Pacific Science (1999), vol. 53, no. 3: 299–304

Nerillidae of Hawai'i: Two New Records of Interstitial Polychaetes[1]

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ABSTRACT: Two species of the polychaete family Nerillidae are reported from sand collected from the south shore of O'ahu, Hawai'i. *Nerilla antennata* O. Schmidt was collected from a shallow fringing reef, and *Mesonerilla fagei* Swedmark with coarse sand from Honolulu Harbor. Both are less than 0.5 mm in length and occupy an interstitial habitat. *Nerilla antennata* has a broad geographic distribution including Atlantic, Pacific, and Indian Oceans, and *M. fagei* is known from the North Atlantic. The morphology of Hawaiian specimens is described and reproductive stages of *M. fagei* are illustrated.

THE HAWAIIAN INTERSTITIAL and "Archiannelidan" fauna are poorly understood because these small polychaetes are easily overlooked unless sediments are elutriated. Two of the five families traditionally grouped in the order Archiannelida, the Saccocirridae and Protodrilidae, are included in Bailey-Brock's (1987) revision of Edmondson's (1946) *Reef and Shore Fauna of Hawai'i.* These five families are now considered unrelated to each other and placed in the class Polychaeta (Fauchald and Rouse 1997). The Protodrilidae and Saccocirridae are each represented by a single genus, *Protodrilus* and *Saccocirrus*, respectively (Bailey-Brock 1987). In this paper I add new distributional records for the former archiannelidan family Nerillidae, two species belonging to different genera from sand habitats of O'ahu, Hawai'i.

MATERIALS AND METHODS

Honolulu Harbor sediment was collected by diving and preserved with 10% formalin in the field. Later the sample was elutriated and sieved through 0.25- and 0.5-mm mesh sieves. Rose bengal stain and 75% ethanol were added before the two fractions were examined.

Sand from the upper intertidal was collected at Niu beach park and the overlying water and fine sediment poured over 0.5- and 0.25-mm sieves. A few live nerillids were found and examined by students in the Invertebrate Biology course at the University of Hawai'i at Mānoa. A live specimen was examined with a compound microscope, illustrated live, and later preserved in 10% formalin. Preserved specimens were mounted on a slide with glycerol and viewed with phase, dark field, and between-stop phase microscopy to establish fine structure of setae, number of setae per setiger, and distribution of cilia on the appendages and body.

RESULTS

Two nerillid genera were found in the meiofaunal (0.25 mm) sieve fraction, *Mesonerilla* from Honolulu Harbor and *Nerilla* from Niu beach park. These genera are distinguished from each other by their setae. The former has compound setae, the latter simple setae with fine serrations along one margin of the blade. The genera share a number of characteristics and a brief generic diagnosis is given for each.

Genus *Nerilla* O. Schmidt, 1848

DIAGNOSIS (after Westheide 1990): Nerillidae with three jointed antennae, two palps, nine setigers including the buccal segment, all parapodia with simple setae. First setiger with a pair of jointed parapodial cirri, se-

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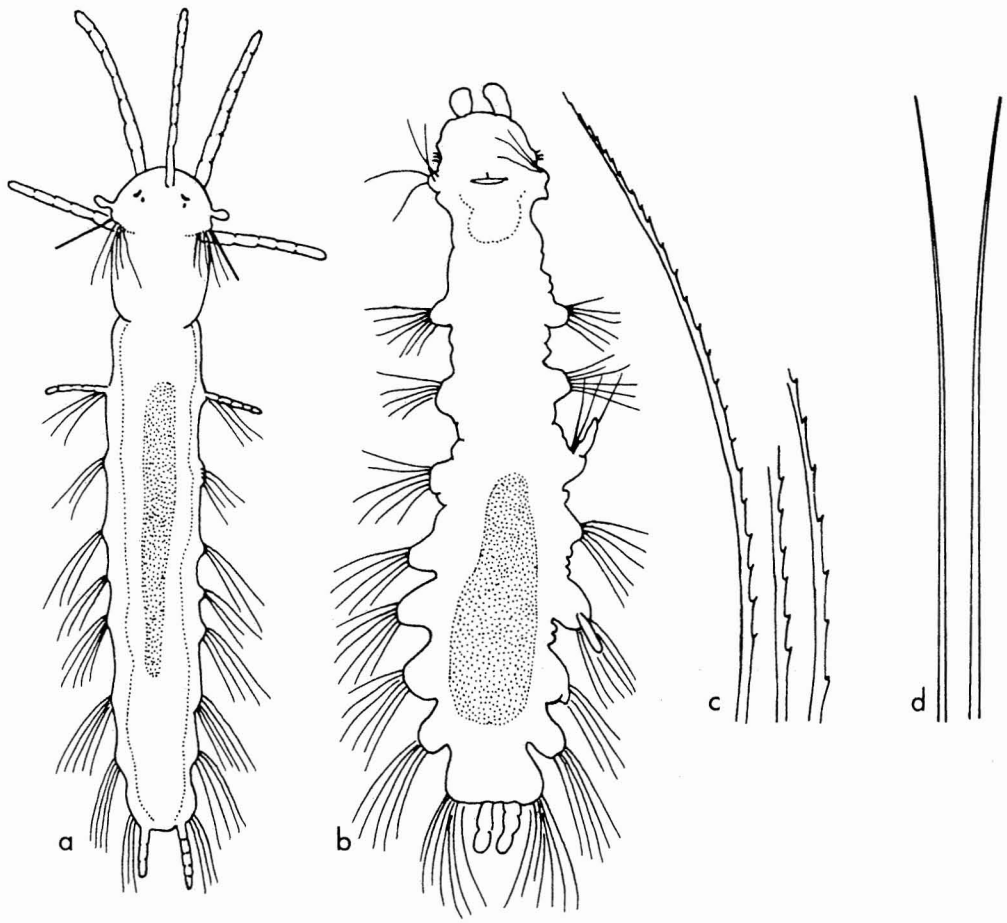

FIGURE 1. *Nerilla antennata: a*, live specimen, dorsal view, ×40; *b*, preserved specimen, ventral view, ×40; *c*, serrate setae, ×100; *d*, smooth setae of the first setiger, ×100.

tigers two to nine with simple cirri. Gonochoristic.

Nerilla antennata O. Schmidt, 1848

Body of live specimen (Figure 1*a*) with nine setigers, three long antennae, a pair of palps, and a pair of anal cirri. Eyespots each composed of two reflective oscelli, nuchal organs narrow slits just posterior to the palps. Antennae extend a distance equal to that between the first and second setigers and are weakly articulated. At rest, setae of setiger one are straight, lie parallel to the body, and are directed posteriorly; when the worm crawled they were moved rapidly in a 180° arc and projected forward and then backward. A single seta in each parapodium of setiger one moved independently of the others. Cirri of setiger one are almost as long as the antennae and weakly articulated with five articles. Setigers two to nine with long, slightly curved setae. Parapodial cirri and setae directed laterally and posteriorly. Setae of setigers seven and eight are more numerous than those of anterior segments. Anal cirri with three to five articles. Pharyngeal apparatus could be seen moving, which changed the diameter of the buccal region, but buccal pieces were not recognizable with light mi-

croscopy. Faint grooves were evident between the palps and first cirri, and between setigers one and two demarcating the pharyngeal region from the rest of the body. Gut contents between setigers two and seven were brown with green inclusions.

A preserved specimen (Figure 1*b*) in ventral view shows two of the three antennae, a small pair of palps, a slitlike mouth, nine setigers, and pair of anal cirri. Articulation is not evident except as three articles in the anal cirri. Setae of setiger one are smooth (Figure 1*d*), without serrations, very slender; the majority point anteriorly and a few are laterally directed. Setae of setigers two and nine (Figure 1*c*) are all serrated along one margin and vary in length. Number of setae are as follows: setiger one has 4–5, two has 11, three has 12, four has 16–17, five has 15, six has 15, seven has 17–18, eight has 12, and nine has 16. A single interramal cirrus remained on some parapodia. Eyes were not seen in the preserved specimen despite its small size and transparent appearance.

Preservation caused contraction of some structures and had changed the apparent proportions of antennae and parapodial and anal cirri. The palps are hardly discernible after preservation and could have been overlooked if not previously viewed alive.

REMARKS: These specimens differ from the description of *N. antennata* in having smooth setae on setiger one. To my knowledge this is the only observation of a *Nerilla* specimen with smooth setae on the buccal segment, and the only one with two kinds of setae represented. Descriptions of *N. antennata* differ slightly in the expression of some diagnostic features, which led Remane (1949) to recognize two subspecies, *N. antennata antennata* and *N. antennata mediterraneum* (e.g., length of interramal cirri on setiger one, articulation of cirri, and number of ciliary patches on the segments [Westheide 1990: figure 10, p. 52]). There are large genetic differences among *N. antennata* regional populations. American West Coast worms have a genetic character closer to those of China (described as *N. inopinata* Gray, 1968) than to the European forms (Schmidt and Westheide 1998). Based on this information, and without molecular studies, the Hawaiian *Nerilla "antennata"* may be a separate species or resemble the North Pacific species of the *"antennata"* complex, *N. inopinata* (W. Westheide, pers. comm.).

HABITAT: Collected on 16 September 1998, in muddy sand close to the beach on the fringing reef at Niu beach park, south shore of O'ahu. Water depth ranges from 1 to 2 m at this location, and collection site remains subtidal throughout the year.

GEOGRAPHIC RANGE: *Nerilla antennata* is known from northern Europe, the Pacific coast of Washington, southwestern Africa, South Africa, and India (Gelder 1974, Westheide 1990).

Genus *Mesonerilla* Remane, 1949

DIAGNOSIS (after Westheide 1990): Nerillidae with two or three smooth antennae, two palps, nine setigers, compound heterogomph setae, buccal segment with or without setae. Gonochoric or hermaphrodite.

Mesonerilla fagei Swedmark, 1959

Description of Hawaiian material based on preserved specimens. Body with nine setigers (Figure 2*a*). Prostomium with three smooth or slightly wrinkled antennae (Figure 2*a,b*) extending in length to the second setiger and a pair of club-shaped, laterally directed palps. Buccal pieces and eyes were not observed. Parapodia of first setiger lie just posterior to the palps and have clearly defined dorsal and ventral bundles of compound setae. Setigers two to nine similarly organized with compound setae. A single interramal cirrus on each parapodium, the longest cirri on setiger eight and/or nine. First setiger cirri are notably shorter than those of setigers two to nine (Figure 2*b*). Posterior region without anal cirri (Figure 2*c*), and in some specimens two developing embryos obscure the dorsum of the terminal segment (Figure 2*a*). Another specimen was found with a six-setiger juvenile attached to the last segment (Figure 2*d*). Setae are all compound (Figure 2*e*), each with a slender smooth blade and boss at the

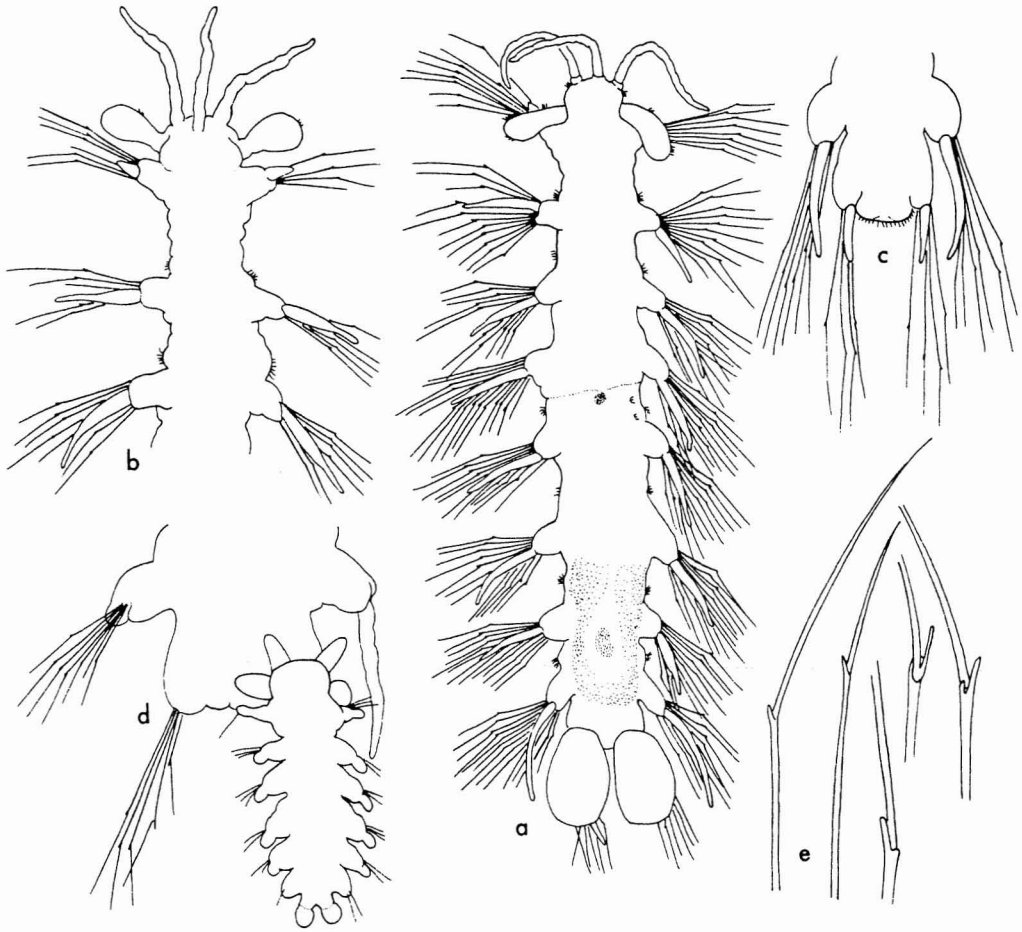

FIGURE 2. *Mesonerilla fagei:* preserved specimens. *a*, Dorsal view, entire specimen with attached embryos, ×40; *b*, anterior segments showing short cirri on setiger one, dorsal view, ×40; *c*, posterior end of nonbrooding specimen, ×40; *d*, attached six-setiger juvenile, ×40; *e*, setae, ×100.

tip of the shaft. Blades of some setae are conspicuously longer than others. Number of setae per parapodium varies along the body, with most in the posterior setigers. Setal counts for one specimen are as follows: setiger one with 18 setae, two with 11–13, three and four with 17, five with 14–18, six with 18–21, seven with 29, eight with 21, and nine with 12–14. Ciliary tufts are present on anterior and lateral margins of the palps, at the bases of antennae and parapodia, along the body, and on the pygidium (Figure 2*a*,*b*,*c*). One tuft of cilia could be seen between parapodia (Figure 2*a*,*b*).

HABITAT: Numerous specimens were found in coarse sand collected from a slope on 17 November 1997 at 3 to 5 m depths in Honolulu Harbor, south shore of O'ahu.

GEOGRAPHIC RANGE: *Mesonerilla fagei* is known from the English Channel and Irish Sea (Westheide 1990).

REMARKS: The Hawaiian material of *M. fagei* fits the description in Westheide (1990) except that the buccal setae point laterally in fixed specimens and anal cirri were not observed. Buccal pieces could not be distinguished. *Mesonerilla fagei* is hermaphroditic

and is sexually mature in temperate latitudes during the summer months (Westheide 1990).

Mesonerilla fagei resembles *M. intermedia* Fransen, which has a geographic range that includes the northwestern and northeastern Atlantic and Mediterranean Sea, except that *M. fagei* has short cirri on setiger one and longer cirri on setigers two to nine, whereas those of *M. intermedia* are the same length. *Mesonerilla intermedia* has a dorsal brood hood (Fransen 1983), but *M. fagei* does not produce one. *Mesonerilla fagei* resembles *M. ecuadoriensis* Schmidt & Westheide, 1977, which is known from the Galápagos Islands, except that these two species differ in the length of first setiger parapodial cirri. *Mesonerilla fagei* has short anal cirri; *M. ecuadoriensis* has long cirri.

DISCUSSION

Taxonomic work on the Nerillidae is challenging because of their small size, which is near the limits of light microscopy, and the fragile nature of these polychaetes. Important features that usually cannot be successfully resolved in preserved material include the ventral ciliary fields, but these are only occasionally mentioned in species diagnoses, and more importance is placed on larger structures.

Species identification may require determining the sex of the worm. Sex organs are in the last three or four segments, and in some genera both gonochoristic and hermaphroditic species are known. Methods of brooding embryos, attached to the terminal segment in *Mesonerilla fagei* and under a dorsal hood in *Mesonerilla intermedia,* are possibly adapatations to small body size and living in an interstitial habitat. Such methods of brood protection constrain brood size, result in low fecundity, and may be a response to an unstable habitat. Attachment of developing young to the parent indicates that considerable parental investment and retention of young within the parental population occur. *Nerilla antennata* is gonochoristic and males leave spermatophores attached to the substratum. Females lay eggs nearby and young develop under a mucus cover within a few days. Absence of a pelagic larval stage from the life cycle, direct development, and recruitment to the parent population indicate that other means of dispersal are required to ensure survival of a population at any location. Life cycle stages and longevity are known for a few temperate-latitude species (Westheide 1990), and Hawaiian nerillids may also be semicontinuous reproducers with a short life span lasting a few months.

ACKNOWLEDGMENTS

My thanks to Richard Brock and Austin Murai for assistance in the field and to Kimberly Hata for sketches of *M. fagei.* I am grateful to Susan Monden and Fabio Moretzsohn for preparing the final illustrations.

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