

The subfamily Tethininae (Diptera: Canacidae) in the Hawaiian Islands¹

LORENZO MUNARI

*c/o Entomology Section, Natural History Museum, S. Croce 1730, I-30135 Venezia, Italy;
email: lormun@iol.it.*

NEAL L. EVENHUIS

*Hawaii Biological Survey, 1525 Bernice Street, Bishop Museum, Honolulu, Hawai'i 96817, USA;
email: NealE@bishopmuseum.org.*

Since Hardy & Delfinado's (1980) contribution to the Hawaiian fauna of the beach fly family Tethinidae (included now into Canacidae *s.l.*), no additional comprehensive faunal studies on these flies from the Hawaiian Islands have been done until present. In that paper Hardy and Delfinado recorded four species of tethinid flies from Hawai'i. *Pelomyia steyskali* Hardy & Delfinado (a junior synonym of *P. occidentalis* Williston) and *Dasyrhicnoessa vockerothi* Hardy & Delfinado were described by the two authors as species new to science. Also, they reported *Tethina variseta* (Melander) [a junior synonym of *T. willistoni* (Melander)] and *Dasyrhicnoessa insularis* (Aldrich) from these oceanic islands. Except for the pelomyiine species *P. steyskali*, all the other species belong to the subfamily Tethininae.

Based on the re-examination of both determined and undetermined material deposited in the Bishop Museum, Honolulu, and a few additional undetermined specimens from the collection of the Zoological Museum, University of Lund (Sweden), this study aims to strengthen and update the taxonomy of the subfamily Tethininae inhabiting the seashores of Hawai'i. After studying this material, three species were found to be new to this remote Pacific archipelago, namely *Dasyrhicnoessa clandestina* Munari, *D. fulva* (Hendel), and *Tethina pallipes* (Loew). Our concept of Hendel's species is based primarily upon the examination (Munari, 2002) of the syntypic series preserved in NMW (only three of the four syntypes were then examined). Unfortunately, no lectotype was designated. Additional syntypes are in DEI (Rohlfien & Ewald, 1972). Furthermore, the male terminalia of one of the examined syntypes perfectly match the figure given by Hennig (1939).

We have also found it useful to include here an identification key to all genera and species of Hawaiian Tethininae in order to facilitate future investigations.

Material and Methods

Material examined was borrowed from or is deposited in the following collections: BPBM (Bishop Museum, Honolulu, Hawai'i, USA); DEI (Deutsches Entomologisches Institut, Eberswald, Germany); MZLU (Museum of Zoology, Lund University, Lund, Sweden); NMW (Naturhistorisches Museum, Vienna, Austria). Unless otherwise noted in the material examined, specimens are deposited in BPBM.

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Taxonomy

Key to genera and species of Tethinae from the Hawaiian Islands

1. Face with a shiny knob laterad, just above the vibrissal angle, and with more or less developed median carina or tubercle on lower portion; no true vibrissa, at most a foremost vibrissa like peristomal seta present; eye bare; male mid femur without postero-ventral armature; terminalia of ♂ with a posterior surstylus only genus *Tethina* Haliday ... 5
- . Face lacking a shiny knob laterad, and without a median carina or tubercle on lower portion; true vibrissa present; eye with dense, tiny pubescence formed by several ommatidial microtrichia; male mid femur with postero-ventral armature formed by a row of black spinulae (figs. 8–9); terminalia of ♂ with both anterior and posterior surstyli genus *Dasyrhicnoessa* Hendel ... 2
2. Dark species, with dark brown thorax; legs sometimes paler, yellowish brown, with tibiae yellowish to brown 4
- . Entirely yellowish to rufous species; legs mostly yellow 3
3. Acrostichal setulae arranged in 4, occasionally 5, rows; forefemur with poorly developed antero-ventral ctenidium, formed by a row of 4–6 spaced, tiny, pale spinulae; mid femur of ♂ (fig. 8) with postero-ventral comb of spinelike setae on distal half or less, formed by 5–6 strong spines increasingly spaced towards rear; hind femur of ♂ with 3–5 irregularly long, fine, spaced ventral setae on proximal half, distinctly longer than half of femur height (= femur thickness); external terminalia of ♂ as in figs. 3–4, with minute, rod-like anterior surstylus and subtriangular posterior surstylus (lateral view); posterior surstylus with 4–5 minute, globular spinulae on apical ventral side ***Dasyrhicnoessa fulva*** (Hendel)
- . Acrostichal setulae arranged in 6, occasionally 7, rows; forefemur with well developed antero-ventral ctenidium, formed by a row of 6–12 close, stout, black spinulae; mid femur of ♂ (fig. 9) with postero-ventral comb of spinelike setae on distal two-thirds or its entire length, formed by 14–16 regularly spaced, close, strong spines; hind femur of ♂ with usual row of short, fine ventral setae, shorter than half of femur height; external terminalia of ♂ as in fig. 7, with very large, trapezoidal, anterior surstylus and spatulate posterior surstylus (lateral view); posterior surstylus without such globular spinulae ***Dasyrhicnoessa vockerothi*** Hardy & Delfinado
4. External terminalia of ♂ as in figs. 1–2; anterior surstylus longer than posterior surstylus length, with large, perfectly triangular (both in lateral and caudal views) apical part ***Dasyrhicnoessa clandestina*** Munari
- . External terminalia of ♂ as in figs. 5–6; anterior surstylus as long as or slightly shorter than posterior surstylus length, with characteristically kidney-shaped apical part (in caudal view) ***Dasyrhicnoessa insularis*** (Aldrich)
5. Pale grey species; setae and setulae of body and legs white to slightly off-white, sometimes with a few to many black main setae on mesonotum (incl. scutellum); gena whitish, uniformly microtomentose 6
- . Dark brown species; setae and setulae of body and legs black; gena yellowish, with broad, longitudinal, subshiny stripe ***Tethina pallipes*** (Loew)

- 6. External terminalia of ♂ with scarcely rounded epandrium, more vertically elongate, slightly rectangular in lateral view; surstylus in lateral view short and straight (Fig. 14) **Tethina willistoni** (Melander)
- . External terminalia of ♂ with rounded capsulate epandrium; surstylus in lateral view long and curved antero-ventrally (Fig. 10) **Tethina albula** (Loew)

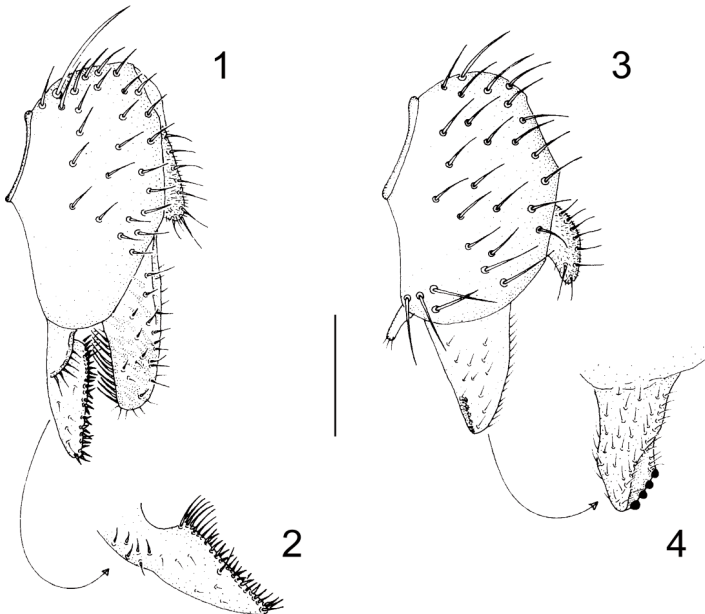
***Dasyrhicnoessa clandestina* Munari, 2002 New state record**
(Figs. 1–2)

Dasyrhicnoessa clandestina Munari, 2002: 543.

A poorly known species recently described from the southwestern Pacific and newly recorded here from the Hawaiian Islands. Except for the male terminalia, which are very distinctive in this species (Figs. 1–2), we have found no consistent external characters that distinguishes it from the closely related *D. insularis* (Aldrich). Therefore, females of *D. clandestina* can tentatively be assigned to this taxon only when strictly collected along with males, like the record below from Kalihi.

Material examined: HAWAIIAN ISLANDS: **O‘ahu:** Kalihi, on window, 14 May 1958, A. Suehiro, 1♂, 2♀.

Distribution. AUSTRALASIAN/OCEANIAN: Hawaiian Islands (new) (O‘ahu), ?New Caledonia, Fiji.



Figs. 1–4. External terminalia of male: **1.** *Dasyrhicnoessa clandestina* Munari, lateral view; **2.** Ditto, apical portion of the anterior surstylus in caudal view; **3.** *D. fulva* (Hendel), lateral view; **4.** Ditto, apical portion of the posterior surstylus in caudal view. Scale bar = 0.1 mm. [Slightly modified after Munari, 2002].

Dasyrhicnoessa fulva (Hendel, 1913)
(Figs. 3–4, 8)

New state record

Rhicnoessa fulva Hendel, 1913: 110.

Hendel (1913) described *Dasyrhicnoessa fulva* from two localities in Taiwan: Anping and Tainan. Since then, this species was almost forgotten until Munari (2002) newly recorded it from Sri Lanka and, later, from Oman (Munari, 2007) and the United Arab Emirates (Munari, 2010). Until now, *D. fulva* was known only from the northern Indian Ocean and the westernmost part of the northern Pacific. This species is newly recorded here from the Hawaiian Archipelago. The distribution of this species is now known to occur throughout the tropico-equatorial belt of the northern Indo-Pacific area, from the United Arab Emirates (the westernmost record) to the Hawaiian Archipelago (the easternmost record). *Dasyrhicnoessa fulva* differs from the externally similar *D. vockerothi* Hardy & Delfinado mainly by the characters given in the key couplet 3.

Material examined: HAWAIIAN ISLANDS: **Maui:** 2 km S Lahaina, swept on herbs and grass along seashore, loc. 41, 23 Oct 1981, L. & I. Cederholm leg., 4♂, 2♀ (MZLU). **O‘ahu:** Hickam AFB, 29 Oct 1977, 16, 19 Nov 1977, 28 Dec 1977, C.W. Mills III, 1♂, 3♀; Poughala Marsh, first pool, 0 ppt. salinity, 19 Jun 1998, K. Arakaki & K. Kami, 1♂; Hālawā Stream, bridge area, 0–1 m, sweeping over mud along stream, 2 Jun 1998, G.A. Samuelson, K. Arakaki & K. Kami, 1♂, 1♀; *ibidem*, (upper), 0 m, over water, 2 Jun 1998, same collectors, 2♂, 1♀; *ibidem*, (lower), 0 m, mud bank under bridge, 2 Jun 1998, same collectors, 1♂; Honouliuli, mud bank, mangrove – *Batis*, 17 Jun 1998, same collectors, 1♂; *ibidem*, along mangrove bank, 17 Jun 1998, same collectors, 1♂, 1♀; Pearl Harbor, Middle Loch near Waiawa springs, sweeping shoreline – mud, sand, rocks and decaying seaweed, 6 May 1998, G.A. Samuelson, 3♂; “Panulū” [= Punalū‘u] Beach Park, swept in swamp and around small stream, loc. 40, 18 Oct 1981, L. & I. Cederholm leg., 1♂ (MZLU).

Distribution. AUSTRALASIAN/OCEANIAN: Hawaiian Islands (new) (Maui, O‘ahu). ORIENTAL: Sri Lanka, Taiwan. PALAEARCTIC: Oman, United Arab Emirates.

Dasyrhicnoessa insularis (Aldrich, 1931)
(Figs. 5–6)

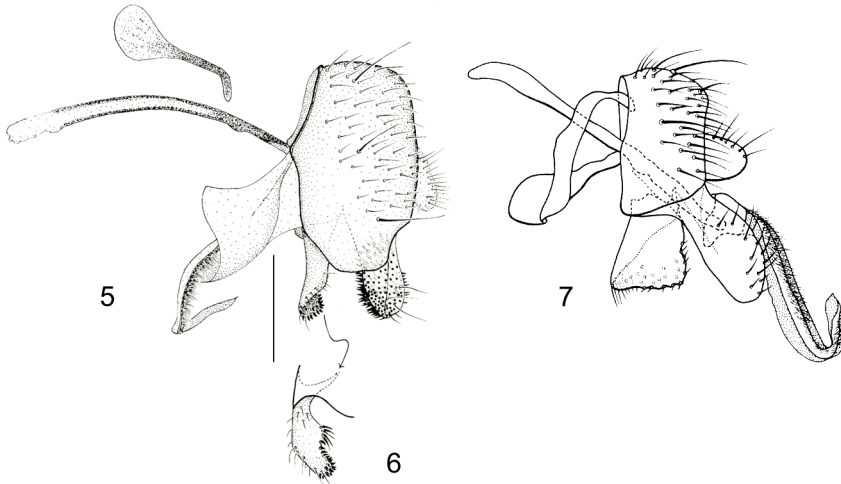
New island records

Tethina insularis Aldrich, 1931: 395.

A common, pantropical species occurring throughout the tropical seashores of the world. Like its congeners, it is associated mainly with mangrove swamps. Along with *D. clandestina*, Aldrich’s species from the Hawaiian Islands can be distinguished by its dark color. As opposed to the former species, it is commonly found in many maritime places. It is new to the Hawaiian Islands of Kaho‘olawe, Kaua‘i, and Moloka‘i.

Material examined: HAWAIIAN ISLANDS: **Hawai‘i:** Kealakekua, 12 May 1959, S. Kimoto, 1♂; Pololū Valley, 2 Aug 1958, L.W. Quate, 1♂, 3♀. **Kaho‘olawe:** *Sida* salt bush, E end, 900 ft elev., 14 Feb 1931, E.H. Bryan Jr, 1♀; **Kaua‘i:** Barking Sands, rock shore, 2 Apr 1969, J.L. Gressitt, 1♂, 5♀; **Midway Atoll:** Sand Island, Feb 1953, C.F. Clagg, 4♂, 11♀. **Molokai:** Kaunakakai, 21 Jun 1962, K. Yano, 1♂. **O‘ahu:** Barbers Point, light trap, Jan 1959, [no collector name], 1♀; Hanauma Bay, seashore, 6 Mar 1961, L.W. Quate, 2♂. **Pearl & Hermes Reef:** SE Island, ex crucifer, 14 Dec 1970, J.L. Gressitt, 1♂, 4♀; *ibidem*, *Solanum*, 14 Dec 1970, same collector, 2♂, 5♀; *ibidem* [no additional data], 14 Dec 1970, same collector, 1♂, 1♀; *ibidem*, *Tribulus*, 15 Dec 1970, same collector, 8♂, 6♀; *ibidem*, *Eragrostis*, 15 Dec 1970, same collector, 3♂, 1♀; *ibidem* [no additional data], 15 Dec 1970, same collector, 1♀.

Distribution. AFROTROPICAL: Cameroon, Madagascar, Nigeria. AUSTRALASIAN/OCEANIAN: American Samoa (Tutuila), Australia (Queensland), Bismarck Is-



Figs. 5–7. External terminalia of male: 5. *Dasyrhicnoessa insularis* (Aldrich), lateral view; 6. Ditto, apical portion of the anterior surstylus in caudal view; 7. *D. vockerothi* Hardy & Delfinado, lateral view. Scale bar = 0.1 mm. [Figs. 5–6, slightly modified after Munari, 1994, as *D. freidbergi* Munari; fig. 7, slightly modified after Sasakawa, 1995].

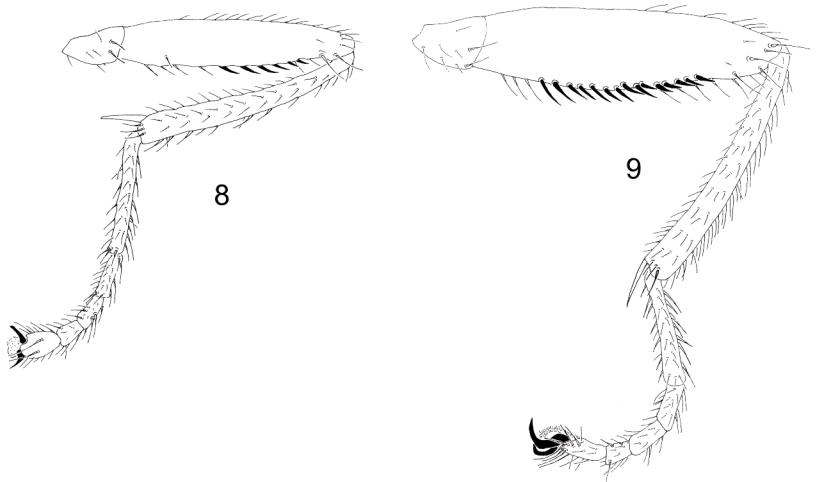
lands (Dyaul), Canton Island, Caroline Islands (Ponhpei, Chuuk, Yap, Palau), Fiji (Ovalau, Suva, Viti Levu), ?French Polynesia (Society Islands: Moorea), Hawaiian Islands (Hawai‘i, French Frigate Shoals, Kaho‘olawe (new), Kaua‘i (new), Lisiansky, Maui, Midway Islands, Moloka‘i (new), O‘ahu, Pearl & Hermes Reef), Kiribati (Butaritari, Makin, Eita, Tarawa, Abemama), Line Islands (Christmas), Mariana Islands (Saipan, Tinian), Marquesas (Hivaoa, Nuku Hiva), Marshall Islands (Majuro, Japtan, Parry, Lib, Jibu, Jaluit, Namorik), New Hebrides (Erromanga), Palmyra Island, Pitcairn Island, Rapa Island, Society Islands (Bora Bora), Wake Island. NEARCTIC: Bermuda, United States (Florida). NEOTROPICAL: Bahamas (South Bimini), Belize, Brazil (Ceará), Mexico (Tabasco), West Indies (Cuba, Dominica, St. Lucia, St. Kitts, St. Vincent).

***Dasyrhicnoessa vockerothi* Hardy & Delfinado, 1980**
(Figs. 7, 9)

Dasyrhicnoessa vockerothi Hardy & Delfinado, 1980: 373.

First recorded by Hardy (1952) as “*Tethina* sp.?, taken on beach at Waimanalo, Oahu, September, 1951”, it was later recognized to be a species new to science (Hardy & Delfinado, 1980). The holotype from “Haena, Kauai, collected on beach, August, 1953 (D. E. Hardy)” is deposited in BPBM.

A common Indo-Pacific species externally similar to *D. fulva* that can easily be distinguished from it by the many consistent characters given in the key. At first glance, both species are distinguished from their Hawaiian congeners primarily by their smaller size and yellowish to pale rufous color of body and legs.



Figs. 8-9. Posterior view of the male mid leg: **8.** *Dasyrhicnoessa fulva* (Hendel); **9.** *D. vockerothi* Hardy & Delfinado (the leg appears very slightly rotated postero ventrally. For this reason, both lengths of the femoral spinelike setae and the basitarsus give the impression to be proportionally shorter than those of *D. fulva*). Scale bar = 0.5 mm.

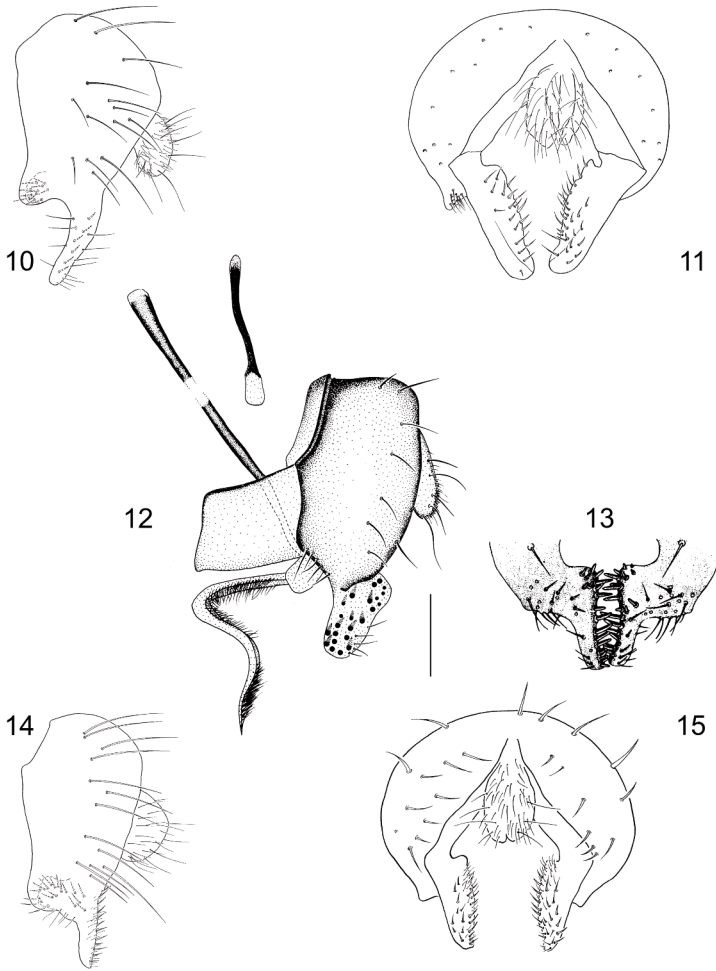
Material examined: HAWAIIAN ISLANDS: **Hawai'i:** Kealakekua, 12 May 1959, S. Kimoto, 1♂; **Kaua'i:** Barking Sands, rock shore, 2 Apr 1969, J.L. Gressitt, 8♂, 8♀; Koke'e, 4-6 Aug 1961, Maa, Miyatake & Yoshimoto, 2♀; Nawiliwili, at light, 9 Sep 1946, W.W. Wirth, 1♂; **O'ahu:** [no additional data], 9-10 Sep 1955, M.R. Wheeler, 1♂, 1♀; Barbers Point, 11 Aug 1966, C.M. Yoshimoto, 1♀; Hālawā Stream (upper), 0 m, over water, 2 Jun 1998, G.A. Samuelson, K. Kami & K. Arakaki, 1♀; Hickam AFB, at light, 28 Dec 1977, C.W. Mills III, 1♂, 1♀; Honolulu, on window, N.L.H. Krauss, 20 Dec 1941, 1♀.

Distribution. AFROTROPICAL: Seychelles (Aldabra, Mahé). AUSTRALASIAN/OCEANIAN: Australia (New South Wales, Northern Territory, Queensland), Bismarck Islands (Dyaul), Caroline Islands (Chuuk, Palau), Gilbert Islands, Hawaiian Islands (Hawai'i, Kaua'i, Maui, Moloka'i, O'ahu), Mariana Islands (Guam, Saipan), Marshall Islands, ?New Caledonia, Papua New Guinea, Wake Island. ORIENTAL: Japan (Ryukyus), Malaysia (Sarawak), Philippines, Sri Lanka.

Tethina albula (Loew, 1869)
(Figs. 10-11)

Rhichnoessa albula Loew, 1869: 44.

This species was first recorded from the Hawaiian Islands by Mathis & Foster (2007) who did not cite any locality of Hawai'i for specimens examined in that paper. The above distribution was later also reported by Foster & Mathis (2008a, b) and by Munari & Mathis (2010). Mathis & Foster (2007) stated that *T. albula* and *T. willistoni* are often captured together, and that these two species apparently have no external diagnostic characters that distinguish them. Very likely these two taxa are sibling species that can be distinguished from each other only on the basis of slight, though consistent, morphological characters



Figs. 10–15. External terminalia of male: **10.** *Tethina albula* (Loew), lateral view; **11.** Ditto, caudal view; **12.** *T. pallipes* (Loew), lateral view; **13.** Ditto, surstyli in caudal view; **14.** *T. willistoni* (Melander), lateral view; **15.** Ditto, caudal view. Scale bar = 0.1 mm. [Figs. 10–11 and 14–15, slightly modified after Mathis & Foster, 2007; Figs. 12–13, slightly modified after Munari, 1990 (as *T. (Rhicnoessa) canzonerii* Munari)].

of the male terminalia (cf. Figs. 10–11, 14–15). According to Mathis & Foster (2007), the concept of *T. albula* is limited to those specimens with the rounded capsulate epandrium and an anteroventrally curved and longer surstylus (Fig. 10). Contrastingly, the epandrium of *T. willistoni* is less rounded and more vertically elongate, slightly rectangular in lateral view. Furthermore, the surstylus of the latter species is shorter and straight in lateral view (Fig. 14). In conclusion, we think it very important to carry out in the future more

detailed morphological examinations on both preserved and newly captured materials in order to confirm the possible occurrence of *T. albula* in the Hawaiian Archipelago.

Distribution. AUSTRALASIAN/OCEANIAN: Hawaiian Islands (Hawai'i, Kaho'olawe, Kaua'i, Maui, O'ahu). NEARCTIC: Mexico (Baja California Sur), United States (California, Delaware, Florida, Maryland, Massachusetts, New York, North Carolina, Rhode Island, South Carolina, Virginia). NEOTROPICAL: Bahamas, Belize, Brazil (Rio de Janeiro), Costa Rica, Curaçao, Ecuador (incl. Galápagos Islands), Guyana, Mexico (Chiapas, Quintana Roo, Sonora), Panama, Peru, Trinidad and Tobago, West Indies (Anguilla, Antigua, Barbados, Barbuda, Dominica, Dominican Republic, Grand Cayman, Grenada, Jamaica, Montserrat, Puerto Rico, St. Croix, St. Lucia, St. Vincent, Turks and Caicos).

Tethina pallipes (Loew, 1865)

(Figs. 12–13)

Rhinoessa pallipes Loew, 1865: 37.

Originally described from Greece, this is now known to be a common subcosmopolitan species that is recorded here for the first time from the Hawaiian Islands.

Material examined: HAWAIIAN ISLANDS: **Lāna'i**: Lāna'ihale, 3000–3370 [feet], 26 Mar 1961, G. Arnemann & Y. Kondo, 1♀. **O'ahu**: Honolulu, on window, 6 Jan 1942, N.L.H. Krauss, 1♂; ibidem, [no additional data], A.M. Okumura, 1♀; Naval Air Station, P.H. [Timberlake], light trap #1B, 20 Aug 1944, Herms & Russell, 1♀; Waikiki, 1 Mar 1932, O. Bryant, 1♀.

Distribution. AFROTROPICAL: Cape Verde Islands, Senegal, Seychelles (Al-dabra), South Africa. AUSTRALASIAN/OCEANIAN: Australia (Western Australia), Hawaiian Islands (new) (Lāna'i, O'ahu). ORIENTAL: India, Taiwan. NEARCTIC: Bermuda, United States (Texas). NEOTROPICAL: Chile, Mexico (Chiapas, Tabasco). PALAEARCTIC: Algeria, Azores, Bulgaria, Canary Islands, Cyprus, Egypt, France, Greece, Israel, Italy, Jordan, Malta, Oman, Portugal (Madeira), Spain (including Balearic Islands), Tunisia, Turkey, United Arab Emirates.

Tethina willistoni (Melander, 1913)

(Figs. 14–15)

Rhinoessa willistoni Melander, 1913: 298.

See discussion under *Tethina albula*. Hardy & Delfinado (1980) recorded this species from the Hawaiian Islands as *T. variseta* (Melander, 1952), a junior synonym of *T. willistoni* (Melander, 1913).

Distribution. AUSTRALASIAN/OCEANIAN: Hawaiian Islands (French Frigate Shoals, Hawai'i, Kaho'olawe, Kaua'i, Lisiansky, Maui, O'ahu, Midway Atoll). NEARCTIC: Bermuda, United States (California, Connecticut, Delaware, Florida, Maryland, Massachusetts, North Carolina, South Carolina, Virginia). NEOTROPICAL: Bahamas, Belize, Brazil (Rio de Janeiro), Cuba, Curaçao, Ecuador, Mexico (Chihuahua, Tabasco), Panama, Peru, Trinidad and Tobago, West Indies (Anguilla, Antigua, Barbados, Barbuda, Dominica, Dominican Republic, Grand Cayman, Grenada, Jamaica, Montserrat, Puerto Rico, St. Croix, St. Lucia, St. Vincent, Turks and Caicos).

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