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Review of the genus *Sinaloa* (Acrididae: Melanoplinae): syntopy and allopatry in the lowlands of western Mexico

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Abstract

The grasshopper genus *Sinaloa* Scudder is composed of 8 species, 5 of which are new: *S. behrens*, *S. nitida*, *S. pulchella*, *S. sipuri* n. sp., *S. uri* n. sp., *S. garabe* n. sp., *S. jubaami* n. sp., and *S. isena* n. sp. *Barytettix peninsulae* from the southern tip of Baja California was incorrectly placed under *Sinaloa* by Bruner (1908) and Hebard (1925). The genus is known only from western Mexico (Sonora, Sinaloa, Nayarit, and Jalisco) where it occurs mostly in the lowlands. The species are differentiated mainly by the configuration of the male genitalia.

Key words

Acrididae, Melanoplinae, *Sinaloa*, new species, Mexico

Introduction

The members of the genus *Sinaloa* and those of *Barytettix* are the most common short-winged melanoplines on the western coastal plain of northern mainland Mexico. Most of the material reported herein was specifically sought on the several trips to this area by the junior author whose interest was stimulated and directed by Irving J. Cantrall of the University of Michigan Museum of Zoology, whose enthusiasm for short-winged melanoplines was unbounded. Intensive collecting was made along the main highway (Mex. 15) transecting the coastal plain from near Nogales in Sonora to southern Nayarit. No attempt was made to penetrate the Sierra Madre Occidental except on the Villa Union-Durango Highway (Mex. 40), where again intensive collections were made. On this transmontane highway the great effort expended collecting specifically for short-wings west of Durango clearly indicates that *Sinaloa* is absent east of the crest of the Sierra Madre in oak and pine woodlands at high elevations where *Conalcea* species are common. Descending from the crest on the west side, *Sinaloa* was first found at about 5700 to 6500 ft., surprisingly, in the pine zone. Because several species extend from near sea level to moderate elevations in Sinaloa and Nayarit, we think that most of the species will penetrate into at least the foothills of the Sierra Madre Occidental, and that not many more species are to be expected from these mountains.

Sinaloa extends from northern Sonora at low elevations through Sinaloa and Nayarit and a short distance eastward from Nayarit into Jalisco. Although sampling for short-wings has been done in areas of Jalisco adjacent to eastern and southern Nayarit, no intensive collecting has been done there. As indicated above, only one altitudinal transect was made into the Sierra Madre for *Sinaloa*.

Our field notes indicate a surprising paucity of melanoplines other than *Sinaloa* and *Barytettix* at low elevations in Sonora, Sinaloa and Nayarit. Only a few species of *Melanoplus* and *Aidemona* were collected here, in addition to several species of one or a few conalciine genera to be described shortly. Only at the altitudinal or distributional limits of *Sinaloa* did we encounter other melanopline genera: at higher elevations on the Durango highway, in the grasslands east of Tequila (Jalisco), and in the more humid habitats of southern Nayarit.

Many of the species of *Sinaloa* are broadly sympatric in Sinaloa and Nayarit and a number occur together in pairs at several localities, much as in *Barytettix* with which *Sinaloa* is frequently found. The uncanny similarity of color between *Sinaloa nitida* Scudder and *Barytettix poecilus* (Hebard), which are often found together, is a particularly interesting situation. Also of note is the close approximation of the ranges of *S. behrensi* Scudder and *nitida* Scudder which have almost identical genitalia but a widely different color pattern. On the other hand, *sipuri* n. sp. and *jubaami* n. sp., also closely allopatric, share distinctively similar aedeagi and color and color patterns, but perhaps were only recently geographically isolated and may soon contact one another.

Collecting localities are arranged north to south and roughly east to west. Specimens recorded with an "ID" number are so labelled in the collection of the Academy of Natural Sciences of Philadelphia, and these specimens have the internal genitalic complex dissected, cleared and stored in alcohol. The numbers on the genitalic complex figures refer to these ID numbers, and the localities can be found in the sections on collecting localities for each species. Numbers following collector's names are those in the field notebooks deposited in the Insect Division of the University of Michigan Museum of Zoology; these field numbers repeat each year, and for each collector or collectors. Locality data in square brackets have been added after additional research on the locality involved.

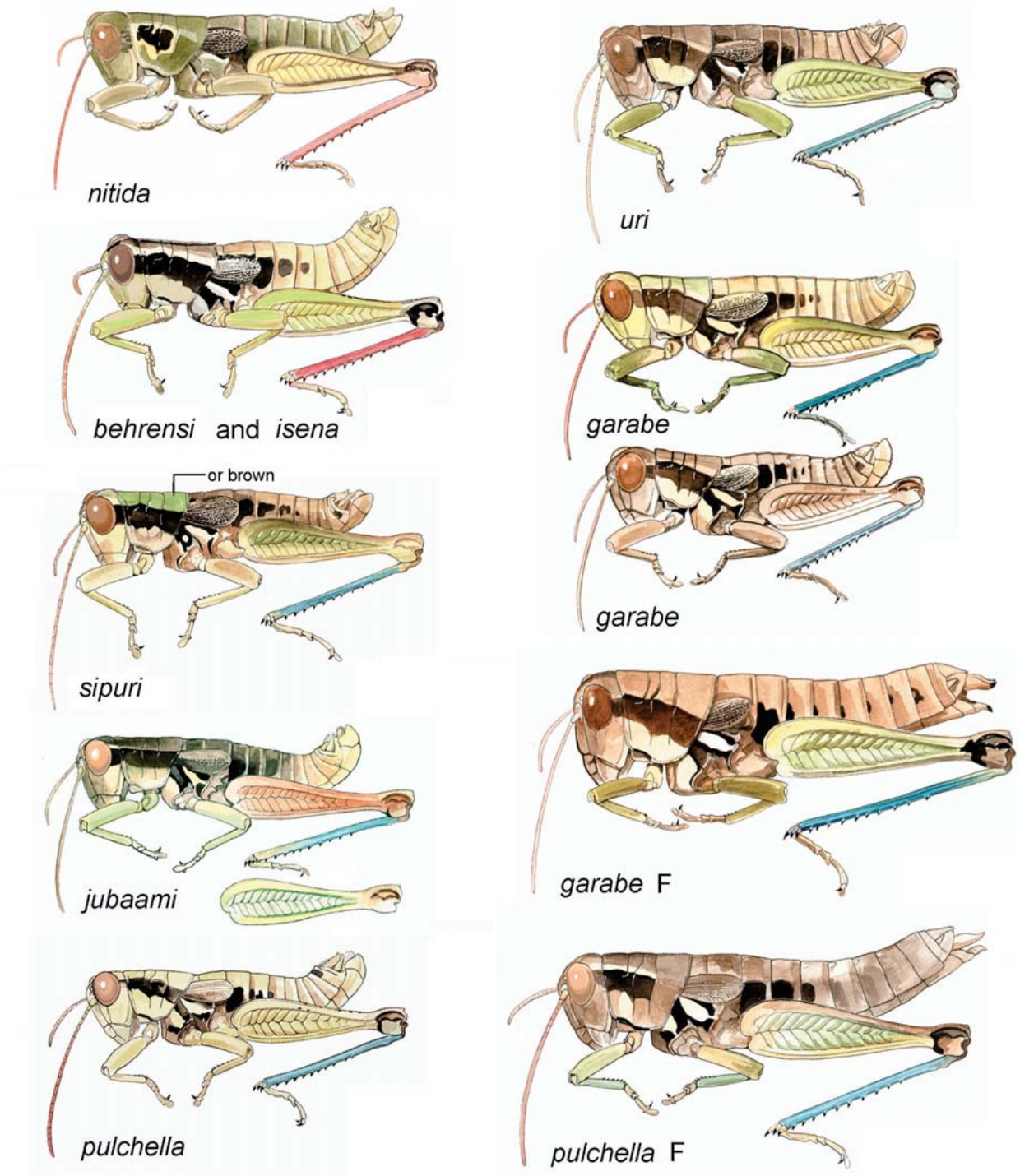

Fig. 1. Portraits of *Sinaloa* species. *S. isena* not shown but is very similar to *S. behrensi*. Two *S. garabe* males shown, having somewhat different wing shape and color.

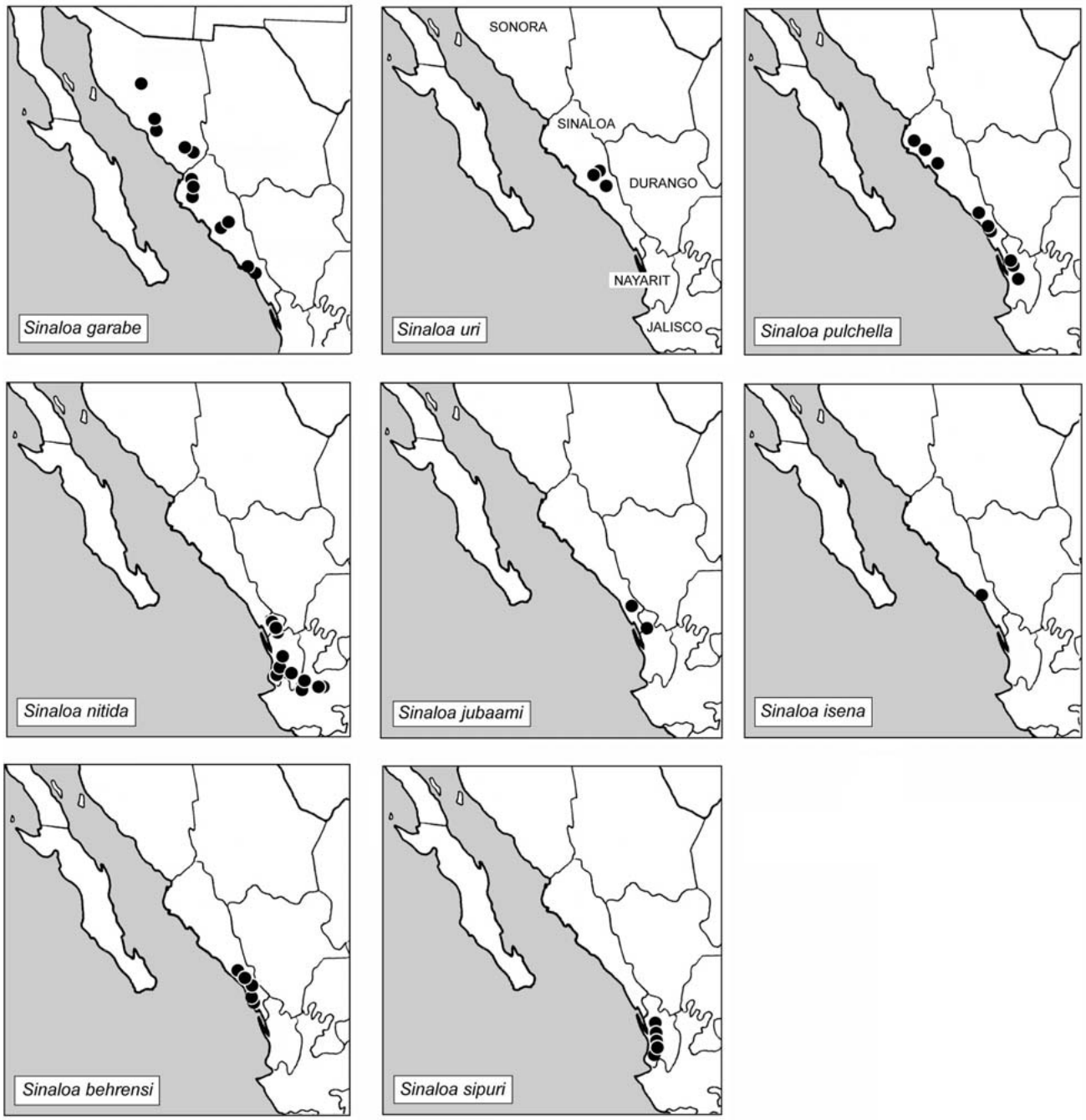

Fig. 2. Distributions of *Sinaloa* species. Some closely spaced localities could not be shown.

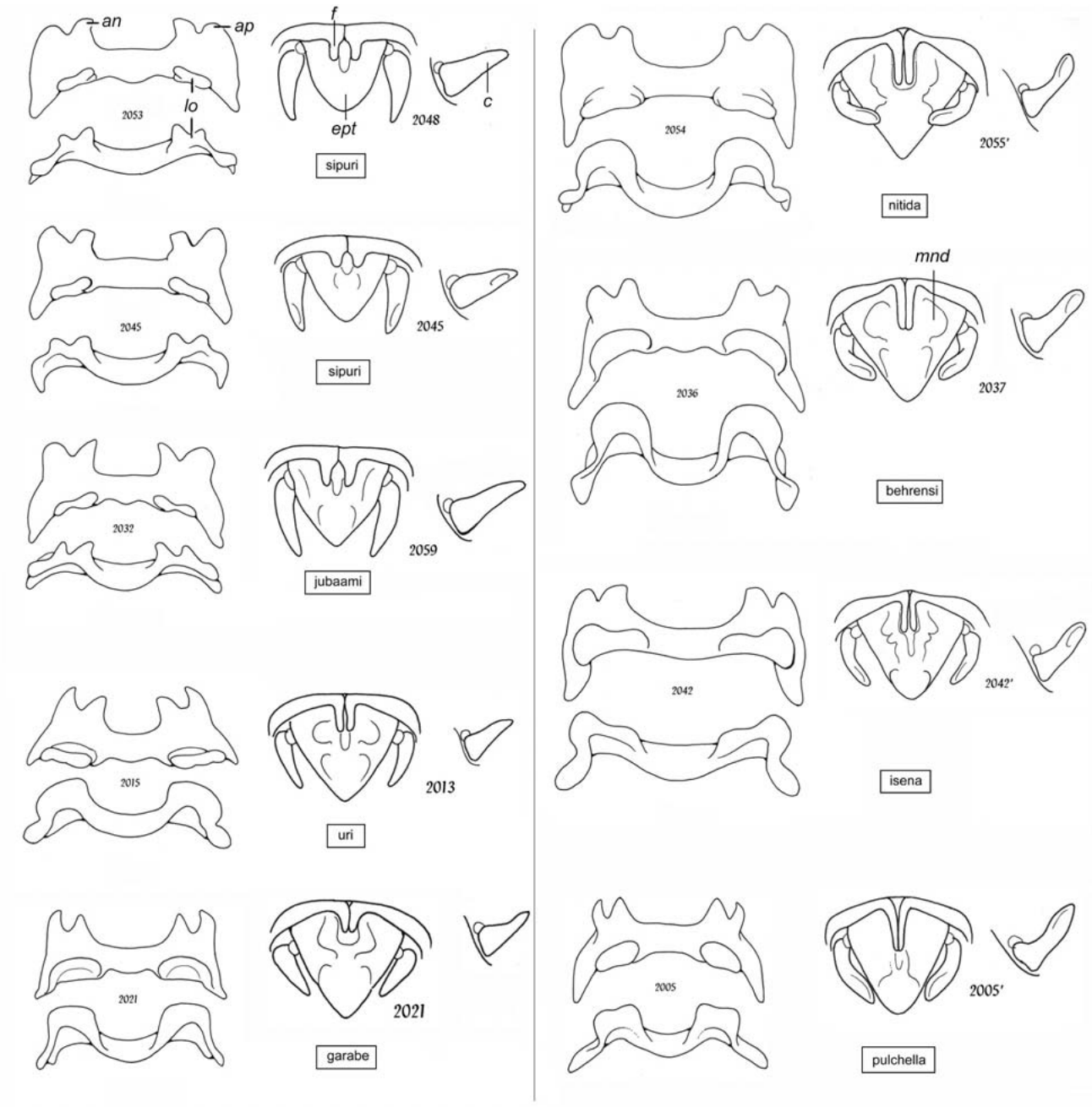

Fig. 3. Comparison of epiphallus (left) epiproct (center) and cerci (right) in *Sinaloa* species. Abbreviations: an, ancorae of epiphallus; ap, anterior process of epiphallus; lo, lophus (lophi) of epiphallus; f, furcula (furculae); ept, epiproct; c, cercus (cerci). Numbers refer to specimen identification numbers.

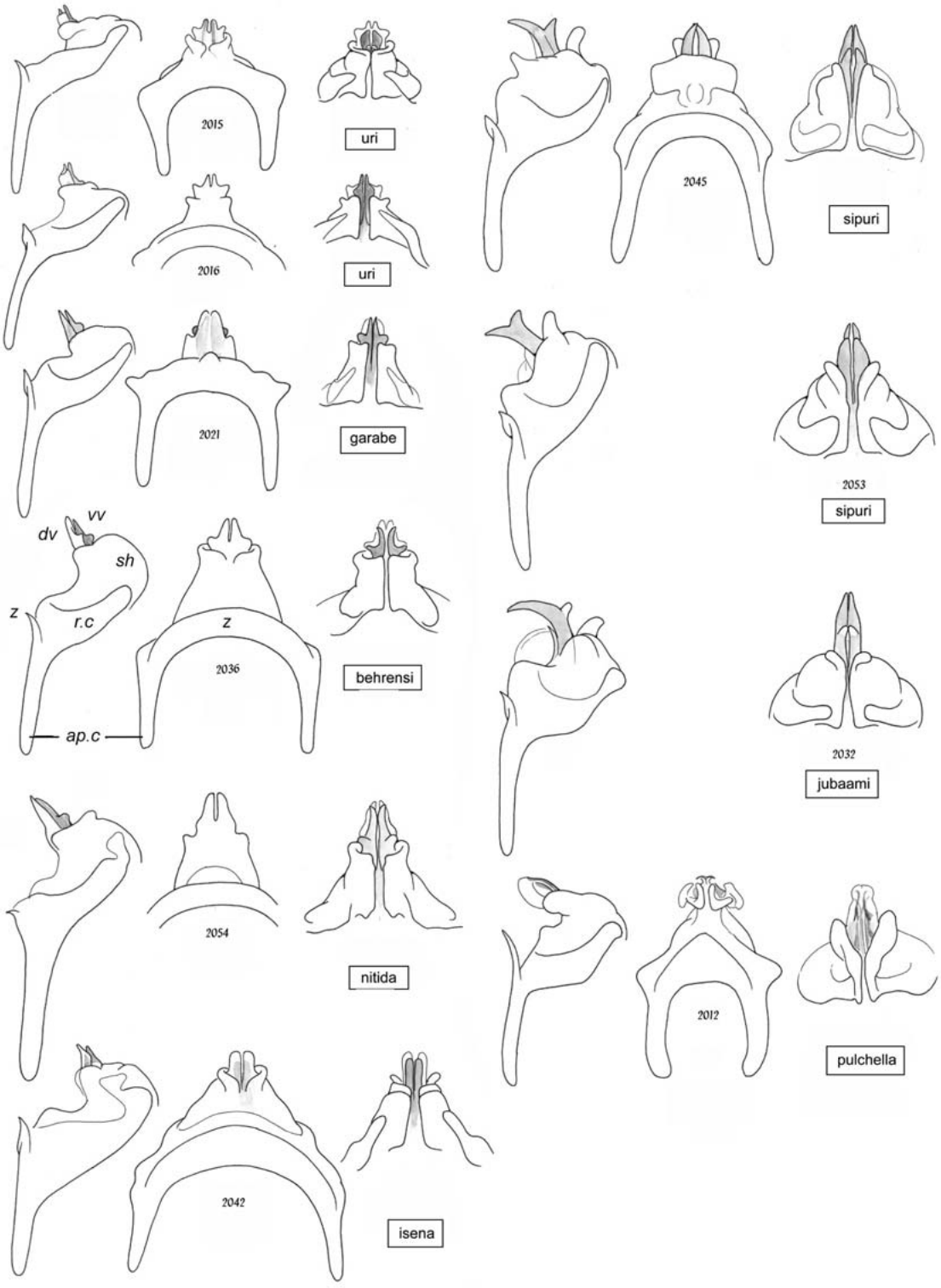

Fig. 4. Comparison of genital complex (endophallus not shown). Abbreviations: z, zygoma of cingulum; rc., rami of cingulum; ap.c, apodeme of cingulum; dv, dorsal valve of aedeagus; vv, ventral valve of aedeagus; sh, sheath of aedeagus.

List of Species

1. *Sinaloa sipuri* n. sp.
2. *Sinaloa jubaami* n. sp.
3. *Sinaloa uri* n. sp.
4. *Sinaloa garabe* n. sp.
5. *Sinaloa pulchella* Hebard
6. *Sinaloa isena* n. sp.
7. *Sinaloa behrensi* Scudder
8. *Sinaloa nitida* Scudder

Genus *SINALOA* Scudder

Type species.— *Sinaloa behrensi* Scudder, by original designation.

Recognition.—This genus may be distinguished from other genera as follows: forewings short, barely covering auditory tympana, wide at base (longer and narrower at base in *Barytettix*) rounded at apex; cerci of male short, never downturned, simple, slightly tapering or weakly expanded distad; furculae of male well developed, often long and narrow; subgenital plate of male slightly conical (much less conical than in *Barytettix*); epiphallus variable, some species with unilobate, others with bilobate lophi; aedeagus generally small, elongate in only two species, ventral valve branched, zygoma of cingulum short, scarcely distinguishable from above; coloration of body often greenish, lateral lobe of pronotum with an upper dark band which usually (except in *nitida*) reaches posterior margin; all femora usually greenish. See Cohn and Cantrall, 1974, p. 19, for further discussion of characters.

Geography.—This genus is confined to the western slopes of northern Mexico, from Sonora to Jalisco. In this region it overlaps extensively with the genus *Barytettix*, but unlike that genus it does not extend northwards into the United States or onto the Baja California peninsula.

Habitat.—The members of this genus are often associated with openings in woodlands and in weedy areas; it is often in tall weeds.

Life Cycle.— Collecting records show that these species reach the adult stage in mid to late summer and may be found well into November.

Species Groups

Sinaloa appears to consist of the following species groups and distinguishing characteristics:

Nitida Group (*nitida, behrensi, isena*)
1. Tibia-3 red
2. Furculae long, narrow, situated in groove (Fig. 3)
3. Cerci more elongate, less pointed, narrower in central region (Fig. 3)
4. Lophi of epiphallus unilobed, slightly bilobed only in *isena* (Fig. 3)
5. Aedeagus short, not strongly upward bending (Fig. 4)

Sipuri Group (*sipuri, jubaami*)
1. Tibia-3 blue (like Garabe and Pulchella Groups)
2. Furculae short, broad, not touching one another (Fig. 3)
3. Cerci short, pointed, continuously tapering (like Garabe Group) (Fig. 3)
4. Lophi of epiphallus strongly bilobed (Fig. 3)
5. Aedeagus long, ventral valves strongly upward bending (Fig. 4)

Garabe Group (*garabe, uri*)
1. Tibia-3 blue (like Sipuri and Pulchella Groups)
2. Furculae narrow, short or intermediate, touching or almost touching one another (Fig. 3)
3. Cerci short, pointed, continuously tapering (like Sipuri Group) (Fig. 3)
4. Lophi of epiphallus unilobed (Fig. 3)
5. Aedeagus slightly longer than Nitida Group, straight (Fig. 4)

Pulchella Group (*pulchella*)
1. Tibia blue (like Sipuri and Garabe Groups)
2. Furculae long, narrow, touching one another, situated in a groove (Fig. 3)
3. Cerci more elongate, less pointed, narrower in central region (like Nitida Group) (Fig. 3)
4. Lophi flat above or barely bilobed (Fig. 3)
5. Aedeagal valves short, shape unique (Fig. 4)

Key to *Sinaloa* species

1 Tibia-3 red; ridges above or below pagina of femur-3 more darkly pigmented forming dark line **2**
— Tibia-3 blue **4**
2 Side band on lateral lobes not extending to rear margin, surrounded by yellow area . . . . . ***nitida***
— Side band of lateral lobes extending to rear margin, without surrounding pale area **3**
3 Lophi of epiphallus slightly bilobed (Fig. 3), aedeagus as in Fig. 18 . . . . . ***isena***
— Lophi of epiphallus not bilobed (Fig. 3), aedeagus as in Fig. 17 . . . . . ***behrensi***
4 Epiphallus lophi strongly bilobed; furculae short, not situated in groove **5**
— Epiphallus lophi not bilobed; furculae longer, situated in groove **6**
5 Aedeagus ventral valve shorter (Fig. 12) . . . . . ***sipuri***
— Aedeagus ventral valve distinctly longer (Fig. 13). . . . . ***jubaami***
6 Furculae very long, narrow (Fig. 3) . . . . . ***pulchella***
— Furculae relatively short **7**
7 Aedeagus as in Fig. 9; furculae shorter (Fig. 3) . . . . . ***garabe***
— Aedeagus as in Fig. 15; furculae longer (Fig. 3) . . . . . ***uri***

1. ***Sinaloa sipuri*** n. sp.
Figs 1-5, 12

Type.— Holotype male. Mexico: Nayarit: 4 mi SW of Estacion Yago (ca 0.1 mi from Hwy #15, 0.6 miles NW of Rio Santiago), 29 Aug 1965 (Cohn 78) ID-2043 (deposited at Academy of Natural Sciences, Philadelphia).

Recognition.— Tibiae blue; tibia-3 without a dark ring; furculae short, and not touching one another and not lying within a groove; cercus short, tapering; lophi of epiphallus bilobed; epiproct without mounds; lateral lobes of pronotum without lower black margin; dorsum of pronotum green or grey-brown; femur-3 without dark ridges on pagina, green; femur-1 and -2 green in males, brown in some females.

Diagnosis.— Very similar to *S. jubaami*, differing mainly in the shape of the aedeagal valves (Fig. 4).

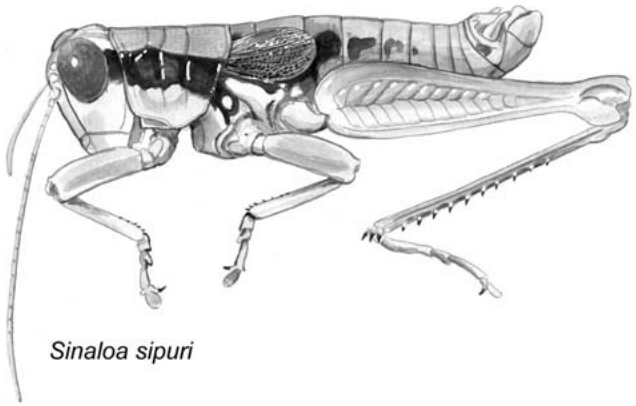

Fig. 5. Portrait of *Sinaloa sipur*i n. sp.

Measurements (in mm).— Body length to end of femur-3: 18.5 to 22 (males) 22.5 to 27 (females); length of femur-3: 10 to 12 (males) 12.5 to 15 (females).

Collecting localities.— All paratypes. **MEXICO**: **Nayarit**: 4 mi SW of Estacion Yago (ca 0.1 mi from Hwy #15, 0.6 mi NW of Rio Santiago), 29 Aug 1965 (Cohn 78) ID-2043 — Rio Santiago, 14 Aug 1958 (E. Helwig) — 31 road-mi NW of Tepic (2.2 mi SE of Rio Santiago) on Hwy #15, 250 ft, 29 Aug 1965 (Cohn 77) ID-2045 — San Blas 16 Aug 1956 (Frank N. Young), ID-2048 — 17.9 mi NW of Tepic on Hwy 15, 1210 ft, 2 Sept 1961 (Cohn & Cantrall 67) ID-2047 — 4 road-mi N of Tepic, 2800 ft, 22 Nov 1958 (Cohn 304) ID-2049 — 3 mi NW of Tepic (0.3 mi SE of junction of Hwys #15 and #54), on Hwy #15, 28 Aug 1965 (Cohn 75) ID-2046 —Tepic, 11 Aug 1958 (E. Helwig) — 12.7 road-mi S of Jalisco on Compostela road, 2700 ft, 28 Aug 1965 (Cohn 76) ID-2044 — 9 mi N of Compostela, 3450 ft, 4 Nov 1958 (Cohn 251) ID-2053 — 7.6 mi E of Las Varas, 8 Oct 1970 (Cohn and Cohn 51) ID-2234 — 36.6 mi SW of Las Varas, hills, 8 Oct 1970 (Cohn and Cohn 49) ID-2232, 2233 — **Jalisco**: 5.4 mi E of bridge at Plan de Barrancas, 21.2 road-mi E of Ixtlan del Rio (Nayarit), 3000 ft, 27 Aug 1965 (Cohn 73) ID-2059.

Habitat.— Cohn 1958: 257 was an area with good woods with numerous good sized trees and numerous small ones and much cactus. The area also contained vines and some bushes. Many broad-leaf trees, with some losing their leaves, produced a thin litter. The soil consisted of sand and decomposing rock. Weeds were very thin in shade and somewhat thicker where open, never forming a dense cover.

Cohn 1958: 304 was in steep hilly country; most hills were bare, or somewhat bushy and weedy or covered with scattered trees. There was heavy growth of low trees and bushes in the draws. Collection came from a shelf near the bottom of a draw, a region clear of most bushes and trees but the shelf's other side and the hillside above were covered in heavy growth. The shelf had a thick growth of weeds and grass heavily trampled by cattle.

Cohn 1958: 252 and Cohn 1959: 206 were on a hillside in oak woods with thick litter and a good, but patchy, growth of weeds and bushes.

Cohn 1965: 73 was an area of thorny scrub and some thorny trees, with good growth of weeds and vines on steep hillside and on a 20-ft roadside mound; there was a variety of trees and bushes, below thinned pasture.

Cohn 1965: 75 was at a roadside with weeds along low cliff; with lush thick weeds and bushes and with an occasional tall tropical looking tree. Otherwise the area was farmed.

Cohn 1965: 77 was at a small patch of probably thinned tropical forest in hilly country; with a few big trees and a thin understory of trees and bushes; weeds were thin below but thick outside near the road, but not lush. All grasshoppers were in the thicker weeds.

Cohn 1965: 78 was a roadside with weeds, almost lush, below a hillside in dense brush, trees and vines.

Etymology.— Sipuri is the name for tarantula in the Tarahumara language

2. ***Sinaloa jubaami*** n. sp.
Figs 1-4, 6, 13

Type.— Holotype male. Mexico: Nayarit: 2 mi S of Acaponeta (at Hwy #15 river bridge) [ca 200 ft], 1 Sep 1961 (Cantrall and Cohn #62) (deposited at Academy of Natural Sciences, Philadelpha).

Recognition.— Tibiae blue; tibia-3 without dark ring; furculae short, not touching one another, and not lying within a groove; cercus short, tapering; lophi of epiphallus bilobed; epiproct without mounds; lateral lobes of pronotum without lower black margin; dorsum of pronotum grey-brown; femur-3 without dark ridges on pagina, green or orange; femur-1 and -2 green or rusty colored.

Diagnosis.— Very similar to *S. sipuri*, differing mainly in the shape of the aedeagal valves.

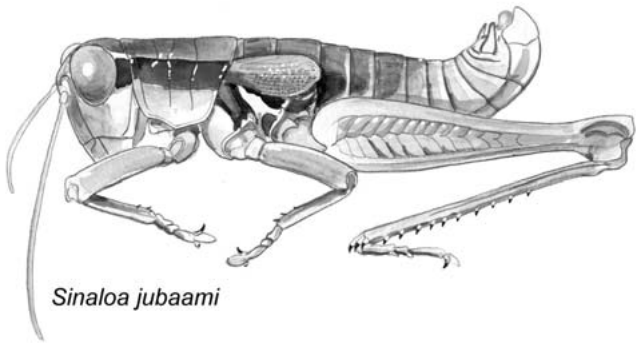

Fig. 6. Portrait of *Sinaloa jubaami* n. sp. male.

Measurements (in mm).— Body length to end of femur-3: 18.5 to 20 (females) 24 to 27 males; length of femur-3: 10.5 to 11 (males) 13.5 to 14 (females).

Collecting localities.— All paratypes. MEXICO: Sinaloa: 12.5 mi NE of Concordia [on Durango hwy], 1100 ft, 30 Aug 1965 (Cohn 83) ID-2033 — Nayarit: 5 mi N of Acaponeta (on Huajicori Mine rd.), ca 300 ft, 20 Nov 1958 (Cohn 302) ID-2035 — 2 mi S of Acaponeta (at bridge over river on Hwy #15), [ca 250 ft], 1 Sept 1961 (Cantrall and Cohn 62) ID-2032, 2034 — [female: 8.6 mi SE of Acaponeta, 1 Sept 1961 (Cantrall and Cohn 64)]

Habitat.— Cohn 1958: 302 was at the base of a hill in an area covered in short, thick grass with scattered leguminaceous low trees and patches of tallish but thin weeds. The area was edged by heavier weeds, sapling bushes, and low trees that quickly became low, mixed woods.

Cohn 1965: 83 was well into the Sierra Madre [but at only 1100 ft]. Here was a fairly good thorn forest in very mountaininous country, but thinned, with a lush growth of roadside weeds and vines, partly cut down, and with bushes mostly chopped out.

Etymology.— Jubaami is the word for ultimate in the Tarahumara language.

3. ***Sinaloa uri*** n. sp.
Figs 1-4, 7, 14

Type.— Holotype male. Mexico: Sinaloa: 50 mi NW of Culiacan, on Hwy #15, 2 Sept 1965 (Cohn 89) ID-2013 (deposited at Academy of Natural Sciences, Philadelphia).

Recognition.— Tibia-3 blue; hind knee with a dark ring; furculae short, nearly touching one another and situated in a groove; cercus short, tapering; lophi of epiphallus not bi-lobed; epiproct with mounds; lateral lobes with black lower margin; dorsum of pronotum grey-brown and with pale lateral bands; femur-3 green and without dark ridges on pagina; femora-1 and -2 green, sometimes yellowish.

Diagnosis.— Most similar to *garabe*, differing in having longer furculae (Fig. 3) and in the shape of the zygoma and aedeagal valves (Fig. 4).

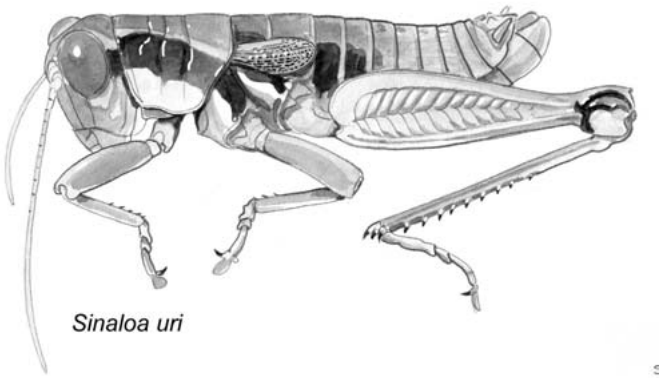

Fig. 7. Portrait of *Sinaloa uri* n.sp. male.

Measurements (in mm).— Body length to end of femur-3: 17 to 20 (males) 20 to 24 (females); length of femur-3: 9 to 10.5 (males) 11 to 13.5 (females).

Collecting localities.— All paratypes. **MEXICO: Sinaloa**: 50 mi. NW of Culiacan on Hwy #15, 2 Sept 1965 (Cohn 89) ID-2013 — 6 mi W of Jesus Maria (23 mi N of Culican on Presa Humaya road), 11 Nov 1958 (Cohn 279) — 5.2 mi SW of Badiraguato, 10 Nov 1959 (Cohn 232) ID-218 — 1 mi W of Tecorito, [13 mi N of Culiacan], [ca 250 ft], 24 Oct 1959 (Cohn 221) ID-2018 — 3 mi NE of Tepuche (13.5 mi N[NW] Culiacan), 6 Sept 1966 (Cohn 40) ID-2020 —24.5 mi SE of Culiacan Cathedral on Hwy #15, 26 Nov 1974 (Cohn and Cohn 145) ID-2014 — 35 mi SE of Culiacan (1.5 mi S of Rio Tabala), 6 Nov 1954 (Cohn 260) ID-2017 — 52 mi SE of Culiacan (20 m SE of Rio Tabala), 6 Nov 1958 (Cohn 259) ID-2016 — 75 mi SE Culiacan (3.5 mi N of Rio Elota) on Hwy #15, 22 Nov1974 (Cohn and Cohn 141) ID-201

Habitat descriptions.— Cohn 1959: 232 was in hills above the town. The area consisted of modified and probably thinned woods, but with a variety of trees, bushes and cactus. The road edge had tall weeds. Nearby were good woods and a small corn field.

Cohn 1965: 89 was apparently chopped-over thorn forest, now in fields or grazed; near the road were many tall bushy broad-leaved weeds plus various bushes and low trees, this vegetation not thick.

Cohn and Cohn 1974: 141 was at a wide pull-off in a narrow valley. The habitat consisted of rich weeds, sometimes 5 ft or higher, and several species of grass. The area was also next to a row of small trees and bushes of several species, and some vines. Fields on other side of the valley were within 100 yd of hillsides covered in rich thorn forest or thickly overgrown fields.

Etymology.— Uri is the word for barranca in the Tarahumara language.

4. ***Sinaloa garabe*** n. sp.
Figs 1-4, 8, 15

Type.— Holotype male. Mexico: Sonora: 14.7 mi N of Los Mochis, 3 Sept 1965 (Cohn 92) ID-2021 (deposited at Academy of Natural Sciences, Philadelphia).

Recognition.— Tibia-3 blue; hind knee with a dark ring; furculae short, touching one another and situated in a groove; cercus short, tapering; lophi of epiphallus not bilobed; epiproct with mounds; lateral lobes with black lower margin; dorsum of pronotum light grey-brown, some pale grey-green; femur-3 color green or light brown and without dark ridges on pagina; femora-1 and -2 pale green or yellowish.

Diagnosis.— Most similar to *uri*, differing in having shorter furculae (Fig. 3) and in the shape of the zygoma and aedeagal valves (Fig. 4).

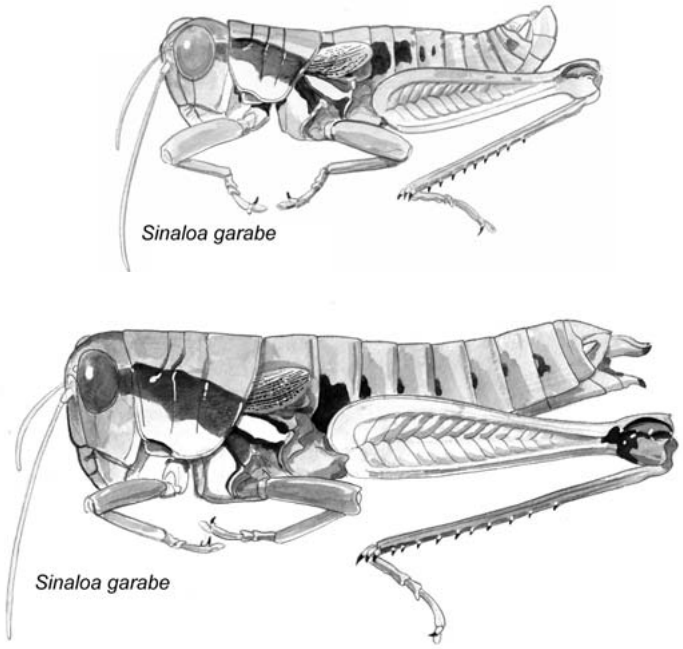

Fig. 8. Portraits of *Sinaloa garabe* n. sp., male and female.

Measurements (in mm).— Body length to end of femur-3: 16 to 18 (males) 19 to 24 (females); length of femur-3: 8 to 9.5 (males) 10.5 to 13.5 (females).

Collecting localities.— All paratypes. **MEXICO**: **Sonora**: 49 mi N Hermosillo, 400 to 500 m., 31 Aug 1957 (Cohn and Tinkham 87) ID-2026 — 37 mi SE of Guaymas, ca 200 m., 5 Sept 1957 (Cohn and Tinkham 111) ID-2027 — **Sinaloa**: 4.4 mi S Estacion Don (Sonora), 57 mi S of Navajoa (Sonora), 11 Nov 1959 (Cohn 234) ID 2025 — 17.8 mi N of Los Mochis turnoff on Hwy 15 (16 mi S of Cerro Prieto), 3 Sept 1965 (Cohn 93) ID-2022 — 14.7 mi N of Los Mochis turnoff on Hwy 15, 3 Sept 1965 (Cohn 92) ID-2021 — 1 mi NW Alamos, ca 1300 ft, 11 Nov 1959 (Cohn 236) ID-2024 — 14.9 mi SE Navojoa (1.5 mi S Bacabachi) on Hwy 15, 4 Sept 1965 (Cohn 96) ID-2023 — 2.5 mi NW of bridge [over Rio Culiacan] in Culiacan, [130 ft], 29 Aug 1961 (Cantrall and Cohn 56) ID 2028

Habitat descriptions.— Cohn 1959: 234 was an area of very rich, closely spaced bushes of several species and bushy weeds, with a fairly thick growth of grass and numerous leafless white-bark trees and both giant and low cactus.

Cohn 1965: 93 was in low mountains in desert-thorn (or transition); hillsides were covered by a very good growth of low trees and columnar cacti; collections came from cutover weeds, bushes and cacti above the road.

Cohn 1965: 96 was desert with a few kinds of leguminous trees,, some spiny and some non-spiny bushes, and organpipe cactus. The area was more or less flat, with gravelly soil, much open ground, some very thin low weeds and grass. Nearer the road acacias were heavier and thicker, with moderate weedy growth. *Sinaloa* was found in the weedier vegetation.

Cohn 1959: 236 was in a rather broad valley. Collections came from a gently sloping valley floor with short carpet-like grass, and regularly scattered small clumps of low bush mesquite which protected tall grass and weeds. Farther down, the grass became tall with patches of weeds and scattered spiny legumes and occasional broad-leaf trees. Surrounding hills were covered in heavy growth of bushes, some of them spiny.

Etymology.— Garabe is the word for perfect in the Tarahumara language.

5. ***Sinaloa pulchella*** Hebard
Figs 1-4, 9, 16

Sinaloa pulchella Hebard, 1925, Transactions of the American Entomological Society 51: 288.

Type.— Holotype male. Mexico: Sinaloa: Venvidio, 2 Sept 1918 [J.A. Kusche?] [probably El Venadillo, 4.5 mi N of old Mazatlan airport; see Cohn and Contrall 1974, p. 24] (deposited in Academy of Natural Sciences, Philadelphia).

Recognition.— Tibia-3 blue; hind knee with a dark ring; furculae long, touching one another and situated in a groove; cercus longer, narrower in middle; lophi of epiphallus slightly bilobed; epiproct without mounds; lateral lobes with black lower-margin side band sometimes not continuous; dorsum of pronotum green, yellow, or pale grey-brown; femur-3 color greenish or green-yellow and without dark stripes on pagina; femora-1 and -2 green or yellowish.

Diagnosis.— Most similar to *garabe* and *uri*, but furculae very long and narrow (Fig. 3), and zygoma and aedeagal valves distinctively different (Fig. 4).

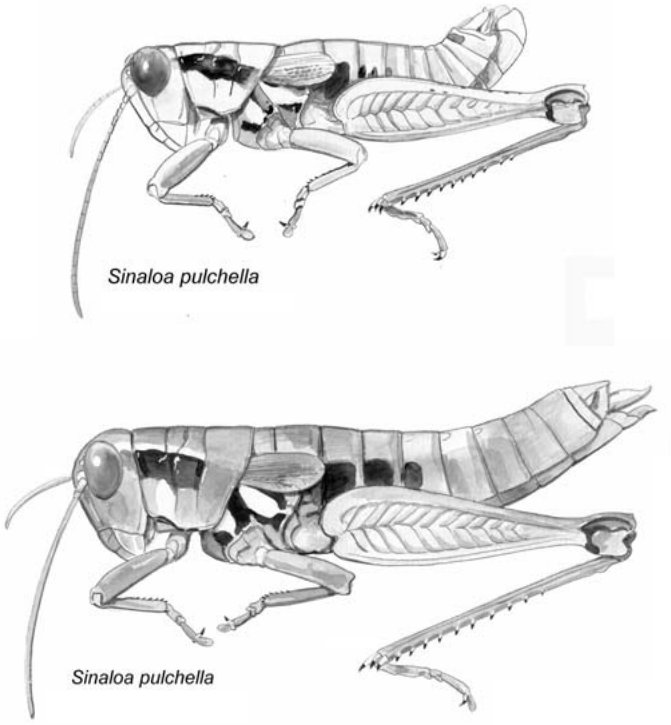

Fig. 9. Portraits of *Sinaloa pulchella* male and female.

Measurements (in mm).— Body length to end of femur-3: 16 to 19.5 (males) 18.5 to 22.5 (females); length of femur-3: 13 to 13 (males) 15 to 16 (females).

Collecting localities.— **MEXICO**: **Sinaloa**: 3.6 mi W of Guamuchil on Hwy #15, 3 Sept 1965 (Cohn 90) ID 2009 — 50 mi NW of Culiacan [on Hwy #15], 2 Sept 1965 (Cohn 89) — 30 mi N[W] of Culiacan [on Hwy #15], 2 Sept 1965 (Cohn 88) ID-2011 — 14 mi NW of Culiacan Cathedral on Hwy #15, 24 Nov 1974 (Cohn and Cohn 142) ID-2012 — 1 mi E of Tecorito (E. side Rio Humaya)(13 mi N of Culiacan), 130 ft, 13 Nov 1958 (Cohn 284C) — 7.6 mi N of Culiacan Plaza (Hacienda Simon Stopol), ca 200 ft, 3 Nov 1959 (Cohn 230) —3 mi N[W] Culiacan, 30 Oct 1958 (Cohn 39) — 2.5 mi NW of [Culiacan River] bridge in Culiacan, 29 Aug 1961 (Cohn and Cantrall 56) — 1 to 2 mi E of Culiacancito, 100 ft, 29 Oct 1958 (Cohn 236) — Rio Culican at Culiacan, 4 Sept 1957 (Cohn and Tinkham 105) — 2 mi W of Culiacan, 16 Nov 1958 (Cohn 290) ID 2007 — 15 mi SW of Navolato (4.5 mi NE of Altata), 31 Oct 1958 (Cohn 243) — 1.7 mi NE of Altata (18 mi SW of Navolato), 31 Oct 1958 (Cohn 243) — Alatata (19 mi SW of Navolato), 31 Oct 1958 (Cohn 242) ID 2008 — 19 mi SE of Culiacan on Hwy #15, 280 ft, 31 Aug 1961 (Cantrall and Cohn 59) — 24.5 mi SE of Culiacan Cathedral, 26 Nov 1974 (Cohn and Cohn 145) — 33 mi SE of Culiacan (1.5 mi S of Rio Tabala), 200 ft, 6 Nov 1958 (Cohn 260) — 37 mi SE of Culiacan center), 100 ft, 28 Oct 1958 (Cohn 233) — 39.9 mi SE of Culiacan (9.4 mi. SE of Rio San Lorenzo) on Hwy #15, 31 Aug 1961 (Cantrall and Cohn 60) ID 2005 — 52 mi SE of Culiacan (20 mi SE Rio Tabala), ca 200 ft, 6 Nov 1958 (Cohn 259) — 66 mi SE of Culiacan, ca 200 ft, 6 Nov 1958 (Cohn 258) — 73 mi SE of Culiacan (40 mi SE of Rio San Lorenzo), ca 300 ft), 18 Nov 1958 (Cohn 296) — 1 mi NW of El Venadillo [4.5 mi. N. of old Mazatlan airport], 31 Aug 1961 (Cantrall and Cohn 61A) — El Venadillo (ca. 0.4 NW), 4.5 mi N of [old] Mazatlan airport, 28 Aug 1961 (Cantrall and Cohn 55) — 1.3 to 2.6 mi NW of Villa Union on Hwy #15 (W side Rio Presidio) 29 Aug 1965 (Cohn 81) ID-2010 — Villa Union, 4 road-mi SW of Santa Lucia, 13 road-mi NE of Concordia, 28 Aug 1961 (Cohn and Cantrall 228) — **Nararit**: 15 mi N of Tuxpan Rd Jct (28 mi SSE Acaponeta) on Hwy #15, 2 Sept 1961 (Cohn and Cantrall 66) ID-2006.

Habitat.— Cohn 1958: 290 was a tall weedy field, with many dry weeds. There were many malvaceous weeds and some bushes. The area merged into spiny legumes (8 ft tall) and then into a thinned thorn forest. This was probably the first extensive heavily weeded field south of the river.

Cohn 1965: 90 was an area of low (cut-over) heavy roadside weeds and *Acacia cymbispina* bushes, next to low, open thorn forest.

Cohn 1965: 81 was a badly damaged farmed and grazed landscape, with various trees, bushes and thick weeds near the road. *S. behrensi* also was found here. The range of *S. behrensi* is included within the wider range of *pulchella*; when the two occur together, which is often, one is usually rare.

Cohn 1965: 88 was more or less flat (agricultural land?) consisting of a field of low and medium bushes (not thick) and a thick 1 to 2 ft cover of composite weeds; bushes, catclaw, *Acacia cymbispina etc.* were spaced and bunched.

6. ***Sinaloa behrensi*** Scudder
Figs 1-4, 10, 17

Sinaloa behrensi Scudder, 1897, Proceedings U.S. National Museum 20: 40.

Type.— Holotype male. Mexico: Sinaloa (deposited at Academy of Natural Sciences, Philadelphia).

Recognition.— Tibia-3 red; hind knee with a dark ring; furculae long, touching one another and situated in a groove; cercus longer, narrower in middle; lophi of epiphallus unilobed; epiproct with mounds; lateral lobes with black lower margin, side band sometimes not continuous; dorsum of pronotum grey-brown, with dark midline, with wider lateral pale bands; femur-3 color greenish or brownish and with dark ridges on pagina; femora-1 and -2 greenish.

Diagnosis.— Most similar to *isena*, but lophi of epiphallus not bilobed (Fig. 3). Also differing in the aedeagal valves.

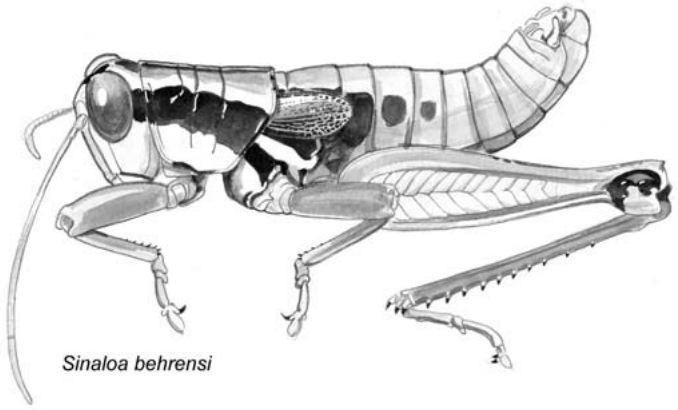

Fig. 10. Portrait of *Sinaloa behrensi* male.

Measurements (in mm).— Body length to end of femur-3: 22 to 25 (males) 24 to 30 (females); length of femur-3: 12 to 14 (males) 13 to 16 (females).

Collecting localities.— **MEXICO: Sinaloa**: 1.1 mi SW of San Igancio ferry, 21 Nov 1974 (Cohn and Cohn 139) ID-2041 — 48 mi N of [old] Mazatlan airport on Hwy #15, 28 Oct 1958 (Cohn 232d) ID-2029 — 38.8 mi N of [old] Mazatlan airport on Hwy #15, 30 Aug 1965 (Cohn 84) ID-2037 — El Venadillo (ca 0.4 mi NW), 4.5 mi N of [old] Mazatlan airport, 28 Aug 1961 (Cantrall and Cohn 55) — Venvidio [probably El Venadillo, 4.5 mi N of old Mazatlan airport, See Cohn and Cantrall 1974, p. 24], 25 Aug 1918 (J. A. Kusche) — 1.3 to 2.6 mi NW of Villa Union (west side of Rio Presidio) 29 Aug 1965 (Cohn 81) ID-20326 — ca 5 mi SW of Palmito [on Hwy #40], [ca 5700 to 6500 ft], 26 Oct 1958 (Cohn 227) ID-2030 — 1.2 road-mi NE of Santa Lucia [ca 18 road-mi NE of Concordia] on Durango hwy, 3750 ft, 21 Nov 974 (Cohn and Cohn 137) ID-2040 — 4 road-mi SW of Santa Lucia (13 road-mi NE Concordia), 3200 ft, 26 Aug 1958 (Cohn 228) ID-2038 — 6.7 mi SW of Concordia, ca 300 ft, 1 Sept 1961 (Cantrall and Cohn 61B) ID 2031.

Habitat descriptions.— Cohn 1958: 227 was a cleared hillside with a good, but not thick, growth of weeds and bushes. The area was in the pine zone with both long-needle pine and "pinostristle" and probably some deciduous trees.

Cohn 1958: 228 was in a much-dissected area of steep canyons; collections were made on a ridge, covered with widely branching legume trees with broad leaves and good growth of low weeds underneath, higher weeds in the clearings. This area had probably been cleared, since other species of trees occurred on the high ridges. The cleared ridges had much bush (low trees and weeds) and deciduous woods in spots.

Cohn 1958: 250 was in open pines and oaks with clumps of tall weeds.

Cohn 1958: 232 was a hillside which had apparently been thinned. Tall broadleaf trees and some scattered organ pipe cactus were prevalent. There was also good growth of tallish weeds underneath but not very thick and only of a few types.

Cohn and Cohn 1974: 137 was a road shelf in a variety of weeds. The steep slopes were rich in vegetation, with much brush. Pines and oaks were nearby, above and below the site.

Cohn and Cohn 1974: 139 was a brushy, tall-weed area near the road; nearby slopes were thinned thorn forest.

Cohn 1965: 81 was a badly damaged farmed and grazed landscape, with various trees, bushes and thick weeds near road. *S. pulchella* also was found here.

Cohn 1965: 84 had heavy roadside weeds and tall thinned but good thorn forest, with a complete canopy above and thin weeds below; grazed.

7. ***Sinaloa isena*** n. sp.
Figs 1-4, 18

Type.— Holotype male. Mexico: Sinaloa: 75 mi SE of Culiacan, 3.5 mi N of Rio Elota on Hwy 15, 22 Nov 1974 (Cohn and Cohn 141) ID-2042 (deposited at Academy of Natural Sciences, Philadelphia).

Recognition.— Tibia-3 red; hind knee with a dark ring; furculae intermediate in length, touching one another and situated in a groove; cercus long, narrow in middle; lophi of epiphallus slightly bilobed; epiproct with mounds; lateral lobes with black lower margin, side band sometimes not continuous; dorsum of pronotum grey-brown, with dark midline, with wider lateral pale bands; femur-3 color green and with dark ridges on pagina; femora-1 and -2 greenish.

Diagnosis.— Most similar to *pulchella*, but lophi of epiphallus not bilobed (Fig. 3). Also differing in the zygoma and aedeagal valves (Fig. 7). Color and color pattern similar to *behrensi*.

Measurements (in mm).— Body length to end of femur-3: 22.5 to 23 (males) 27 (female); length of femur-3: 12 to 13.5 (males) 15 (female).

Collecting localities.— All paratypes. **MEXICO**: **Sinaloa**: 75 mi SE of Culiacan, 3.5 mi N of Rio Elota on Hwy 15, 22 Nov 1974 (Cohn and Cohn 141) ID-2042.

Habitat.— Cohn and Cohn 1974: 141 was at a wide pulloff in a narrow valley. Habitat consisted of rich weeds sometimes 5 ft or higher, and several species of grass. The area was next to a row of small trees and bushes of several species, and some vines. Fields on the other side of the valley were within 100 yd of hillsides of rich thorn forest or richly overgrown fields.

Cohn 1958: 250 was in scattered pines and oaks and clumps of tall weeds.

Cohn 1958: 252 and Cohn 1958: 206 were on a hillside in thinned oaks with thick litter and a good, but patchy, growth of weeds and bushes.

Etymology.— Isena is the word for distinct in the Tarahumara language.

8. ***Sinaloa nitida*** Scudder
Figs 1-4, 11, 19

Sinaloa nitida Scudder, 1897, Proceedings U.S. National Museum 20: 207.

Type.— Holotype male. Mexico: Jalisco: Tepic (deposition of type uncertain, not Harvard or Academy of Natural Sciences, possibly U.S. National Museum).

Recognition.— Tibia-3 red; hind knee with a dark ring; furculae long, touching one another and situated in a groove; cercus longer, narrower in middle; lophi of epiphallus not bilobed; epiproct with mounds; lateral lobes with black lower margin, side band not reaching posterior margin, surrounded narrowly above and below by yellow margin; dorsum of pronotum grey-brown, with dark midline, with narrower lateral pale bands; femur-3 yellow-green and with dark paginal ridges; femora-1 and -2 greenish; furculae situated in groove.

Diagnosis.— Differing from all other species in having the side bands on the lateral pronotal lobes not extending to the rear margin, and narrowly surrounded by yellow and thus similar to *Barytettix poecilus*.

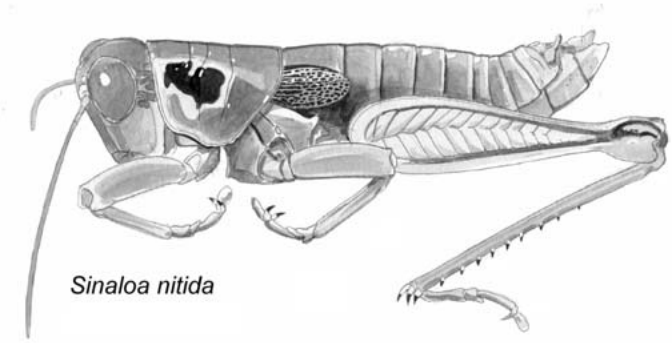

Fig. 11. Portrait of *Sinaloa nitida* male.

Measurements (in mm).— Body length to end of femur-3: 22 to 23.5 (males) 27.5 to 30 (females); length of femur-3: 12 to 13 (males) 15 to 16 (females).

Collecting localities.— **MEXICO**: **Sinaloa**: 20 mi SE of Escuinapa, [ca 100 ft] 1 Nov 1958 (Cohn 247) — **Nayarit**: 5 mi N of Acaponeta on Huajicori mine road, ca 200 ft, 20 Nov 1958 (Cohn 302) ID-2056 — 2 mi S of Acaponeta (at bridge over river on Hwy

#15), [ca 250 ft], 1 Sept 1961 (Cantrall and Cohn 62) — 3.1 mi SE of Acaponeta on Hwy #15, 2 Sept 1961 (Cantrall and Cohn 65) — 8.6 mi SE of Acaponeta, 1 Sept 1961 (Cantrall and Cohn 64) ID-2057 — 9.6 mi SSE of Acaponeta, 270 ft, 5 Oct 1959 (Cohn 210) — 15 mi N of Tuxpan Rd Jct (28 mi SSE Acaponeta) on Hwy #15, 2 Sept 1961 (Cohn and Cantrall 66) — [ca 4 mi SW of Tepic], 2.5 mi S of Jalisco, 18 mi N of Compostela, ca 5000 ft, 4 Nov 1958 (Cohn 254) — [ca 8 mi SW of Tepic], Cerro de San Juan, 3.5 road-mi SW of Jalisco, 4100 ft, 3 Nov 1958 (Cohn 250) — 9 mi N of Compostela, 3450 ft, 4 Nov 1958 (Cohn 251) — 4 mi N of Compostela, 3100 ft, 4 Nov 1958 (Cohn 252) — 8.8 mi E of Ixtlan del Rio, 3480 ft, 2 Sept 1961 (Cantrall and Cohn 69) — 7 mi W of Ixtlan del Rio, 3740 ft, 22 Nov 1958 (Cohn 306) ID-2055 — 25.7 mi NW of Ixtlan del Rio (0.8 mi NW of Ocotillo). 3740 ft, 2 Sept 1961 (Cantrall and Cohn 68) ID-2054 — **Jalisco**: Tequila, [3840 ft], 12 Sept 1938 (H. R. Roberts) — 3.1 mi NW of Tequila, 4120 ft, 3 Sept 1961 (Cantrall and Cohn 74).

Habitat.— Cohn 1958: 302 was at the base of hill in an area covered in short thick grass with scattered leguminaceous low trees and patches of tallish, but thin, weeds. The area was edged by heavier weeds, sapling bushes, and low trees, quickly becoming low mixed woods.

Cohn 1958: 306 was in volcanic hill country, rocky and with many ridges. The area was covered in low trees, bushes and tall weeds, but never very dense.

Cantrell and Cohn 1961: 74 was in rolling grassland with scattered clumps of *Salvia.*

Discussion

The degree of overlap of species of *Sinaloa* is extensive. Other than the northward extension of *S. garabe* into Sonora where it alone occurs, all the other species are found in Sinaloa and Nayarit in varying degrees of sympatry. Thus, *garabe*, *uri*, *pulchella*, *behrensi*, and *isena* broadly overlap one another on the coastal plain in Sinaloa, and *nitida*, *jubaami*, and *sipuri* broadly overlap in Nayarit.

Syntopy.— At a number of localities 2 species are found syntopically (we rarely collected widely at any one locality). These are arranged from north to south with abbreviated localities:

pulchella and *garabe*, 2. 5 mi NW Culiacan
pulchella and *uri*, 24.5 SE Culiacan
pulchella and *uri*, 52 SE Culiacan
isena and *uri*, 75 mi S Culiacan
pulchella and *behrensi*, El Venadillo (ca 0.4 NW)
pulchella and *behrensi*, 1.3 to 2.6 mi NW Villa Union
pulchella and *behrensi*, 4 mi SW Santa Lucia
nitida and *jubaami*, 5 mi N Acaponeta
nitida and *jubaami*, 2 mi S Acaponeta
nitida and *pulchella*, 28 mi SSE Acaponeta
nitida and *sipuri*, 9 mi N Compostela

In addition to these, *uri* and *pulchella* replace each other frequently and over short distances south of Culiacan, as do *sipuri* and *nitida* at somewhat longer distances in Nayarit and adjacent Jalisco, so that a longer list of syntopic localities is to be expected for these species. And it is probable that some apparent allopatry is the result of sampling error in small collections.

It is interesting to note that in 8 out of 11 of these cases the syntopic pairs of species are composed of a red-legged one and a blue-legged one. Only at 2.5 NW, 24.5 and 52 SE Culiacan are two blue-legged species (*garabe* and *pulchella*, and *uri* and *pulchella*) found together and those species are very close elsewhere both north and south of Culiacan.

Six of the syntopic occurences involve *pulchella* which has very distinctive internal genitalia (particularly the dorsal and ventral valves of the aedeagus). *S. nitida* and *jubaami* also have rather different ventral valves, as well as different furculae. Most, but not all the syntopic pairs have small differences in the cerci.

Habitat.—Because almost all of our collections were made in weedy areas near the roads, it is difficult to say what the natural habitat was before human disturbance, nor is it certain that these grasshoppers have not moved along the roadsides to achieve their current distribution. Because only 2 species have wide distributions (and even these two reach their southern limits at or near the beginning of the Tropical Deciduous Forest zone), we think that there probably has been only limited movement along the highway corridors.

If we assume that there have been no major movements along the highways, and that weedy areas merely allowed larger populations to develop from sparser ones in the adjacent more natural vegetation, then we can specify the general vegetation zones (of Rzedowski 1972) occupied by the species.

S. garabe occurs in the Sonoran desert where it was collected at one locality in association with *Franseria*, a very dry-adapted plant. But this species also extends far into the Thorn Forest vegetation zone in Sinaloa.

S. uri has been found only in the Thorn Forest zone.

S. pulchella occurs in the Thorn Forest and barely penetrates into the Tropical Deciduous Forest zone.

S. nitida ranges from Tropical Deciduous Forest to the Grassland zone, and into the Pine-Oak zone (see below).

S. jubaami has been found only in the Tropical Deciduous Forest zone.

S. isena occurs at only one locality in the Thorn Forest zone.

S. behrensi ranges from the southern end of the Thorn Forest zone into the Conifer zone (see below), but does not penetrate the mapped edge of the Tropical Deciduous Forest zone in southernmost Sinaloa and Nayarit, where extensive collections have been made.

S. sipuri ranges from the Tropical Deciduous Forest zone to the Oak zone.

The presence of *S. behrensi* in the Conifer zone at ca 5700 to 6500 ft is surprising in view of its wide range in coastal plain thorn forest. Unfortunately the mileage from Palmito is approximate, and the elevation calculated from nearby localities, but the field notes clearly indicate tbe Pine zone. It was also found at lower elevations on this road at around 3500 ft. At least one other species, *nitida*, penetrates the Pine-Oak zone at lower elevations (4100 ft), and *sipuri* penetrates at least the Oak zone at 3400 ft in southern Nayarit; both occur in Tropical Deciduous Forest at close to sea level in northern Nayarit.

Similarly, the presence of *S. nitida* in both Tropical Deciduous forest near sea level and in Grassland at 4000 ft is even more surprising. There are two records from Tequila, and our field notes clearly indicate rolling grassland on volcanic soil. On the Rzedowski map this should be occupied by Tropical Deciduous forest, but as the grassland is not far to the east, the boundaries may be inaccurate on the map.

Similarity of S. nitida to Barytettix poecilus.— The similarity of these two species in color and color pattern is striking, and in field notes there is often a comment that the *Sinaloa* in a particular locality is like *Barytettix*. They broadly overlap and are frequently synopic in southernmost Sinaloa and most of Nayarit, but *B. poecilus* extends farther north in Sinaloa. Both are bright green with reddish antennae, a restricted black spot on the lateral lobes of the pronotum which is bordered narrowly with yellow, the same metaespisternal yellow stripe on the metathorax, a green pagina of the hind femora with dark ridges, and reddish legs. In all of these characters (except the red tibiae), *nitida* is rather different than its congeners. And even more peculiar, in the general area of overlap, *B. poecilus* lacks a dark paginal stripe found elsewhere, tends to have more reddish than purplish tibiae, and the median yellow abdominal stripe is either missing or reduced, in which characters it closely resembles those of *S. nitida*. The only real difference between the two, other than tibial color, is that *S. nitida* lacks the diagonal yellow line through the black spot on the pronotum. *S. nitida* is always smaller, and the tegmina are shorter and much broader proximad in contrast to the long proximad tapering of the tegmina to a very narrow base in *B. poecilus*.

We have no explanation for this similarity to *Barytettix poecilus* and the departure of *S. nitida* from the color and pattern of its congeners, which also overlap and are frequently syntopic with various species of *Barytettix*.

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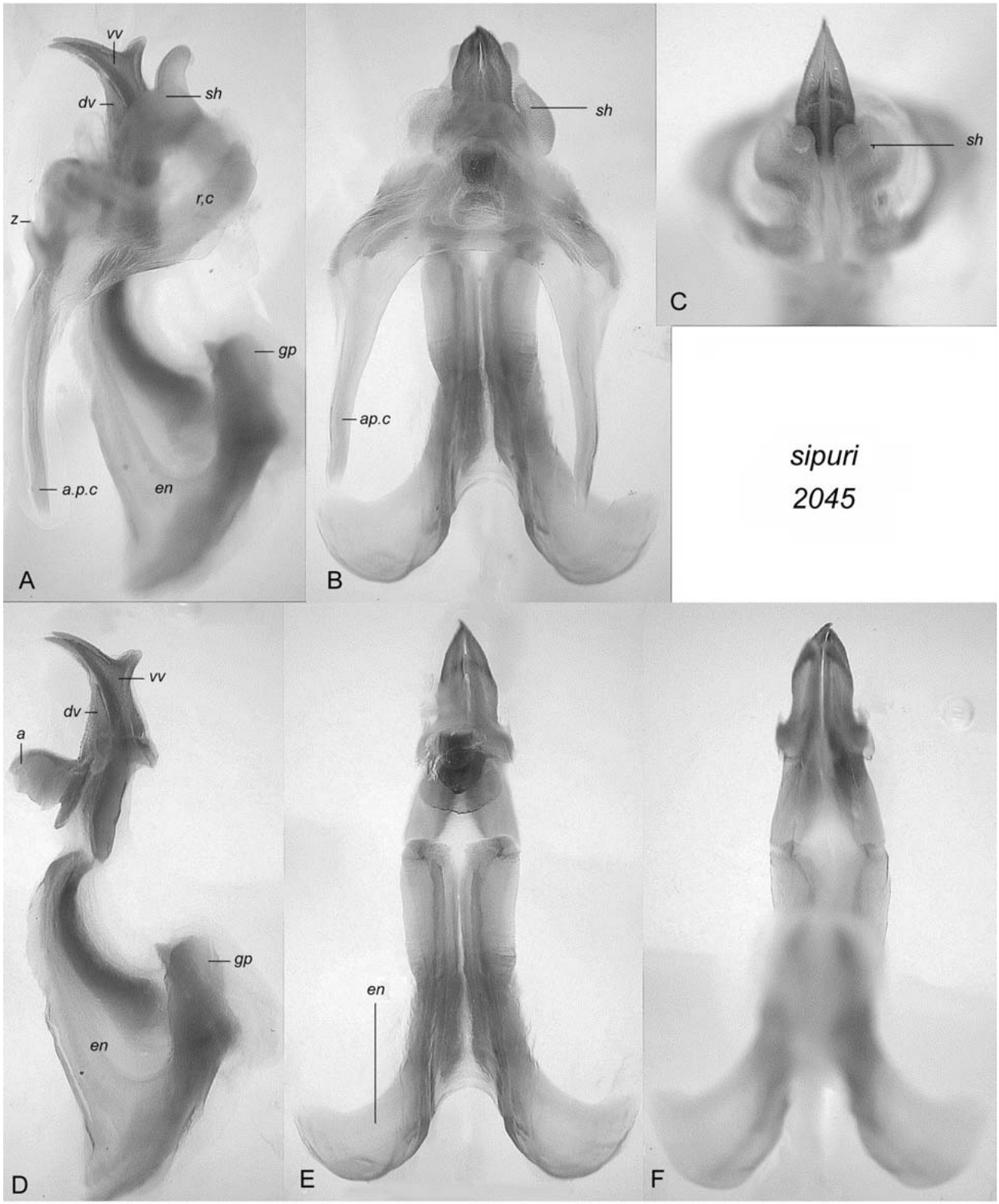

Fig. 12. Genitalic complex in *S. sipuri*. A-C, entire complex with cingulum in place (A, lateral view; B, dorsal view; C, ventral to posterior view). D-F, internal genitalia with cingulum removed. (D, lateral view; E, dorsal view; F, ventral to posterior view). Abbreviations: z, zygoma of cingulum; ap.c., apodeme of cingulum; r.c, rami of cingulum; dv, dorsal valve of aedeagus; vv, ventral valve of aedeagus; a, arch of aedeagus; en, endophallic plate; gp, gonopore plate; sh, sheath of aedeagus.

Fig. 13. Genitalic complex in *S. jubaami*. A-C, entire complex with cingulum in place (A, lateral view; B, dorsal view; C, ventral to posterior view). D-F, internal genitalia with cingulum removed. (D, lateral view; E, dorsal view; F, ventral to posterior view). Abbreviations: z, zygoma of cingulum; ap.c., apodeme of cingulum; r.c, rami of cingulum; dv, dorsal valve of aedeagus; vv, ventral valve of aedeagus; a, arch of aedeagus; en, endophallic plate; gp, gonopore plate; sh, sheath of aedeagus.

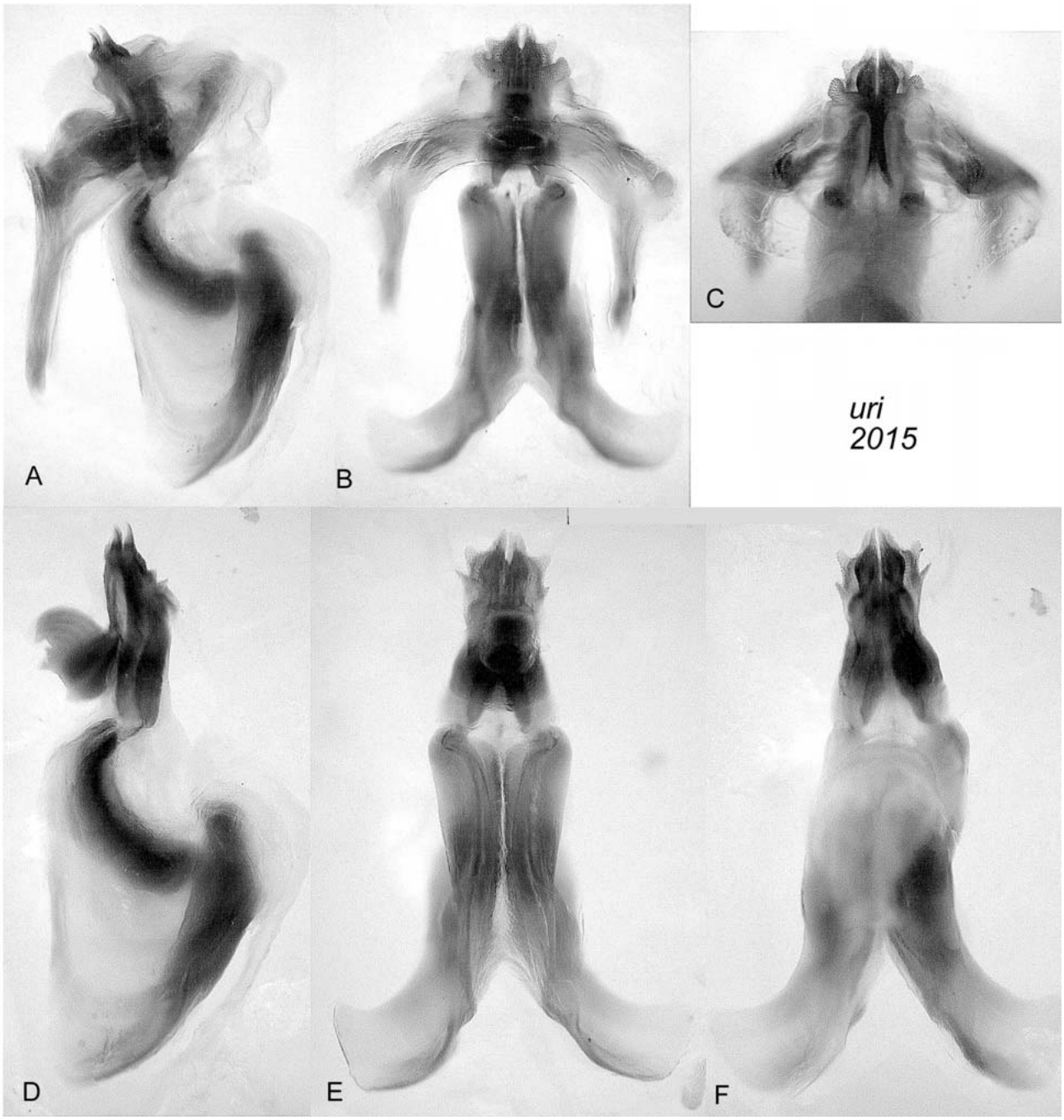

Fig. 14. Genitalic complex in *S. uri*. A-C, entire complex with cingulum in place (A, lateral view; B, dorsal view; C, ventral to posterior view). D-F, internal genitalia with cingulum removed. (D, lateral view; E, dorsal view; F, ventral to posterior view).

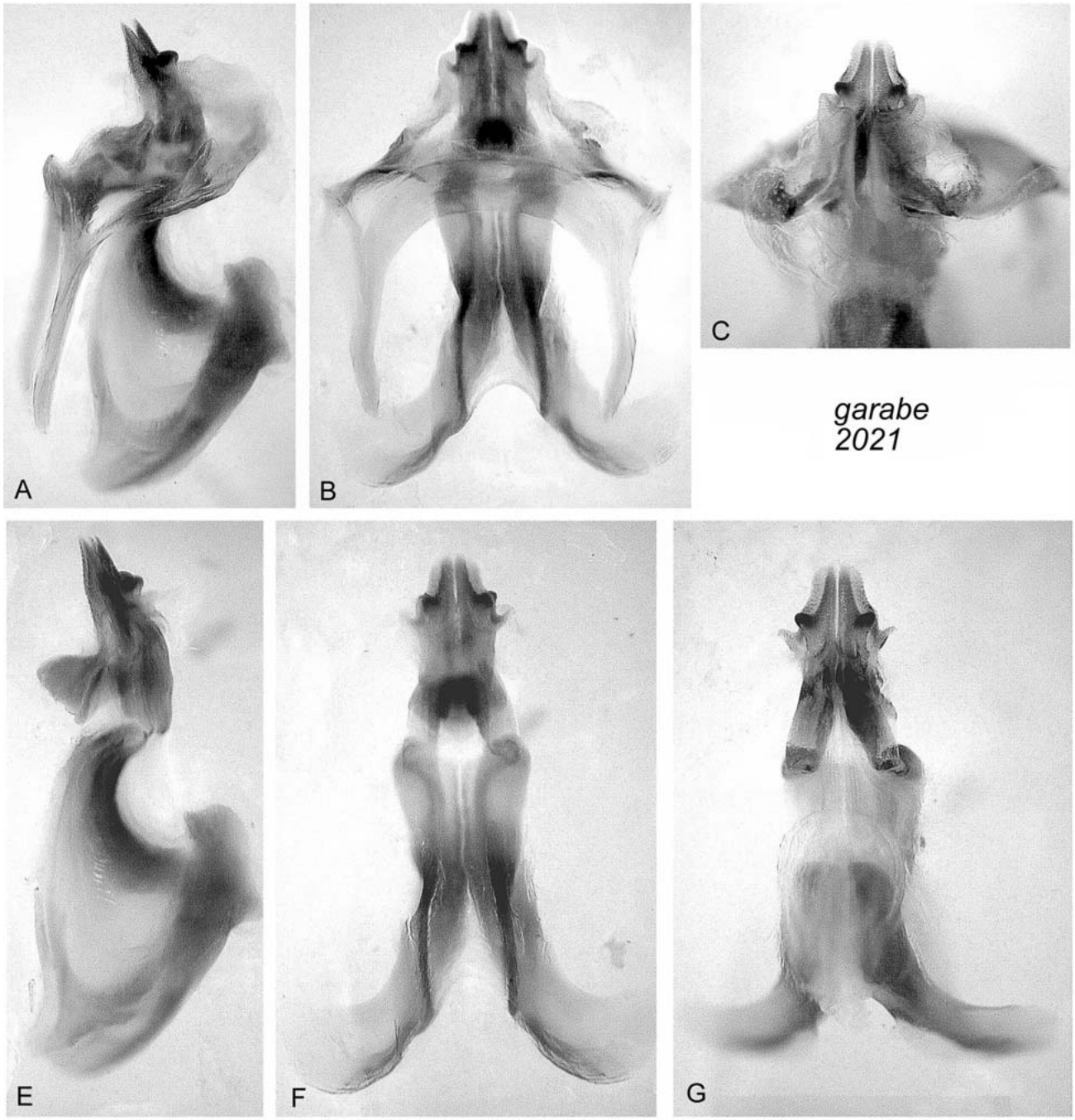

Fig. 15. Genitalic complex in *S. garabe*. A-C, entire complex with cingulum in place (A, lateral view; B, dorsal view; C, ventral to posterior view). D-F, internal genitalia with cingulum removed. (D, lateral view; E, dorsal view; F, ventral to posterior view).

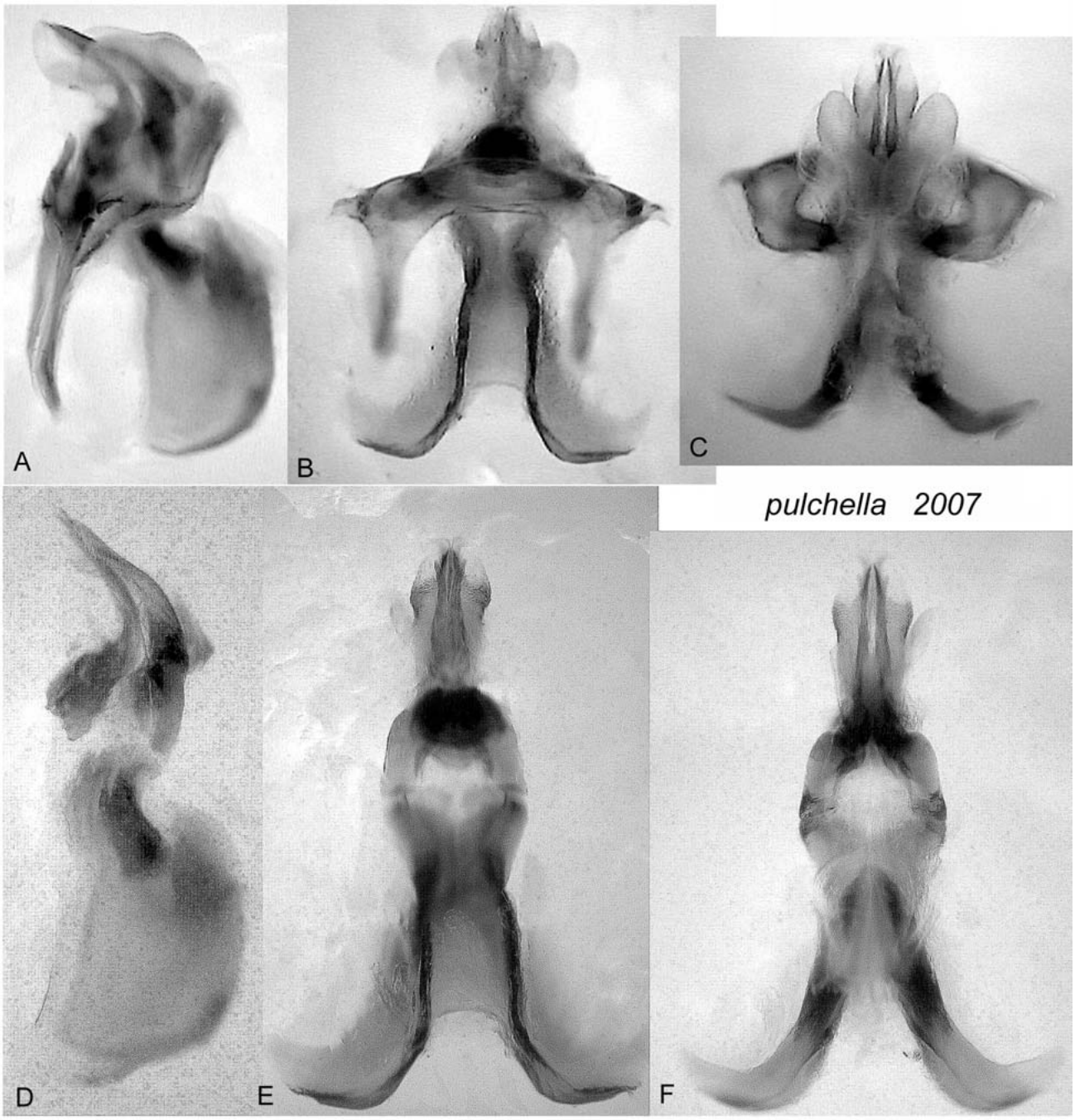

Fig. 16. Genitalic complex in *S. pulchella*. A-C, entire complex with cingulum in place (A, lateral view; B, dorsal view; C, ventral to posterior view). D-F, internal genitalia with cingulum removed. (D, lateral view; E, dorsal view; F, ventral to posterior view).

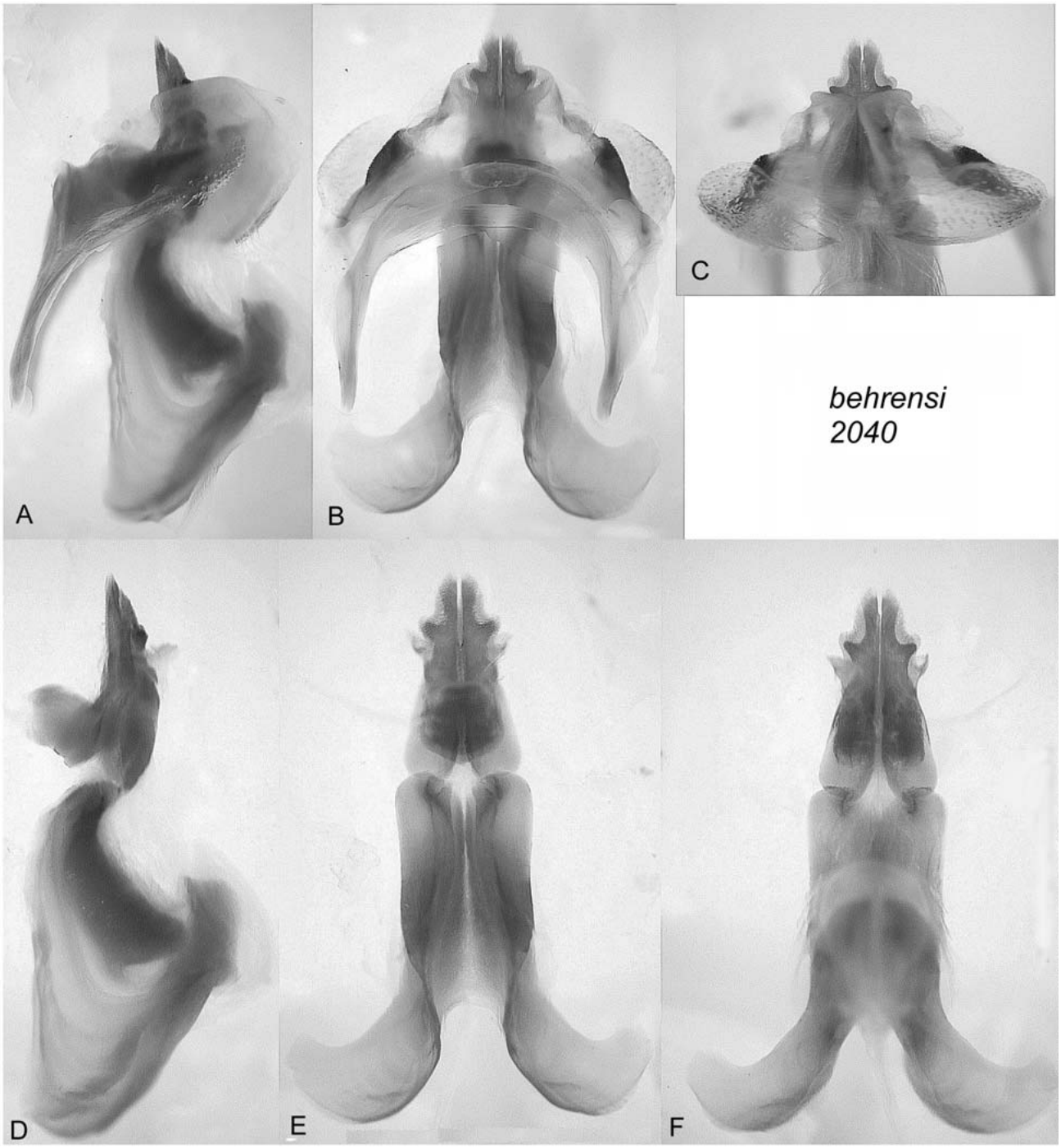

Fig. 17. Genitalic complex in *S. behrensi*. A-C, entire complex with cingulum in place (A, lateral view; B, dorsal view; C, ventral to posterior view). D-F, internal genitalia with cingulum removed. (D, lateral view; E, dorsal view; F, ventral to posterior view).

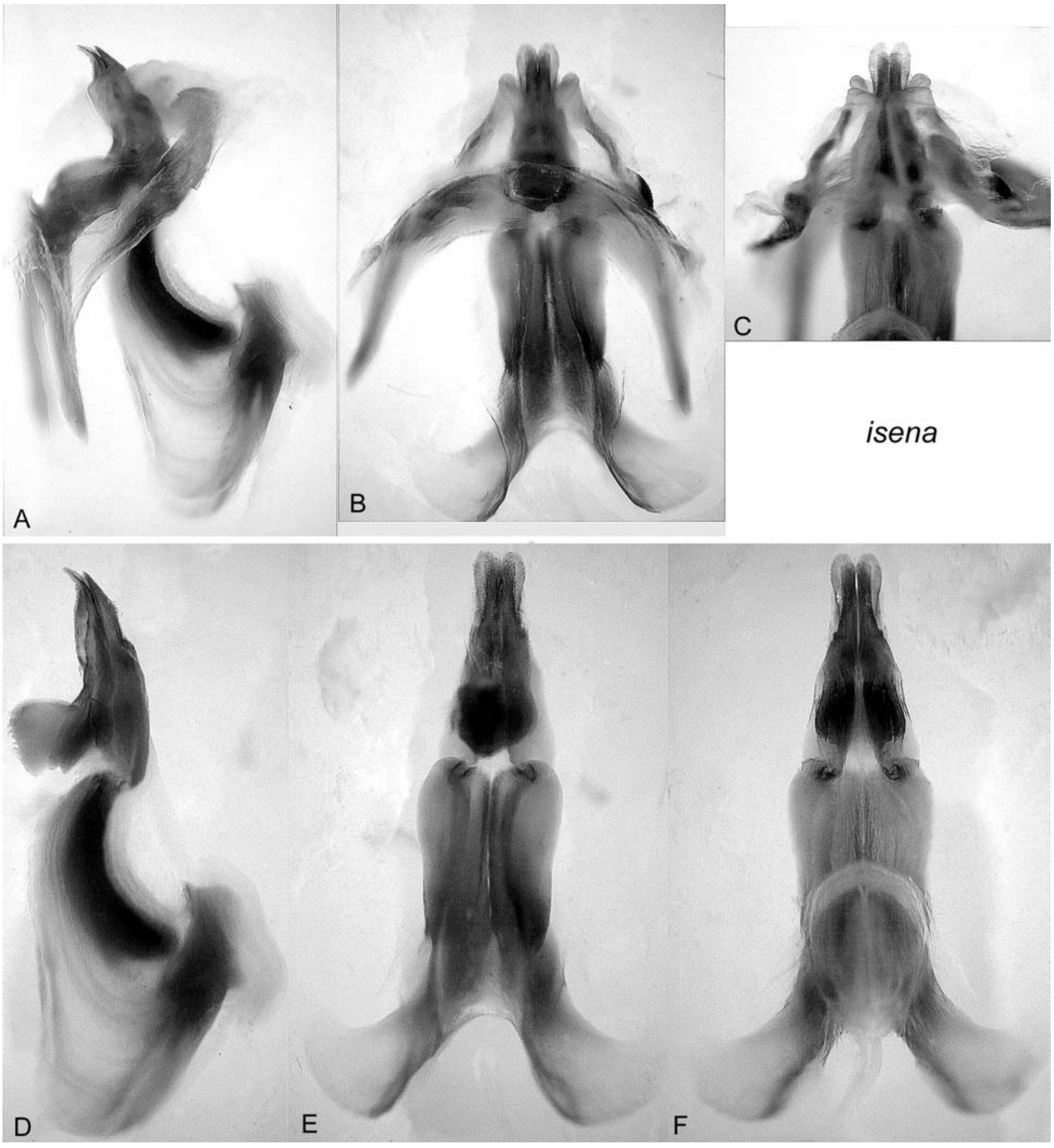

Fig. 18. Genitalic complex in *S. isena*. A-C, entire complex with cingulum in place (A, lateral view; B, dorsal view; C, ventral to posterior view). D-F, internal genitalia with cingulum removed. (D, lateral view; E, dorsal view; F, ventral to posterior view).

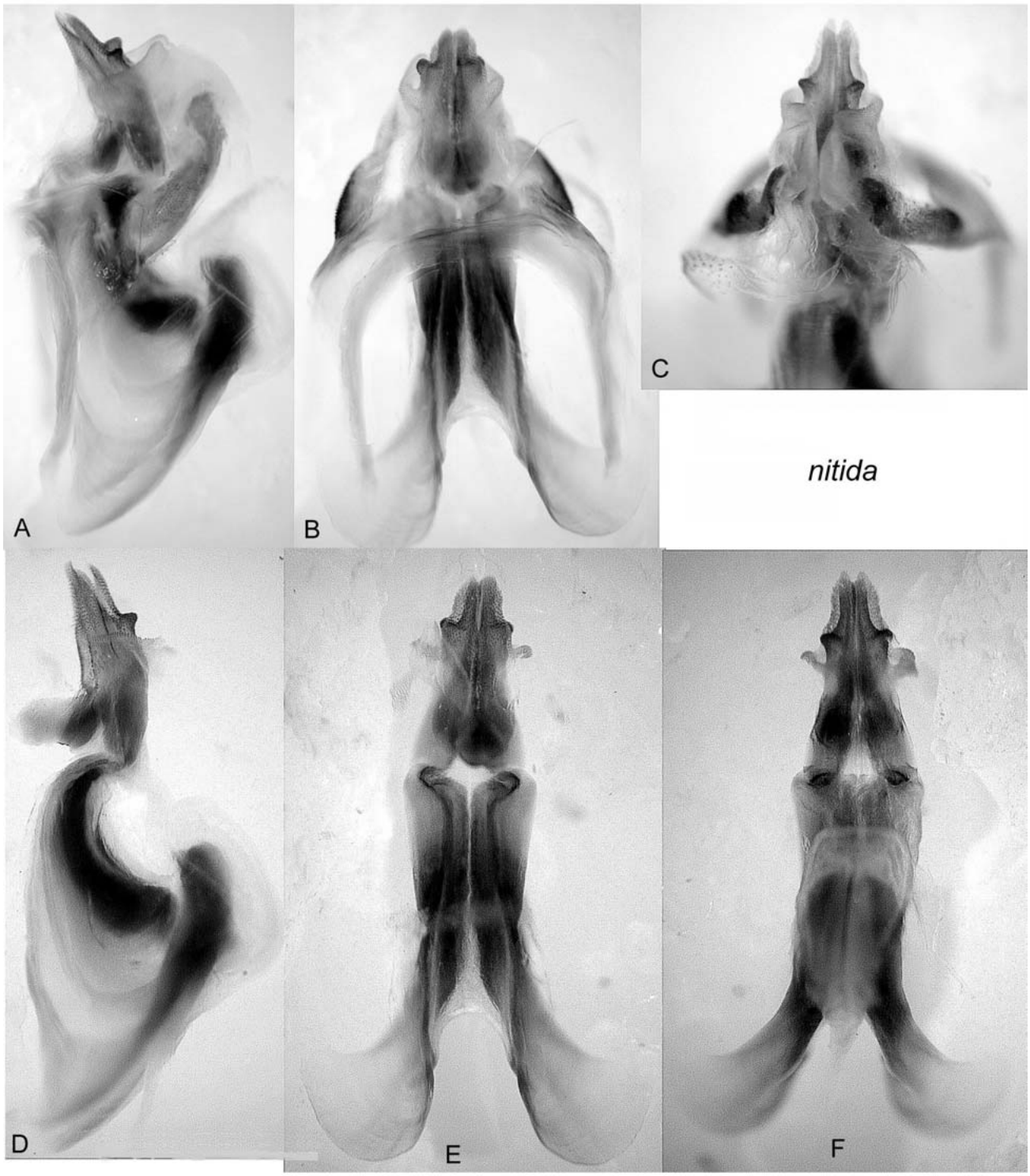

Fig. 19. Genitalic complex in *S. nitida*. A-C, entire complex with cingulum in place (A, lateral view; B, dorsal view; C, ventral to posterior view). D-F, internal genitalia with cingulum removed. (D, lateral view; E, dorsal view; F, ventral to posterior view).