JOURNAL OF NATURAL HISTORY, 1988, **22**, 1489–1494

A new troglobitic meenoplid from a lava tube in Western Samoa (Homoptera Fulgoroidea Meenoplidae)

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(*Accepted 28 April 1988*)

Recent investigations in lava tubes on Savai'i, Western Samoa, have revealed the existence of a new cave-dwelling meenoplid species, *Suva oloimoa* sp. nov., from the deep cave zone. Troglomorphies displayed by *S. oloimoa* sp. nov. include reduction of ocelli, compound eyes, pigmentation and, to a lesser degree, of tegmina and wings. Due to these features and to its ecology, the species is regarded as an obligate cavernicole (troglobite). This is the first record of a troglobitic meenoplid in the Pacific.

KEYWORDS: Kermesiinae; *Suva oloimoa* sp. nov.; Savai'i; Deep cave zone; Troglomorphy.

Introduction

Until recently terrestrial troglobites (obligate cavernicoles) were believed to occur only sporadically in tropical regions. Attempts to rationalize this apparent impoverishment were based on the assumption of ecological stability in tropical environments.

In temperate zones instability, such as climatic changes during glaciation, has apparently caused extinction and extirpation of surface populations resulting in subsequent cave adaptation of troglophilic (facultative cavernicole) populations (Barr, 1968). The discovery of terrestrial troglobitic arthropods in lava tubes on Hawaii (Howarth, 1972) together with the existence of closely related epigean species, showed that cave adaptation is not necessarily preceded by extinction or extirpation of surface populations. It may as well be due to adaptive shifts occurring when potential food resources (for example tree-roots) are to be exploited (Howarth, 1986). Howarth (1980) proposed a bioclimatic model to explain the geographic distribution of terrestrial troglobites, taking into account the bioclimatological and physical characteristics of the cave rather than the surface environment. According to Howarth (1980), terrestrial troglobitic species are to be expected in caves that are old enough to allow sufficient evolutionary time for acquiring cave adaptations, and provide adequate moisture and food supply.

Accordingly, investigations in suitable lava tubes on the island of Savai'i, Western Samoa, have revealed the existence of a cave-adapted species of the Fulgoroid family Meenoplidae. This is the first record of cavernicolous Meenoplidae in the Pacific Region. Meenoplidae are among the smaller Fulgoroid families and contain slightly more than a hundred species. They occur exclusively in the Old World, the majority of species being found in tropical areas. According to a review of cave-dwelling

Fulgoroidea (Remane & Hoch, 1988), only two cavernicolous meenoplid species were known: *Phaconeura pluto* Fennah (1973) from Western Australia and *Meenoplus cancavus* Remane & Hoch (1988) from the Canary Islands.

Suva Kirkaldy, 1906: 428. Type species: *Suva koebelei* Kirkaldy, 1906: 428, by monotypy.

Suva oloimoa sp.nov.

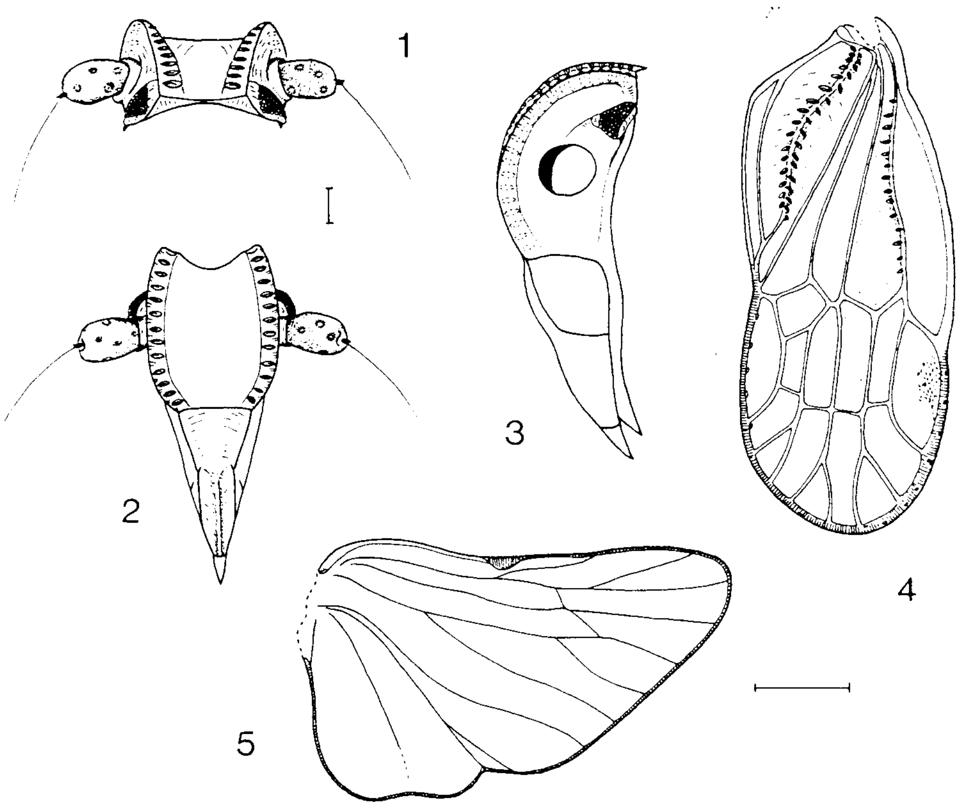
(Figs 1–14)

Description. Body and legs pale yellowish; tegmina and wings translucent, whitish; veins light yellow or white. Ocelli and blemmata absent. Compound eyes (Fig. 1) strongly reduced, less than half the normal size of the eyes of epigean *Suva* species. A short transverse rim above the antennal bases. Vertex (Fig. 1) broader at base than its mid length (1·7 : 1), continuously rounded onto frons (Fig. 3); posterolateral areolets small; lateral margins of vertex and frons prominent, each anteromedian side packed with a row of 24 oval sensory pits over the full length. Area of frons (Fig. 2) without carinae and sensory pits, smooth, sunk towards the margins. Frons, in mid line, slightly longer than post- and anteclypeus together (1·1–1·2 : 1), lateral margins shallowly convex, broadest at level of the antennae. A distinct interruption at frontoclypeal suture between lateral carinae of frons and clypeus. Lateral carinae of postclypeus present over the full length, surface of postclypeus convex without median carina; anteclypeus with distinct median carina. Rostrum surpassing the posterior coxae. 1st segment of antennae short, ring-like, 2nd segment subcylindrical, 1·7 times longer than wide; sensory fields star-shaped, irregular in number and arrangement. Posttibia distally with 6–7 spines in a row (individually asymmetrical), postbasitarsus apically with 6, 2nd posttarsal segment with 5 spines in row. Postbasitarsus 1·2 times longer than 2nd and 3rd posttarsal segments together. Claws and pads present. Tegmina (Fig. 4) slightly reduced in length: 2·4–2·5 times longer than their maximum width (in epigean *Suva*-species about 2·7–2·9 : 1); 7 apical cells; arrangement of sensory pits on tegmen as in other Kermesiinae. Hindwings (Fig. 5) fully developed, but relatively shorter than in epigean species, no obvious reduction of veins.

Male genitalia. Genital segment (Figs 6–8) ventrally about 3·5 times longer than dorsally, in caudal view as in other meenoplids, typically shaped as an upright 8. Parameres (Figs 12–13) longer than genital segment is high, basal half dilated as in *Suva koebelei* Kirkaldy, distal part abruptly slender, finger-shaped, curved dorsad. Aedeagus (Figs 10–11) short and stout; sperm conducting part slightly bent ventrad, distally on each side flanked by a longitudinal, sharp-edged lamella; dorsal margin caudad of phallotrema expanded to a short truncate process; ventrolaterally of the base of the aedeagus complex and arising from the surrounding diaphragm are two cone-shaped, granulate processes that are bent dorsad. Anal segment (Figs 8–9) about as long as the ventral side of the genital segment, caudal margin deeply notched, the ventrocaudal edges with lobe-like extensions and slightly bent laterad distally.

Female genitalia (Fig. 14). As in other Kermesiinae, strongly reduced; structures indistinct, hyaline; laterocaudal margin of ventral portion produced in a rounded lobe that originates from the inner side, and in a short ventral process (apparently remnants of gonapophyses VIII or/and IX).

Type material. HOLOTYPE ♂, Western Samoa: Savai'i I., Sataua, Oloimoa Cave, deep cave zone, 21–22.IV.1987, leg. M. Asche & H. Hoch (depository: Bernice P. Bishop Museum, Honolulu). PARATYPES: 14♂, 1♀, same locality and data as holotype



FIGS 1–5. *Suva oloimoa* sp. nov. (paratype ♂): 1, head, dorsal view; 2, head, frontal view; 3, head, lateral view; 4, tegmen; 5, wing. (Figs 1–3, scale line = 0·1 mm; Figs 4–5, scale line = 0·5 mm).

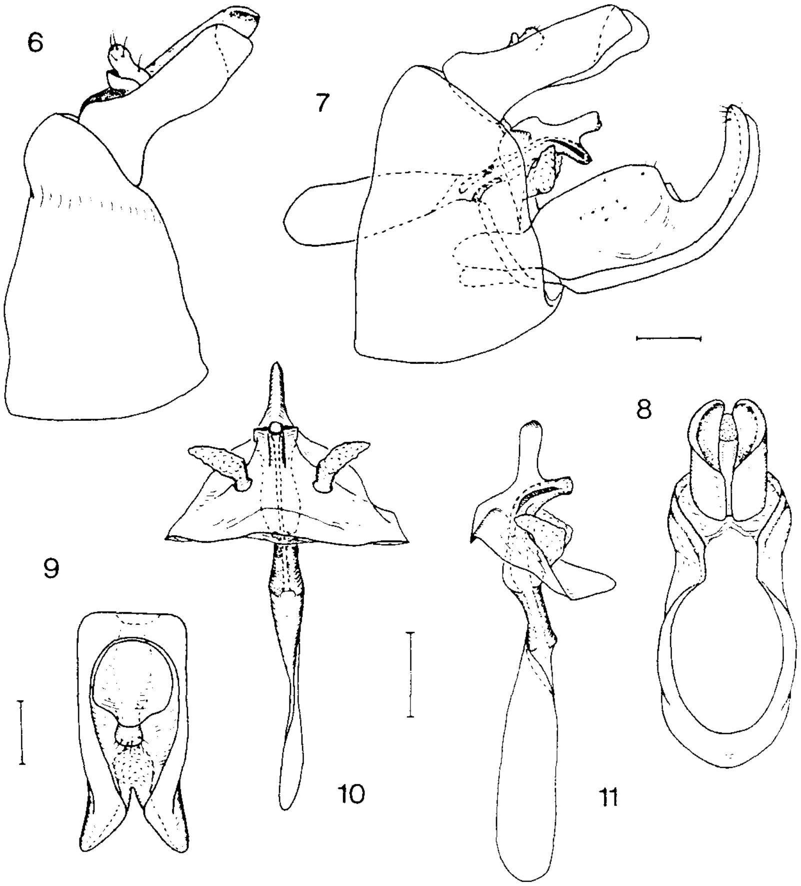
(depository: Bernice P. Bishop Museum, Honolulu; Queensland Museum, Brisbane; British Museum (Natural History), London; Private Collection of M. Asche/H. Hoch, Marburg).

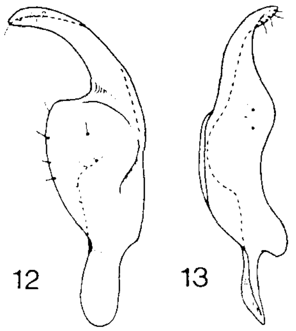
Additional material. 4 nymphs (IV., V. instar).

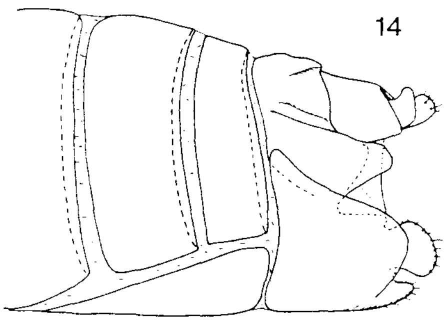
Remarks

This cavernicolous species can be distinguished from other species currently placed in *Suva* by the blunt dorsal process of the aedeagus and by the shape of the granulate, cone-shaped processes arising ventrolaterally near the base of the aedeagus. Nevertheless, the generic placement is tentative since *Suva* is currently defined by characters that have not yet been proven synapomorphies (they may as well be symplesiomorphies) and, at present, cannot be considered monophyletic.

Although *Suva* is represented by several species in the epigean fauna of Western Samoa, no close relationship between any of them and *Suva oloimoa* could be found. Although symplesiomorphic similarities are found in several characters, the epigean Samoan *Suva* species display a different configuration of the aedeagus.







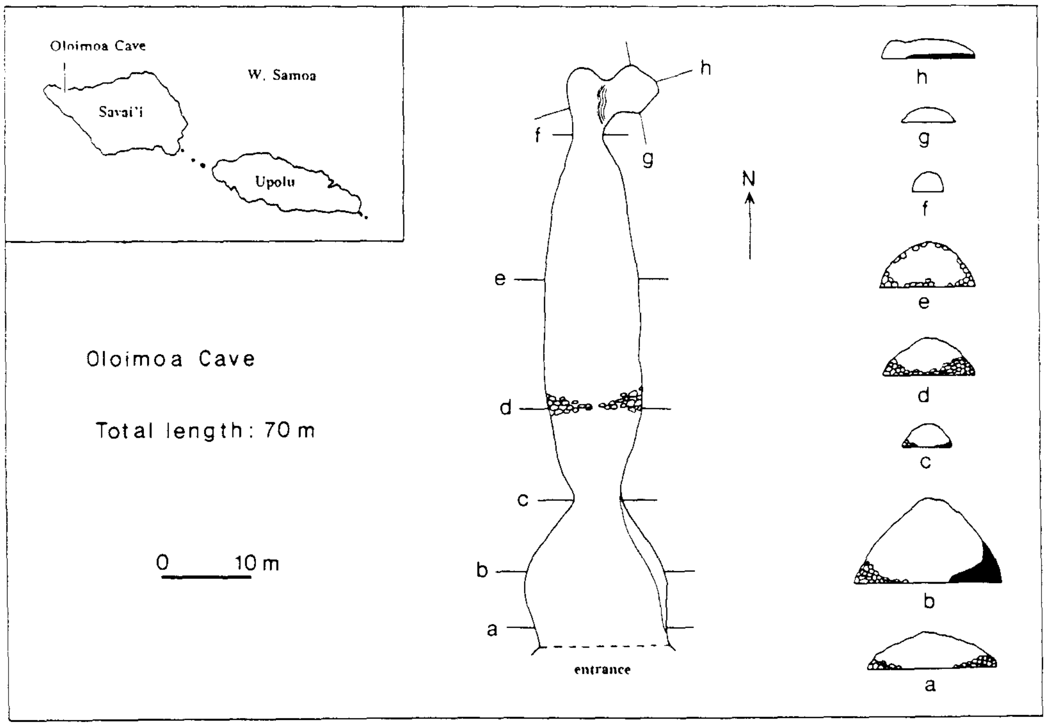
FIGS 6–13. *Suva oloimoa* sp. nov. (paratype ♂): male genitalia. 6, genital segment and anal tube, left lateral view; 7, male genitalia *in situ*, left lateral view; 8, genital segment and anal tube, caudal view; 9, anal tube, dorsal view; 10, aedeagus, ventral view; 11, aedeagus, left lateral view; 12, left paramer, left lateral view; 13, left paramere, ventral view (Scale line = 0·1 mm).

FIG. 14. *Suva oloimoa* sp. nov. (paratype ♀): female genitalia, left lateral view (Scale line = 0·1 mm).

Ecology

Oloimoa Cave (<50 m a.s.l.) near Sataua, north-western Savai'i, meets all requirements postulated by Howarth (1980) for caves that can be expected to house terrestrial troglobites. It was formed in the Mulifauna Formation which, according to Kear & Wood (1959), is less than 100,000 years old. These *pahoehoe* flows, however, cover older lava flows of the Salani volcanics which date back to about 310,000 years (Kear & Wood, 1959). After the entrance zone (about 16 m in length) the passage narrows (Fig. 15 c), followed by a comparatively small transition zone (Fig. 15 c–d) (Howarth, 1983). In about 60% of the passage (Fig. 15 d–g) deep cave conditions (Howarth, 1983) prevail with nearly constant temperature (23·9–24·4°C), stagnant air, and atmosphere close to saturation.

Suva oloimoa sp. nov. displays a considerable degree of troglomorphy with rudimentary compound eyes, completely reduced ocelli and loss of pigment. Surprisingly, tegmina and wings are only slightly reduced in length, and adult specimens are still able to fly. Nevertheless, it seems unlikely that *Suva oloimoa* specimens are able to survive outside the cave environment, and the species is therefore regarded an obligate cave-dweller. Adults, which are the dispersing stages, were also collected away from roots on walls in the main tube while nymphs of *Suva oloimoa* sp. nov. were found only on roots in a small chamber off the main tube (Fig. 15 g). Banyan trees, *Ficus benghalensis* L., are frequent in the surface vegetation and may be possible hosts.



15

FIG. 15. Location and topography of Oloimoa Cave, Savai'i, W. Samoa.

Acknowledgments

We would like to express our sincere thanks to Lyon and Micky Morel, Sataua, Savai'i, for generous access to their property, and to Kiwi Tutonu, Vaisala, Savai'i, for his enthusiastic field-assistance, especially his help in locating lava tubes and for making the contact between the '*palangi*' and Samoan people. We are especially indebted to M. R. Wilson, CAB International Institute of Entomology, London, who provided valuable comments on the manuscript.

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