on xerophilous shrubs and bushes, the usual habitat for other species of the same genus.

The form of the aedeagus seems to have undergone parallel modifications in both subgenera. It is probable that its apical parts beyond the "flexure," in their primitive condition, would have been moderately long, as in *I.* (*I.*) *spinifera* and *I.* (*A.*) *costulata*. On the one hand, however, it seems to have become exaggeratedly long in the long-bodied *I.* (*A.*) *californica*, and particularly *I.* (*A.*) *elongata*, and, on the other hand, shortened in the short-bodied *I.* (*A.*) *celata* and *I.* (*A.*) *aptera*. This has

proceeded further in *I.* (*I.*) *rehni* and *I.* (*I.*) *parva*. In *Calamacris* and *Sphenacris*, the shortening has proceeded even further, with an accompanying weakening of the apical parts of the aedeagal valves in the latter genus.

In summary, I postulate that, on the basis of world knowledge of the Pyrgomorphidae, the Ichthiacridini are descendants of a primitive line that invaded southern North America from eastern Asia, perhaps in Cretaceous times, though there is no supporting fossil evidence for this. From a *Calamacris*-like ancestor later present in northern Mexico, eventual descendants spread to Baja California, resulting in the evolution of early *Ichthiacris*-like forms. These apparently gave rise to two lineages: *Ichthiacris*, sensu stricto, and the subgenus *Atyphacris*. The latter reached the southernmost part of the peninsula, where it has speciated more than has the nominotypical subgenus (which did not penetrate quite so far south). Descendants of one of the southern forms of *Atyphacris* must, in relatively recent times, it would seem, have made its way back to the northwest Mexican mainland, where it is today represented by *I.* (*A.*) *elongata*, the only member of the genus known to occur outside southern Baja California. On the long-isolated Cedros Island in the northwesternmost part of the range of the genus, it appears that an *I.* (*I.*) *rehni* ancestor gave rise to *I.* (*I.*) *parva*.

ACKNOWLEDGMENTS

I thank Dr. D. B. Weissman and Dr. P. H. Arnaud, Jr., of the California Academy of Sciences, San Francisco, for their assistance in arranging for the loan of the bulk of the material upon which this paper is based. I am also indebted to Dr. D. A. Nickle of the United States Department of Agriculture Systematic Entomology Section, U.S. National Museum of Natural History, Washington, D.C., and to Dr. D. Otte of the Academy of Natural Sciences of Philadelphia, for the loan of certain other material, mostly for re-examination. The line illustrations were inked for publication by D. J. Klimaszewski, formerly of the Lyman Entomological Museum and Research Laboratory; photographs are by Mr. F. Génier, formerly of the same institution, and by Mr. P. Langlois, Department of Entomology, McGill University. This work was supported by a grant to the author from the National Sciences and Engineering Research Council of Canada (Grant No. A 1378).

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