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NEW SPECIES AND RECORDS OF INTERTIDAL BITING MIDGES OF THE GENUS *DASYHELEA* KIEFFER FROM THE GULF OF CALIFORNIA (DIPTERA: CERATOPOGONIDAE)

By **Willis W. Wirth**[1]

Abstract: Four species of biting midges of the genus *Dasyhelea* Kieffer (Diptera: Ceratopogonidae) are described from intertidal habitats around the coasts of the Gulf of California and neighboring areas. *D. bajensis, D. griseola,* and *D. sonorensis* are described as new species. *Dasyhelea calvescens* Macfie, previously known from the Hawaiian Islands and the Islas Revillagigedo, is recorded from the coasts of Baja California and Sonora in Mexico, and from Panama. All species are illustrated.

Biting midges of the genus *Dasyhelea* Kieffer are common and widespread, found in all regions of the world and in a wide variety of habitats. The larvae are aquatic or semiaquatic, requiring at least a thin film of water in which to live. They are unable to swim, so they move by climbing or hitching their way along, using their mouthparts and posterior hooks. Because they will "drown" if deeply submerged, their preferred habitats are in wet moss or algae along shores of streams, lakes, ponds, puddles or other bodies of water, or in wet rotting plant materials such as sap oozing from trees, wet bark and tree holes. Some species are found in unusual habitats such as rock pools, thermal water in hot springs, or water with high mineral content. They have successfully invaded the tidal zone along seashores, where many species breed on algae-covered rocks or in algae growing on mud exposed to tidal action in salt marshes. Their success is demonstrated by their wide distribution in the islands of the Pacific. In Micronesia for example, Tokunaga & Murachi (1959) found 44 species of *Dasyhelea* among the 147 recorded species of Ceratopogonidae. Our knowledge of Neotropical *Dasyhelea* is still in its infancy, and most species in collections are undescribed. The species in this paper are described because of special interest in seashore ecology and to make the names available for reports of biological studies.

I am indebted to Lanna Cheng of the Scripps Institution of Oceanography at La Jolla, California, for sending me intertidal *Dasyhelea* midges from the Gulf of California. Her collections were made during short expeditions supported by the Foundation for Ocean Research, San Diego, California, in April 1972, 1973, and 1974, to Baja California on the R. V. *Dolphin*. For a number of collections of intertidal *Dasyhelea* midges from the coast of Sonora, Mexico, I am also indebted to Vincent D. Roth of the Southwestern Research Station at Portal, Arizona. The remaining material examined is mostly from the collections of the U. S. National Museum of Natural History in Washington, D. C. (USNM), where the types of the new species are deposited. Paratypes when available will also be deposited in the

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California Academy of Sciences in San Francisco (CAS), the Bishop Museum in Honolulu (BISHOP), and the British Museum (Nat. Hist.) in London (BMNH).

For explanation of morphological terminology please refer to the papers by Wirth (1952), Tokunaga & Murachi (1959), and Remm (1962). Measurements, descriptions, and illustrations of the new species were made from the holotypes and allotypes.

Dasyhelea bajensis Wirth, new species FIG. 1

♀. Wing length 0.90 mm; breadth 0.41 mm. *Head.* Pale brown, antenna brownish, palpus pale yellowish. Frontal sclerite as in FIG. 1e. Antenna (FIG. 1a) with lengths of flagellar segments in proportion of 18-17-17-20-20-20-20-20-26-26-26-25-33; 5 distal segments weakly reticulated; last segment with pointed tip, without distinct papilla; antennal ratio 1.03. Palpus (FIG. 1b) with lengths of segments in proportion of 20-40-20-23, antepenultimate segment slender with a few scattered sensilla. *Thorax.* Pale brown; mesonotum with sides and humeri yellowish forming 2 pairs of broad longitudinal vittae on midportion; vestiture and color of pollinosity not apparent in slide-mounted specimens. Scutellum yellowish. Sclerotized bridge (FIG. 1h) between fore coxae with pubescent lobes short and blunt. Legs pale yellowish, knee spots darker, 5th tarsomeres dusky. Hind tarsal ratio 2.3. Wing (FIG. 1c) milky white due to prominent microtrichia; veins of radial field brownish; 2nd radial cell short and complete, end of costa nearly perpendicular to axis of wing; costal ratio 0.45; macrotrichia long and abundant over all of wing. Halter pale. *Abdomen.* Uniformly brownish; subgenital plate (FIG. 1d) constricted in midportion, anterior lobe semicircular with large central lumen. Spermatheca (FIG. 1g) 1, nearly spherical; large, measuring 0.061 mm in diam., with a long, slender, curved, petiolelike neck about as long as diam. of spermatheca.

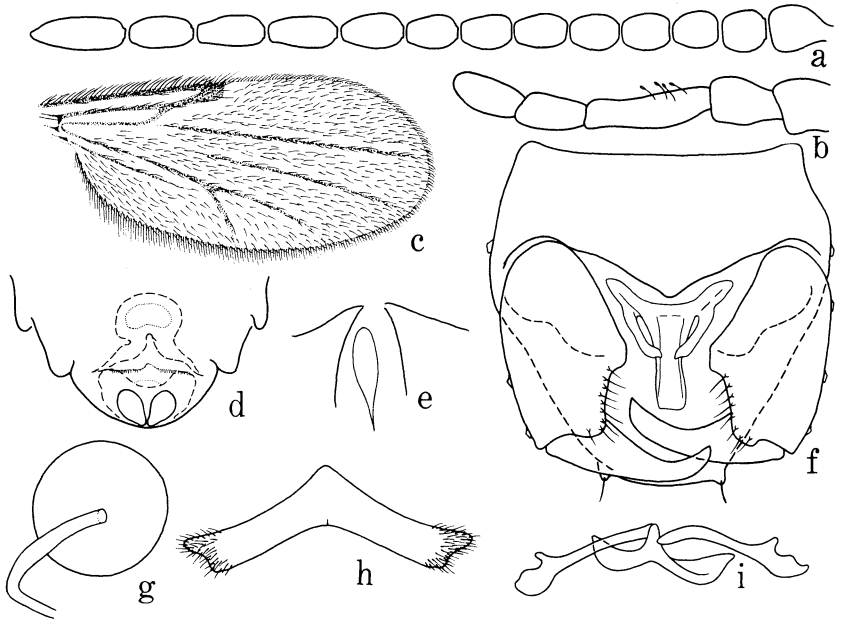

FIG. 1. *Dasyhelea bajensis:* a, antenna (♀); b, palpus (♀); c, wing (♀); d, genital sclerotization (♀); e, frontal sclerite (♀); f, genitalia (♂), parameres removed; g, spermatheca (♀); h, fore coxal bridge (♀); i, parameres (♂).

♂. Similar to ♀ with usual sexual differences. Color more intensely brownish, especially the mesonotal vittae and dorsum of abdomen; legs distinctly brownish; wing membrane grayish. Genitalia (FIG. 1f) short and broad; 9th tergum short and tapering with caudal margin transverse and bearing a pair of minute apicolateral processes; 9th sternum produced slightly in a blunt mesal point on distal margin. Basistyle stout with distinct mesal hump at midlength; dististyle slender and curving, tapering to pointed tip. Aedeagus with basal arms directed anterolaterad; basal arch low; distomedian process exceptionally well developed, with slightly expanded, truncated tip, nearly 2× as long as the short, slender, incurved, lateral processes. Parameres (FIG. 1i) asymmetrical, basal apodemes forming a slender transverse ribbon; posterior median process short and broad, divided near base and forming a pair of curved, pointed, laterally directed plates.

DISTRIBUTION. —Mexico (Baja California, Sinaloa); USA (California).

TYPES. Holotype ♀, allotype ♂, MEXICO: Baja California: Isla San José, 6-7.IV.1973, from emergence trap in mangrove nr edge of wet swamp, L. Cheng (Type no. 69800, USNM); paratypes, 8 ♂♂, 30 ♀♀, as follows (deposited in BISHOP, BMNH, CAS, USNM): 18 ♀♀, same data as holotype; 2 ♂♂, 2 ♀♀, same data, but 18.IV.1972, reared from mangrove shore (W-8); 1 ♂, 8 ♀♀, same data, but 9.IV.1974, emergence trap in tidal zone; Sinaloa: 2 ♂♂, Mazatlan, 17-23.VII.1963, light trap, P. J. Spangler; USA: California: 3 ♂♂, 2 ♀♀, Ventura Co., Point Mugu, 17.VIII.1947, J. N. Belkin.

DISCUSSION. This species belongs in the *mutabilis* group of species that Remm (1962) placed in the subgenus *Pseudoculicoides* Malloch. *Dasyhelea atlantis* Wirth & Williams from Bermuda is very closely related with similar male and female genitalia, but differs in the more uniform color of the mesonotum, the neck of the spermatheca not so long, the lumen of the subgenital plate not so large, the median posterior process of the male aedeagus shorter and more tapering, and the median posterior process of the parameres short, broad, and curved, not divided.

BIOLOGY. From notes by Lanna Cheng: "Collection W-8 was taken from mud samples under *Avicennia* mangroves near a land-locked lagoon ("northern saltern") at the northern end of Isla San José. The lagoon had a salinity 2.7 times that of sea water. The samples were brought on board the research ship and placed in emergence cages, from which the adults were collected when the ship returned to the home port on 22 May." Dr. Cheng's 1973 and 1974 collections were taken in emergence traps located under mangroves (Cheng & Hogue 1974).

Dasyhelea griseola Wirth, new species FIG. 2

♀. Wing length 1.00 mm; breadth 0.44 mm. *Head.* Pale brown, including antenna and palpus. Frontal sclerite as in FIG. 2d. Antenna (FIG. 2a) with lengths of flagellar segments in proportion of 30-23-23-23-23-24-25-26-33-35-35-35-60; segments strongly sculptured; last segment with slender, pointed tip; antennal ratio 1.00. Palpus (FIG. 2b) with lengths of segments in proportion of 20-38-26-23; antepenultimate segment slender and petiolate with single sensillum. *Thorax.* Reddish brown, humeri and scutellum paler; surface slightly shining. Sclerotized bridge between fore coxae bearing small, slender, pointed, pubescent lobes. Legs unicolorous pale yellowish; hind tarsal ratio 2.9. Wing (FIG. 2c) with membrane pale grayish, microtrichia moderately developed; macrotrichia long and abundant; radial cells obsolete, the veins bordering what would be the 2nd radial cell forming a darker stigma with

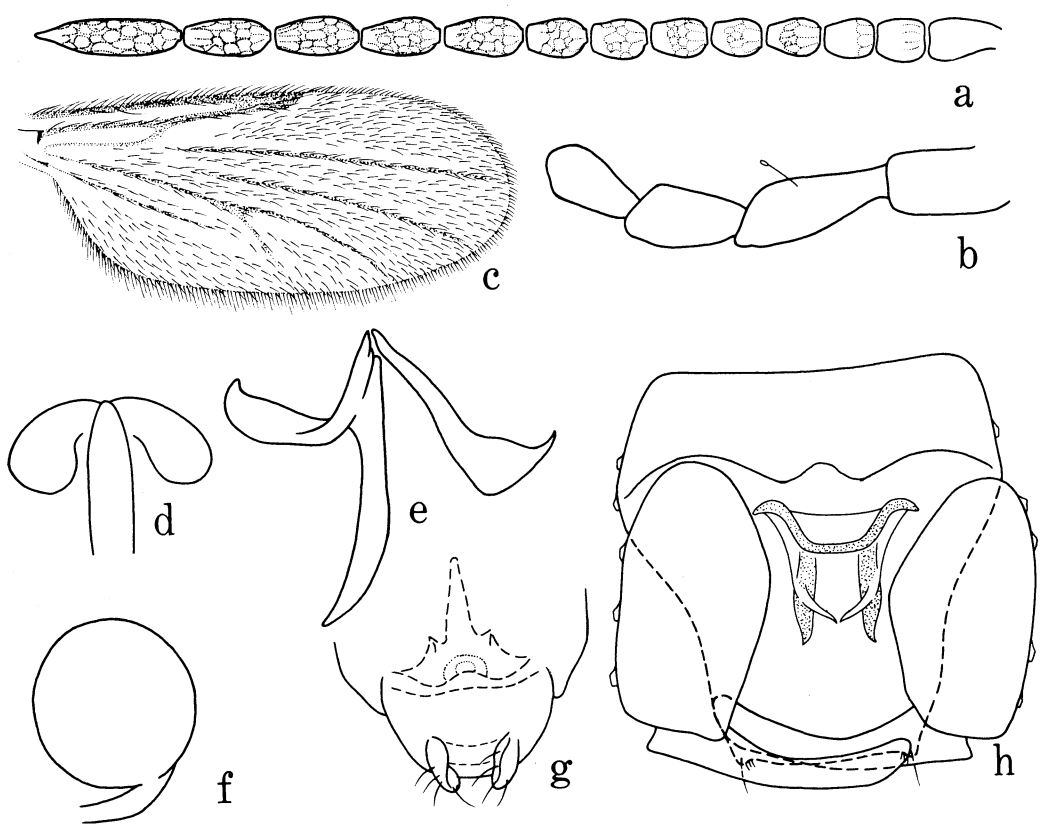

FIG. 2. *Dasyhelea griseola:* a, antenna (♀); b, palpus (♀); c, wing (♀); d, frontal sclerite (♀); e, parameres (♂); f, spermatheca (♀); g, genital sclerotization (♀); h, genitalia (♂), parameres removed.

distinctly oblique tip; costal ratio 0.57. Halter infuscated. *Abdomen.* Reddish brown; dorsum dark brown, bases of hairs arising from minute paler dots. Subgenital plate (FIG. 2g) with posterior portion bordering gonopore short and transverse, anterior part elongate, projecting anteriorad as a tapering median lobe. Spermatheca (FIG. 2f) 1, subspherical, 0.064 mm in diam., with a very oblique, slender neck about 0.043 mm long.

♂. Wing length 1.18 mm; breadth 0.41 mm; costal ratio 0.57. Similar to ♀ with usual sexual differences. Genitalia (FIG. 2h) about as broad as long, structure typical of the *grisea* group; 9th tergum short and tapering, posterior margin transverse, apicolateral processes limited to small setigerous tubercles. Basistyle simple, usual mesal hooklike process not developed; dististyle elongate, darker in color, slightly curved and with blunt tip. Aedeagus slightly longer than broad; basal arch not developed; bearing posteriorly a pair of stout, straight processes and a pair of hyaline, slender, incurved processes. Parameres (FIG. 2e) asymmetrical, basal apodemes curved, very unequal; median posterior process moderately stout, slightly and somewhat spirally curved to slender tip directed ventrocaudad.

DISTRIBUTION. Mexico (Baja California), Panama, Trinidad.

TYPES. Holotype ♀, allotype ♂, MEXICO: Baja California: Isla San José, 21.IV.1972, swept from tops of *Avicennia* mangrove, L. Cheng (Type no. 69801, USNM); paratypes, 46

♂♂, 53 ♀♀, as follows (deposited in BISHOP, BMNH, CAS, USNM): 4 ♂♂, 1 ♀, same data as types; 4 ♀♀, same data but 6.IV.1973, swept from mangrove; 4 ♂♂, 8 ♀♀, same data but 7.IV.1974, malaise trap in mangroves; 1 ♀, 10 mi. (16 km) W of San José de Cabo, 1.IX.1959, light trap, Radford & Werner; PANAMA: 2 ♂♂, 2 ♀♀, Balboa, C. Z., 22.VIII.1942, emergence trap in tidal marsh, P. A. Woke (no. 1050); 9 ♂♂, 6 ♀♀, Fort Kobbe Beach, C. Z., 1.VII.1967, swept from mangroves, W. W. Wirth. TRINIDAD: 27 ♂♂, 31 ♀♀, no locality, IX.1963, reared from algae on tidal flat, R. W. Williams.

DISCUSSION. Structurally this species is similar to *Dasyhelea grisea* (Coquillett), a widespread North American species. *D. grisea* differs in its dull pollinose, grayish green mesonotum, pear-shaped spermatheca with stout, tapering neck, and long, slender apicolateral processes on the male 9th tergum.

Dasyhelea calvescens Macfie FIG. 3

Dasyhelea calvescens Macfie, 1938: 157 (male, female; Hawaii; fig. male genitalia).—Williams, 1944: 180 (all stages; figs.; biology; Hawaii).—Wirth, 1946: 592 (Oahu, biological notes).—Hardy, 1952: 448 (record Oahu).—Hardy, 1960: 182 (redescribed; fig. male genitalia; Oahu, Kauai; notes).—Hardy, 1964: 445 (Midway Atoll, Hawaii I).—Wirth, 1969: 577 (distribution; notes).

♀. Wing length 1.12 mm; breadth 0.50 mm. *Head.* Brownish black including antennae and palpi. Frontal sclerotization as in FIG. 3e. Antenna (FIG. 3a) with lengths of flagellar segments in proportion of 25-23-23-23-23-23-24-25-30-30-28-28-30; last 5 segments strongly sculptured; last segment tapering to bluntly pointed tip; antennal ratio 0.78. Palpus (FIG. 3b) with lengths of segments in proportion of 20-40-22-30; antepenultimate segment slender with a few scattered sensilla. *Thorax.* Dark brown; mesonotum with grayish pollen and some short, stiff, bristly setae; scutellum and humeri slightly paler. Legs usually brownish, sometimes paler becoming yellowish; sclerotized bridge (FIG. 3g) between fore coxae bearing bluntly pointed, pubescent lobes; hind tarsal ratio 2.6. Wing (FIG. 3c) with membrane smoky brownish due to coarse microtrichia, a darker stigma over radial cells; almost devoid of macrotrichia except a few along veins M1 and M2 and at distal margin of wing; 1st radial cell slit-like; 2nd narrow, square ended; costal ratio 0.58. Halter with stem brownish, knob whitish. *Abdomen.* Dark brown. Subgenital plate as in FIG. 3d. Spermathecae (FIG. 3h) 2, ovoid with long tapering necks; subequal, each measuring 0.075 by 0.042 mm including necks (specimen described and illustrated from Puerto de Lobos, Sonora).

♂. Similar to ♀ with usual sexual differences; antennal plume very sparse with relatively short verticils, segmentation resembling that of ♀, flagellar segments with lengths in proportion of 30-20-20-18-18-18-16-16-18-20-25-30-43. Genitalia (FIG. 3f) with 9th tergum tapering abruptly to rounded apex bearing a contiguous pair of small, beadlike, setose, apicolateral processes; 9th sternum prolonged caudally into a pair of elongated, rounded, submedian lobes and a distinct, slender, tapering, median process. Basistyle stout with dense area of long, fine, hairlike setae distally on ventromesal margin; dististyle bent near base, distal portion straighter and tapering to slender, pointed tip. Aedeagus with narrow basal bridge, with low basal arch, and a pair of slender, slightly curved, rather elongate, submedian posterior processes. Parameres (FIG. 3i) nearly symmetrical; basal apodemes transverse, nearly straight; posterior median process a very short, pointed sclerite (specimen described and illustrated from Isla Socorro).

DISTRIBUTION. Hawaiian Archipelago; Mexico (Islas Revillagigedo, Baja California, Sonora); Panama.

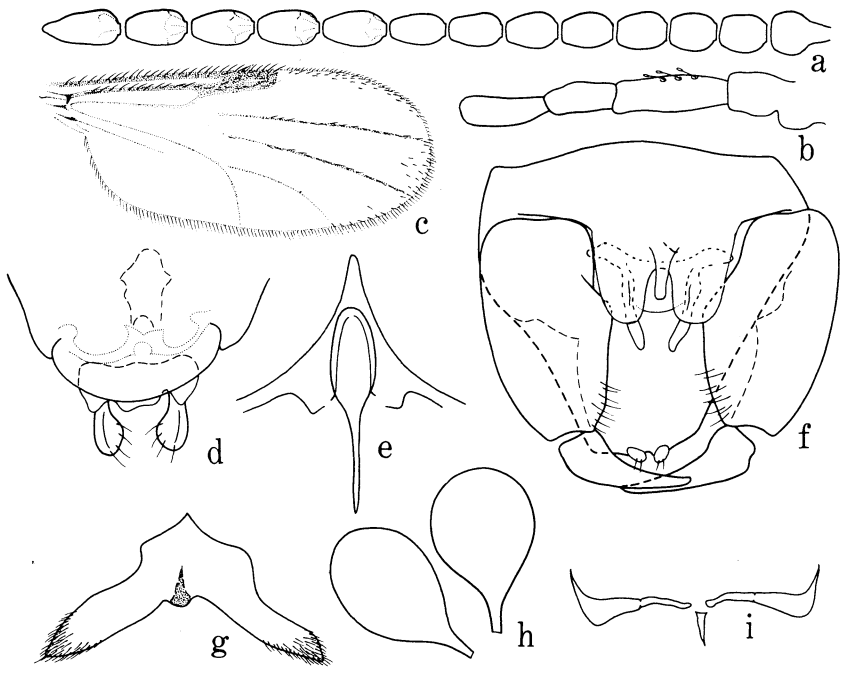

FIG. 3. *Dasyhelea calvescens:* a, antenna (♀); b, palpus (♀); c, wing (♀); d, genital sclerotization (♀); e, frontal sclerite (♀); f, genitalia (♂), parameres removed; g, coxal bridge (♀); h, spermathecae (♀); i, parameres (♂).

TYPES. Syntypes: 8 ♂♂, 1 ♀ (BMNH), HAWAIIAN IS: Oahu: Hanauma Bay, 16-19.V.1936; 3 ♂♂, 1 ♀, Waianae Coast, 5.VI.1936; all collected on beach or coast rocks or tidal rocks by F. X. Williams.

NEW DISTRIBUTION RECORD. MEXICO: Baja California: 29 ♂♂, 1 ♀, 10 mi. (16 km) W of San José de Cabo, 1.IX.1959, light trap, Radford & Werner; Colima: 8 ♂♂, 2 ♀♀, Islas Revillagigedo, Isla Socorro, 1.V.1955, swarming over rock tide pools, McDonald & Blodgett; Sonora: 4 ♀♀, Puerto de Lobos, 18-19.III.1974, V. Roth & W. Brown. PANAMA: 2 ♂♂, 2 ♀♀, Kobbe Beach, C. Z., VII.1967, swept from tidal rocks, W. W. Wirth. WAKE ISLAND: 2 ♀♀, 28,30.VII.1923, in shadow or rocks, E. H. Bryan, Jr. (BISHOP).

BIOLOGY. Williams (1944) reported that *Dasyhelea calvescens* "was common along the shores of Oahu, appearing in the hot sunshine, buzzing in tiny, more or less zigzag movements close over the rocks back of the beach or near the upper tidal zone....It is an insect of the highest tidal zone and of salt water canals (the Ala Wai Canal). It also breeds in the upper splash pools....Here *Dasyhelea* was running and flying, almost hugging the exposed area that was plentifully supplied with fine low algal growth, and with white tooth-like barnacles also present....The larva is very slender and is provided with some grapple-

like hooks posteriorly. It shows some ability to swim. The pupa has very long breathing horns and a pair of stout, lateral spines posteriorly. Both larva and pupa are orange." Wirth (1946) added that "Adults were abundant at Hanauma Bay, Oahu, the type locality, swarming over the rocks back of the shore. Larvae were taken from the felt-like growth of algae and diatoms in the shallow pools in the rocks receiving the splash from the sea at high tide."

Dasyhelea sonorensis Wirth, new species FIG. 4

♀. Wing length 1.34mm; breadth 0.59mm. *Head.* Brown including antenna; palpi pale. Frontal sclerite as in FIG. 4e. Antenna (FIG. 1a) with lengths of flagellar segments in proportion of 25-23-23-25-25-25-25-25-37-40-42-38-48; antennal ratio 1.05; segments not strongly sculptured; last segment tapering to a distal point. Palpus (FIG. 4b) with lengths of segments in proportion of 20-50-25-33; antepenultimate segment unusually long and slender, curved. *Thorax.* Brownish; mesonotum dull yellowish on sides and humeri and on narrow lines on disc forming 2 pairs of darker longitudinal vittae; scutellum yellowish. Legs pale yellow; knee spots blackish; hind tarsal ratio 2.4; sclerotized bridge (FIG. 4h) between fore coxae bearing short, blunt, pubescent lobes. Wing (FIG. 4c) whitish, slightly milky, stigma over radial cells dark grayish brown; microtrichia moderately prominent, macrotrichia long and moderately numerous, forming narrow bare lines along veins; 1st radial cell obsolete, 2nd short with distinct lumen, square ended; costal ratio 0.48. Halter pale, base of knob dark. *Abdomen.* Pale, terga blackish with narrow segmental pale bands across extreme apices of terga. Subgenital plate as in FIG. 4d, anterior portion quadrate with

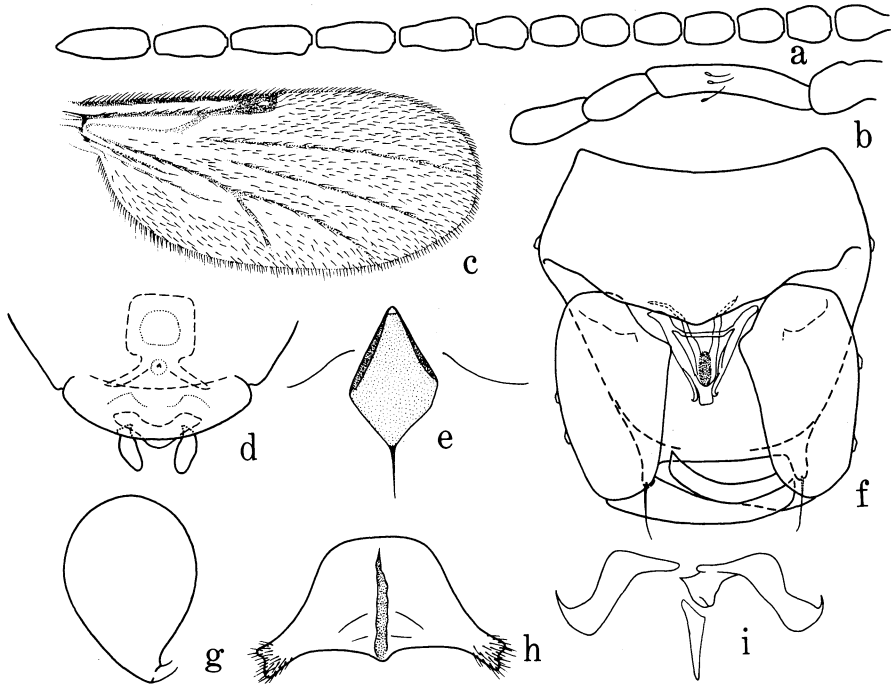

FIG. 4. *Dasyhelea sonorensis:* a, antenna (♀); b, palpus (♀); c, wing (♀); d, genital sclerotization (♀); e, frontal sclerite (♀); f, genitalia (♂), parameres removed; g, spermatheca (♀); h, coxal bridge (♀); i, parameres (♂).

a large pale lumen, posterolateral arms narrow and oblique. Spermatheca (FIG. 4g) 1, ovoid to retort shaped with slender, short, oblique neck; measuring 0.058 by 0.043 mm including neck.

♂. Similar to ♀ with usual sexual differences; mesonotum entirely dark, without prominent vittate pattern; antennal plumes well developed, verticils numerous, long and dark, segmentation of normal ♂. Genitalia (FIG. 4f) typical of *mutabilis* group, about as broad as long; 9th sternum forming a blunt caudal point abutting base of aedeagus; 9th tergum tapering, with transverse caudal margin and widely spaced, well-developed, slender, apicolateral processes. Aedeagus small and triangular in ventral outline, basal arch low; median posterior process short but distinct, slightly surpassing the small, slender, appressed, submedian processes. Basistyle normal, stout; dististyle moderately long, slightly curved, moderately slender, with slightly pointed tip. Parameres (FIG. 4i) asymmetrical, basal apodemes broad; median posterior process short, straight and slender, tapering to sharp point.

DISTRIBUTION. Mexico (coasts of Gulf of California).

TYPES. Holotype ♀, allotype ♂, MEXICO: Sonora: Punta Santa Rosa, 18.I.1974, swept from dry wrack (mainly eelgrass) on shore, V. Roth (Type no. 70439, USNM); paratypes, 4 ♂♂, 12 ♀♀, as follows (deposited in BISHOP, BMNH, CAS, USNM): 5 ♀♀, Puerto de Lobos, 18-19.III.1974, Roth & W. Brown, 4 ♂♂, 5 ♀♀, south of Punta Cirio, 24.IX.1973, among holes in pitted rhyolite rocks, algae-covered, exposed at low tide, Roth & Brown; 1 ♀, Cholla Bay, 25.IV.1972, at light on ship, L. Cheng; Baja California: 1 ♀, 10 mi. (16 km) W of San José de Cabo, 1.IX.1959, light trap, Radford & Werner.

DISCUSSION. This species is a member of the *Dasyhelea mutabilis* group, as evidenced by the anterior lobe of the female genital sclerotization enclosing a distinct lumen, the single spermatheca, and the structure of the aedeagus and parameres of the male genitalia. *D. sonorensis* is an unusually large member of this group, however, and the color markings are distinctive; the whitish wing with dark stigmal spot, the pale mesonotum with prominent broad longitudinal bands, and the narrow segmental bands on the abdominal terga in the female form good specific recognition characters.

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