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Euphthiracaroidea of California Sequoia Litter: With a Reclassification of the Families and Genera of the World (Acarina: Oribatei)

Neil A. Walker
Fort Hays State University

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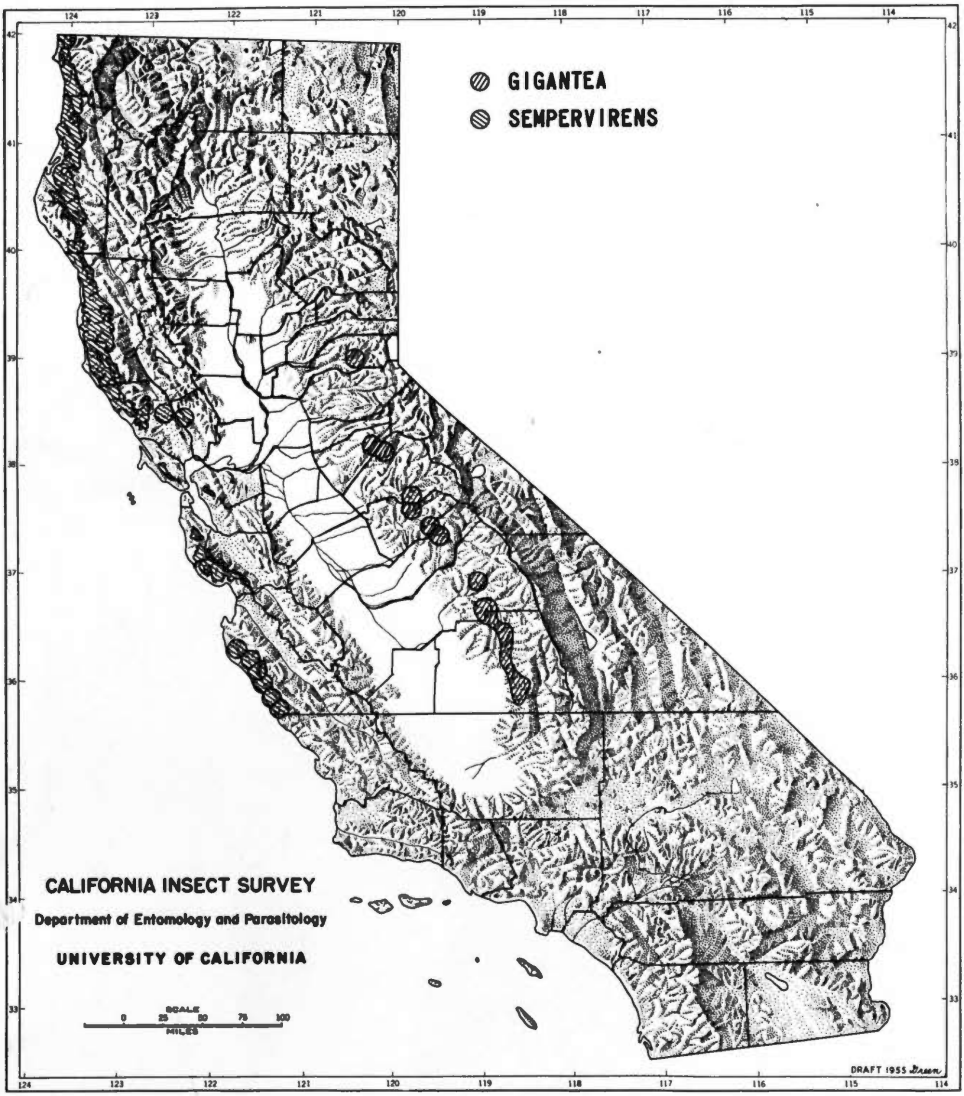

FRONTISPIECE. Distribution of *Sequoia sempervirens* and *S. gigantea* in California.

Walker, Neil A.

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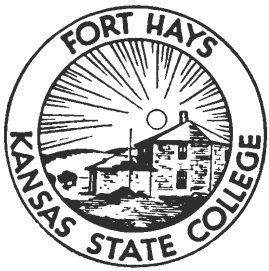

Fort Hays Kansas State College

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Neil Allan Walker

Biographical Sketch of the Author

Neil Allan Walker received the Bachelor of Science degree, in Biology, from Southern Methodist University in 1947, the Master of Arts, in Zoology, from the University of Michigan in 1948, and the degree of Doctor of Philosophy, in Entomology, from the University of California, Berkeley, in 1964. He joined the faculty of Fort Hays Kansas State College, in 1958, as an Assistant Professor of Zoology. He holds memberships in the Entomological Society of America, Society for Systematic Zoology, American Institute for Biological Sciences, Kansas Entomological Society, Kansas Academy of Science, and was a participant in the First International Conference on Acarology.

While studying general collections of mites, he became interested in the ptychoid mites because of their unique capability of folding and, in particular, the Euphthiracaroidea because of the unusual development of the ventral plates. It soon became apparent that almost nothing was known of these mites in Western North America. The present work represents a step toward filling this lacuna, and is a portion of a dissertation submitted in partial fulfillment of the requirements for the Ph. D. degree in Entomology, University of California, Berkeley.

Euphthiracaroidea of California Sequoia Litter:

With a Reclassification of the Families and Genera Of the World (Acarina: Oribatei)

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Introduction

The superfamily Euphthiracaroidea is included among those oribatid mites which are ptychoid, capable of folding rather armadillo-like so that the legs and mouth parts can be protected by a sclerotized plate or aspis. They are segregated from the other ptychoid oribatids by the possession of a series of elongate, contiguous plates on the venter surrounding and covering the genital and anal apertures. The relative extent and pattern of fusion of these ventral plates is the most apparent characteristic used in delimiting the families, and usually genera, included in the superfamily.

The specimens on which this study is based were collected in litter under both the coast redwood, *Sequoia sempervirens* (Lambert) Endlicher, and Sierra redwood, *S. gigantea* (Lindley) Decaisne. The two species of *Sequoia* are indigenous to western North America (Frontispiece). The coast redwood is native to the summer fog belt of the California and southern Oregon coast, and its range comprises the Redwood Transition Life Zone. The Sierra redwood is native to the west slope of the Sierra Nevada Mountains in California and is a component of the Sierra Transition Zone (Jepson, 1925). The common names used are those officially accepted by the California Divisions of Forestry, and Beaches and Parks (Calif., Rept. Legisl., 1952).

There are three small groves of the coast redwood in Oregon (Shirley, 1942). According to U. S. Forest Service personnel stationed in southern Oregon, these small groves had suffered from fire, storm, and logging damage and were inaccessible during the period that collections were being made.

The mites found under coast redwood live in a mixed habitat composed of many plant elements (Pl. 1) and generally are exposed to a rather high humidity and relatively mild temperatures (Jepson, 1925; U. S. D. A., 1941; Shirley, 1942; Bailey, 1949; Fritz, 1957). Mites found under Sierra redwood were collected from a less complex habitat composed primarily of litter and humus derived from this tree (Pls. 2, 3), in an environment characterized by considerable variations in humidity and temperature (U. S. D. A., 1941; Cook, 1942; Calif., Rept. Legisl., 1952).

The redwood regions were selected both to permit comparisons between the euphthiracaroid species of two regions divergent in ecological characteristics and to delimit clearly the areas sampled.

Litter is the habitat occupied by these mites, but I do not infer that any of the species discussed are restricted solely to the redwood litter from which they were extracted.

The results of this study are the taxonomic discrimination of the species of each redwood region. As a corollary to these studies and a re-evaluation of the characteristics evident within the group, new taxa are proposed including: one new family, Synichotritiidae; one new subfamily, Plesiotritinae, included within the previously recognized Oribotritiidae; two new genera, *Plesiotritia* and *Synichotritia;* and fourteen new species, one of which is considered to represent two new subspecies. Observations concerning the life history of one species are reported as an adjunct to the taxonomic study.

A reclassification of the families and genera of the world is proposed. The group of families Oribotritiidae, Euphthiracaridae and Synichotritiidae constitutes the new status of a superfamily, Euphthiracaroidea, co-ordinate with the Phthiracaroidea.

Although these mites have no obvious economic or medical importance, their feeding on decaying wood assists in the reduction of wood to humus. Thus as pointed out by Jacot (1939), they do play a role of importance to man and his environment.

The history of major contributions to the knowledge of the taxonomy of this group of mites begins with C. L. Koch (1836) describing the first of these species, *decumana,* in *Hoplophora* Koch, 1836, (*non Hoplophora* Perty, 1830). During the next half century only scattered miscellaneous works appeared, with that by Nicolet (1855) being the most important. Following this hiatus, Berlese contributed several short descriptions of taxa from 1883 to 1924. Michael (1884, 1888) discussed British species of this group and later (1898) presented a review of the species of the world. Unfortunately he followed Oudemans (1896) and reversed the nomenclatural generic concepts accepted prior and subsequent to that time. Oudemans (1900*a, b*) continued use of his mistaken concept for a short period, but later reversed his stand (1915-16). Meanwhile, Banks (1904) added one species from California, and Ewing described several species during the period from 1907 to 1918, including one species from Oregon (1913). Neither of the species described from California or Oregon was encountered in this study.

In 1923, Sellnick published the first review restricted to the euphthiracaroid mites and clarified many of the early descriptions. Sellnick has referred to these mites in several recent papers, notably in 1959. Jacot, from 1923 to 1939, dealt with this group of mites by describing species, defining higher categories, and reviewing

(1936) and redescribing species described by C. L. Koch. Vitzthum (1940-43) presented the most recent general compilation and classification for the Acarina. Since 1933, Grandjean has infrequently published species descriptions or redescriptions of these mites and, more importantly, has provided much information on characters not previously studied. He proposed (1954) a classification of the Oribatei, which has been the basis for practically all subsequent work in that group. In recent years this group has received more widespread attention as evidenced by the taxonomic publications of Aoki (1958*a*, *b*, 1959 *a*, *b*) in Japan, Fieder and Suciu (1957, 1958) in Romania and Märkel and Meyer (1959) in Germany.

Acknowledgements

I am indebted to Dr. D. P. Furman for guidance and to Drs. F. A. Pitelka and H. V. Daly, of the University of California, Berkeley, and to Dr. T. A. Woolley, of Colorado State University, for reading and criticising the manuscript. I appreciate the kindness of Dr. F. Grandjean in advising me concerning certain generic questions. To Dr. Max Sellnick is extended my gratitude for friendly assistance in regard to certain generic and specific problems, for supplying copies of his otherwise unavailable publications as well as identified European specimens, and his helpfulness and encouragement. It is a pleasure to acknowledge the collecting permits and assistance given me by personnel of the U. S. Park Service and of the California Division of Beaches and Parks.

For permitting me to remove mites from their collected material, I am indebted to: B. J. Adelson, D. J. Burdick, E. E. Gilbert, H. L. Hansen, J. R. Helfer, P. D. Hurd, Jr., W. R. Kellen, J. D. Lattin, C. D. MacNeill, J. W. MacSwain, G. A. Marsh, V. D. Roth, H. Ruckes, Jr., R. O. Schuster, R. Wagner and M. S. Wasbauer. The following generously loaned specimens for examination: Dr. G. W. Krantz, Oregon State University, Ewing collection; Dr. A. N. Tissot, Florida Agricultural Experiment Station, Jacot (Grossman) collection; Dr. E. H. Bryan, Jr. and Miss A. Suehiro, Bernice P. Bishop Museum, Jacot collection; Dr. E. W. Baker, U. S. National Museum; Dr. H. W. Levi, Museum of Comparative Zoology, Harvard University. Drs. Baker and Woolley assisted me by responding to questions in correspondence and by granting me permission to study unpublished drawings of several Ewing type specimens. Dr. L. J. Stannard, Illinois Natural History Survey, assisted in my search for Ewing's type specimens.

Dr. E. A. Steinhaus, University of California, Berkeley, examined specimens of *Oribotritia sellnicki* sp. n. for symbiotic bacteria, and Dr. M. W. Allen, University of California, Davis, identified a nematode found in association with several species of these mites. Mrs. Celeste Green gave me assistance with drawing problems, and Mrs. Patricia Andersen inked many of the drawings. Mrs. Harold Stones typed the manuscript. Dr. P. D. Hurd, Jr., of the California Insect Survey, provided the maps on which distribution data are summarized. Fort Hays Kansas State College and Dr. G. W. Tomanek, Chairman, Division of Biological Sciences, assisted by providing excellent equipment with which much of the study was done. To all of these, my sincere appreciation is due.

Finally, far from smallest is my debt of gratitude to my wife, Margaret, without whom this work could never have been completed.

Methods

The term "collection," as used in this work, refers to the litter material taken, while "sample" refers to the mites extracted from the litter. Material collected included all types of plant material on the ground to the soil line. No attempt was made to segregate the various layers of litter. Definite collection data are stated in the species distributions only when the sole, or major, source of the collection was from decayed logs, stumps, or large limbs. All other collections for which no definite data are given were of litter, with the possible inclusion of a minor amount of larger woody material.

Collections taken prior to April, 1956, by the author and those by other collectors, were taken in a small area selected as being representative of the grove being sampled. After that date and where the area was sufficiently extensive, collections were made by taking small sub-collections at random over a wide area of each grove.

Of the land area classified as coast redwood forest in 1953, the public owned about 15% in the form of national forests and national, state, county, and municipal parks (U. S. D. A., Forest Survey Release, Nos. 19, 25; Drury, 1957). Of the area included in the 72 identified groves of *Sequoia gigantea,* the public owns 88% in the form of national forests and national, state, and county parks (Calif., Rept. Legisl., 1952). The publicly owned redwood areas are frequently more accessible, and many of the coastal and all of the sierran collections were obtained from these areas.

Two hundred and nine redwood collections were taken; 160

appear in the species distribution records. Of the unrecorded collections, some were taken for life history studies, but the majority did not include euphthiracaroid mites when the samples were examined, although they did include phthiracaroid mites. There were also a few collections which yielded no ptyctimous mites. Euphthiracaroids were absent in collections taken from areas that were extremely dry, that had been water pockets, or had burned-over quite recently.

Sierran collections taken during the summer frequently lacked euphthiracaroids, although collections from the same areas in the winter or spring had produced positive results. Those summer collections which were positive were taken from the protected north and east sides of the trees, or in areas made moist by a nearby stream.

Methods of collecting differed between the coastal and montane (Sierra) areas. In the coastal area *Sequoia sempervirens* is occasionally found in pure stands with little understory. Under these circumstances collections could be taken anywhere on the forest floor. Where there was an understory of other plants (Pl. 1), collections were taken directly beneath the redwood trees. These collections necessarily included litter elements other than redwood, but this was considered as a part of the normal range of variation in the coast redwood areas. In the montane region, however, *Sequoia gigantea* is most frequently found in an open park-like spacing (Pl. 2) with an admixture of other trees being common. There the redwood litter is not a thick carpet, but is found as a mound immediately surrounding the base of each tree (Pl. 3). Collecting was restricted to this mound.

PLATE 1. Habitat views under coast redwood: upper, showing rather dense stand of redwood, both young and mature trees, Charles Newbold Black Grove, The Avenue of the Giants, Humboldt Redwoods State Park, Humboldt County, California; lower, showing more open stand of mature redwood with many shrubs and other undercover plants, Newhouse Grove, Prairie Creek Redwoods State Park, Humboldt County, California.

PLATE 2. Habitat view under Sierra redwood, showing a stand of mature and young trees, closely grouped. The Senate Group, Giant Forest, Sequoia National Park, Tulare County, California. Photograph by courtesy of the National Park Service.

PLATE 3. Habitat view under Sierra redwood, showing the mounds of litter found around the base of the trees. The House Group, Giant Forest, Sequoia National Park, Tulare County, California. Photograph by courtesy of the National Park Service.

The individual collections varied in size, from three or four double handfuls to six or more bushels of litter, depending upon the primary interest of the collector and the material available. Collections taken by the author averaged one and one-half cubic feet.

Modified versions of the funnel described by Tullgren (1918), frequently miscalled "Berlese funnel," were used in extracting the mites from the litter. The plan of a satisfactory funnel is shown in Plate 4. The usual source of heat and light used in my study was a 250 watt infrared heat lamp, with its apex approximately one foot above the litter. If the material appeared extremely dry and flammable, a 200 watt light bulb was substituted. Drying the normally moist collection with the heat lamp took from two to two and one-half days, while a similar collection under the light bulb required four days or more. A grid, similar to that described by Newell (1955), was installed to prevent debris from entering the jar.

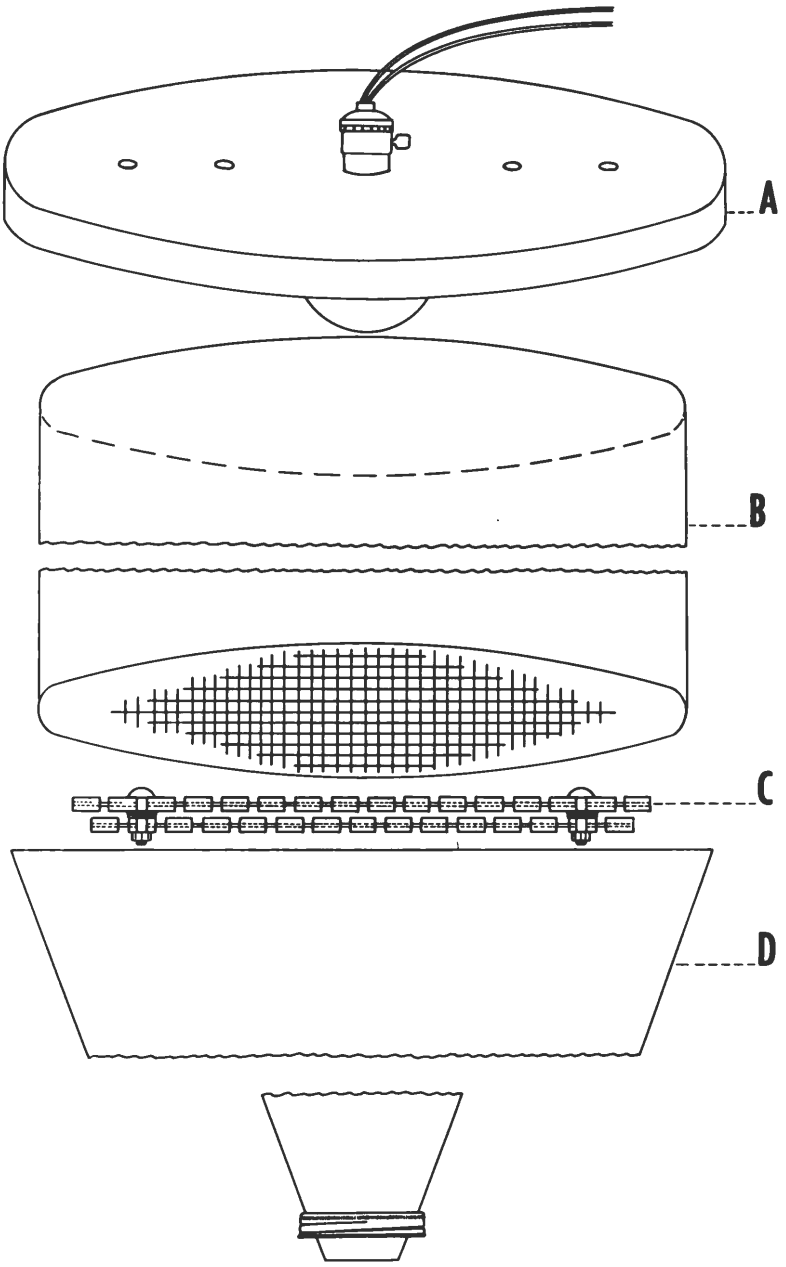

PLATE 4. Diagram of modified Tullgren funnel, used in separating mites from litter. A. Top, 22 inches in diameter, with 1 inch deep rim, electric socket and heat lamp, and 4 vent holes. B. Barrel, 20 inches in diameter and 24 inches high, with ¼ inch hardware cloth bottom soldered in place on narrow in-turned lip. C. Grid of overlapping wooden strips, cut to fit snugly in funnel below barrel, supported on welding rod and connected by bolts with washers as spacers. D. Funnel, 24 inches in diameter at top and 2 inches in diameter at bottom, with mason jar lid ring soldered near bottom opening.

Sample collecting jars were standard one pint mason jars with about one inch of 50% ethyl alcohol added at the beginning of the extraction. The low concentration of alcohol is sufficient to kill the mites without causing immediate fixation. Many specimens became somewhat dilated, which forced the aspis, legs and ventral plates into satisfactory positions for study. Specimens initially placed in higher concentrations of alcohol were less satisfactory study specimens because they were not dilated.

Samples were sorted in 2x9.5 cm petri dishes under a binocular dissecting microscope at a magnification of 10 diameters, or higher as necessary. All transfers of mites were made by use of vari-sized eyedroppers, thus minimizing breakage and loss of setae while handling large numbers of specimens rapidly.

Immature specimens were cleared and studied in permanent mounts by transferring them directly from alcohol into modified Hoyer's solution (Baker and Wharton, 1952, p. 10). For adults, Professor E. O. Essig (personal communication) suggested the clearing solution used, composed of one part 85-90% lactic acid, one part glacial acetic acid, and two parts water. The mites were placed in Stender dishes containing this solution and heated in an oven at 55-65° C until clear, usually one to three days.

Temporary slide mounts were prepared by placing a cleared mite in the well of a depression slide filled with clearing solution and covered with a 22 mm square cover slip. These mounts permitted changes in orientation of the specimen, by sliding the cover slip, so that all aspects could be studied with a compound microscope. The clearing solution is not sufficiently viscid to hold the mite in position and permit use of the oil immersion lens. This technique is similar to the semi-open preparations suggested by Grandjean (1949*a*) but I agree with Evans, Sheals and Macfarlane (1961:80) that closed well slide preparations are more satisfactory.

Permanent slide mounts of the adults were prepared by placing the mite in clove oil for dehydration and mounting it in Euparol on a double cover slip metal slide, of a type first suggested for nematological studies by Courtney (1936). Number one cover slips were used, permitting use of the oil immersion lens on either side.

The plan of study for all species included examination of all aspects and characters visible in a temporary mount. Then the specimen was dissected under a dissecting microscope, with permanent mounts being made of the component parts both for confirmation of the whole mount study and examination of the parts that

could not be studied satisfactorily in a whole mount. Individual dissections of several cleared specimens of each species were made in a well slide. The pattern of dissection was to separate: the notogaster from the aspis, which retained the mouthparts and legs; the aspis from the legs and mouthparts; the legs from the mouthparts, with the chelicerae being separated from the other mouthparts; the ventral plates from the notogaster; and the genitalia from either the notogaster or the ventral plates.

Drawings and measurements were made with an ocular grid, calibrated with a stage micrometer. Solenidial formulae were confirmed by use of polarized light. Occasional use was made of phase-contrast microscopy to confirm points under question, but by its very nature the technique could be used only in studies of the thinner dissected parts.

Following definition of the species, routine identifications were made under the dissecting microscope of uncleared specimens in alcohol, altough occasional specimens were cleared and examined as temporary whole mounts to insure accuracy of identifications.

Sex determinations required clearing of the specimens, after which they were examined under the dissecting microscope in the clearing solution.

A storage fluid, consisting of 100 parts each of glycerine and water with 3 parts of glacial acetic acid, suggested by Dr. Sellnick (personal communication), was used for the permanent storage of unmounted specimens.

Holotype specimens were dissected and the component plates and appendages mounted, while allotypes were lateral mounts of the entire mites. Holotypes and allotypes are deposited in the United States National Museum, and the individual type numbers assigned are given in the type data for each species. Paratypes are deposited, if numbers of specimens permitted, as follows: one dissected and one wholemount female plus one dissected male, U. S. N. M.; one dissected female and one wholemount male in collections of the California Insect Survey, University of California, Berkeley; University of Kansas; Museum of Comparative Zoology, Harvard University; Canadian National Collection; British Museum (Natural History); National Museum of Natural History, Paris; and the remaining specimens in my collection.

Techniques followed and equipment used in rearing experiments are discussed below.

Morphology

Descriptions of ptyctimous mites commonly have appeared without benefit of definitions for either the terms used or the characters described. Notable exceptions to this statement include publications of Michael (1884, 1888), Grandjean (1954) and Jacot (1930, 1933, 1938). Jacot varies in his application of names or symbols on a pragmatic basis, whereas Grandjean's usages vary as his understanding of the various patterns developed. The system of definitions and names or symbols used here follows, almost exactly, that of Grandjean but differs somewhat from that followed by Evans et al. (1961) because certain elements of their terminology apparently were chosen for historical reasons, e. g., pseudostigmatic organ, ambulacrum. Deviations from Grandjean's system were made in order that the presentation may follow a system as simple, uniform and broadly applicable to this group as possible. The changes are primarily: substitution of Latin for Greek letters; substitution of English terms for certain French terms; and rearrangement of ventral setal numbers so that all run from anterior posteriad, although this should not be considered a rejection of Grandjean's (1939, 1950) interpretation of the origin of these setae.

Generalities

In the present work all measurements are expressed in microns with the micron symbol omitted; use of the singular implies the plural where paired structures are concerned; lower case italicized letters refer to setae and fissures borne on particular plates or regions; legs and mouth parts are omitted from lateral, ventral and dorsal drawings as is customary in this group; specific measurements given within the descriptions refer to the specimen drawn. Publications, primarily by Grandjean, are cited in association with the discussions of various morphological characters and were selected for their importance in understanding this group of mites.

The idiosoma of euphthiracaroid mites is covered by a rigid exoskeleton divided into two major shields, or plates, the aspis, or prodorsum (Evans et al., 1961:13), and the notogaster (Pl. 7, figs. A, C, D:*l, p*). The aspis covers the gnathosoma and prodoposoma and is capable of being folded against the notogaster. The latter covers the dorsal and lateral areas of the hysterosoma. Although the composition of the notogaster differs among the various superfamilies of the ptychoid mites, here it includes elements of the ventral region

as evidenced by the position of the pseudo-anal setae (Pl. 7, fig. C:*v*). The ventral surface of the opisthosoma is covered by a series of elongate, contiguous shields or plates, showing various degrees of fusion. These include (Pl. 8, figs. B, D:*a,c,f,i,n*) the lateral plicature plates, the posterior adanal and anterior aggenital plates and the mesal posterior anal and anterior genital plates. Of these, only the plicature plates remain completely separate in all members of this superfamily.

Numerous setae are found on the aspis, notogaster and appendages. *True setae* (Grandjean, 1935*a*) are those with a solid axis surrounded by an external layer, both sclerotized, and frequently ornamented with cilia, spicules, or barbs. The specialized or modified setae include the sensilli, eupathidia, famuli, claws, rutella, both fixed and movable cheliceral extremities, and, possibly, the solenidia. The sensilli, claws, rutella and chelicerae are discussed later.

Eupathidia (Pl. 9, fig. A:*g*; Pl. 10, fig. A:*e*) (Grandjean, 1943, replacing his term "acanthoides," 1935*a*) are hollow with a canal extending nearly to their base. They are spine-like, smooth and often pointed, but never acuminate. These are found on legs I and II and the palpi, without sexual differences in placement. Their function is presumed to be that of taste (Grandjean, 1961*a*).

The *famulus* (Pl. 10, fig. A:*b*) (Grandjean, 1935*a*, 1941*b*) is a short, hollow structure, usually straight but occasionally branched (*Oribotritia brachythrix*) and commonly externally rugose, that is continued into the leg cavity by a chitinized tube and found on the dorsal surface of leg I only. Its function is uncertain, but probably not associated with direct contact (Grandjean, 1961*a*).

Solenidia (Pl. 9, fig. A:*f*; Pl. 10, fig. A:*a*) are thin walled, hollow, internally striated, piliform, chitinous tubes, open all the way into the leg cavity. The insertion of a solenidion is larger in relative diameter than any other insertion. A single solenidion is found on the palpal tarsus and one or more are found on certain of the genua, tibiae and tarsi of the legs. For the legs, a solenidial formula is given, with the numbers representing the numbers found on these leg segments, and for legs I to IV in order. Thus, the solenidial formula for leg I is (2-1-3), leg II is (1-1-2), leg III is (1-1-0) and leg IV is (1-1-0), except in *Rhysotritia* and *Synichotritia,* where the solenidial formula is (2-1-3) (1-1-2) (1-1-0) (0-1-0). The function of the solenidia is presumed to be associated with detection of odors (Grandjean, 1961*a*). All the true setae and modified setae are birefringent under polarized light due to the presence of actino-

chitin, but solenidia lack actinochitin and are optically isotropic (Grandjean, 1935*a*, *b*).

In color these mites vary from off white to a very dark mahogany brown. The surface of the exoskeleton varies from practically smooth and shiny to rugose, pitted or deeply sculptured. Notogastral and aspal setae may be long to short, simple to almost plumose, bluntly ended to acuminate.

Measurements were taken of length, height and width of both aspis and notogaster in a standardized fashion shown on Plate 7. The size range measurements given in the descriptions are those of the individuals with the greatest, or least, notogastral length and are not ranges for each measurement. Males are often somewhat smaller than females.

Determinations of sex were made using cleared specimens by noting, for females, the presence of eggs (Pl. 15, fig. A), or of the ovipositor (Pl. 7, fig. C:*bb*), located at a 45° angle to and often nearly touching the anterior margin of the genital plates. Males were identified by noting the presence of the testes and *vesicula seminalis* (Michael, 1884) (Pl. 7, figs. D, E:*ii*,*jj*), appearing as a white, almost flocculent but delimited, body composed of two lateral lobes connected by a narrower median section and located in the central ventral portion of the notogaster. No external sexual dimorphism was noted within the species studied, although it did appear that slight variations in the numbers and placement of ventral plate setae occur somewhat more commonly in males than in females.

No unisexual species were studied although such species have been reported from Europe (Grandjean, 1941*a*). When equivalent spring and fall samples were available, males and females appeared in approximately equal numbers.

Aspis

The *aspis* covers the gnathosoma when extended and when retracted covers the anterior area of the notogaster. Specimens were found with the aspis in all stages of retraction, but the descriptions have been written assuming that the aspis was fully extended.

The *aspal rims* (Pl. 7, fig. A:*e*) are areas of the margin delimited by being more deeply, heavily colored that the rest of the aspis and may occur on various portions of the aspal margin. The *ribs* are internal structures resulting from an abrupt thickening of the exoskeleton and thus appear delimited as darker areas. The *median rib* (Pl. 27, fig. C:*c*) extends directly anteriad from and as a continuation of the inner margin of the posterior rim on the median

line of the aspis; while the *central rib* (Pl. 27, fig. A:*a*) extends from about midway along the lateral rim toward the median line of the aspis. The central rib is clearly delimited only in *Euphthiracarus* although it is also detectable in *Rhysotritia.*

Carinae are sharp emarginate thickenings of the exoskeleton, running parallel with the long axis of the aspis. No median carina was present in these species. The *lateral carina* may be present, on each side of the aspis, as a single strong carina, or as two lateral carinae, the more dorso-mesal one always stronger, the ventro-lateral one weaker (Pl. 8, fig. A).

Rostral setae are the anterior pair of setae located on the dorsum of the aspis (Pl. 7, fig. A:*h*). They normally are simple, unmodified setae frequently emerging in a distad direction from the aspal surface and recurving toward it. Their insertions are usually separated by not more than their combined setal lengths.

Lateral setae are usually the intermediate pair of setae on the aspis (Pl. 7, fig. A:*g*); occasionally they may be found in a more latero-posterior position, in a transverse line between the sensilli and verticals (Pl. 8). They are frequently somewhat specialized, bearing barbs or spicules of varying lengths. Normally, they originate so that the distances between the pair and from each to the lateral margin are equal.

Vertical setae are the posterior, or medio-posterior, pair of setae on the dorsal aspal surface (Pl. 7, fig. A:*f*), generally in a transverse line with the sensilli. They are frequently the longest of the three pairs of dorsal aspal setae and often are spiculate, barbed, or almost plumose. Since they commonly are situated rather near the bothridia, the distance between them is usually at least twice the distance to the lateral aspal margin.

Exobothridial setae (Pl. 7, fig. B:*i, j*) are located on the lateral surface of the aspis. According to Grandjean (1934*a*), there are normally two pairs of exobothridial setae; the disappearance of one pair is a specialization. Both patterns are present in this group. The anterior pair of exobothridial setae are usually located slightly anteriad to the bothridium and below it, just above the lateral rim, on or near the beginning of the postero-lateral apodemes of the aspis. The posterior exobothridial setae, when present, are located directly posteriad from the anterior pair, usually on the rather thin central portion of the postero-lateral apodemes of the aspis.

Bothridia (= pseudostigmata) (Pl. 7, figs. A, B:*d*) (Grandjean, 1936) are the highly modified setal insertions of the sensilli. They

are deeply invaginated and the external margin of this pit may protrude slightly beyond the normal lateral wall of the aspis forming an "emarginate" atrium. Bothridia are located on the lateral walls of the aspis, usually about one-third its length anteriad from the posterior margin and midway dorso-ventrad. Associated with the bothridia are lightly sclerotized, mesad directed, narrow, elongate lobes; these have been considered to be tracheae (Evans et al., 1961:55; Grandjean, 1933*d*, 1934*b*).

The *scale* (= lid, Jacot, 1930) (Pl. 7, figs. A, B:*c*) is a small flap or emargination of the lateral aspal wall associated with, but often separated from, the bothridial margin. It may be located below, behind or above the bothridium. Its function is unknown; if protective, its variability in position is difficult to interpret.

The *sensilli* (= pseudostigmatic organs) (Pl. 7, figs. A, B:*b*) (Grandjean, 1936) are a pair of specialized sensory setae whose insertions are in the bases of the bothridia. Sensilli vary considerably in size, shape and apparent complexity. Hughes (1959:122) does not ascribe a definite function to these structures but presumes that they detect stimuli not present in water, since they are reduced or absent in aquatic forms. Evans et al. (1961:17) state that these have a tactile function, but Tarman (1959) is quoted by Grandjean (1961*a*:220) as considering sensilli to have both a vibration and wind receptor function. Grandjean (1961*a*:219) considers the primary function of the sensilli and bothridia to be sound reception, with the bothridia acting as resonators and the sensilli, with associated basal sensory cells, as the receptors. Trichobothrium (Grandjean, 1936:37) is the term used for the combined bothridium and sensillus.

Notogaster

The notogaster (Pl. 7, figs. C, E), or perhaps more properly the notogastral shield or plate of the exoskeleton, in dorsal aspect is commonly an elongate ovoid structure, slightly more acutely rounded posteriorly than anteriorly; while in lateral aspect it is gently arcuate to rather flattened on the dorsal surface, with the ventral margin rather sharply curved posteriad and reflexly curved anteriad; thus sub-globose. Of the notogaster, only the anterior margin or rim is often materially modified in the different species and is the only region for which areas have been delimited and named. Structures associated with the notogaster have also been named.

The *collar* (Pl. 7, fig. E:*mm*) (Jacot, 1930) is the dorsal and slightly lateral portion of the anterior notogastral rim. It extends latero-ventrad to the sensillar notch. It is usually about as broad, antero-posteriorly, as the rest of the anterior rim (moderate) but may be somewhat broader (pronounced), or narrower (reduced).

The *sensillar notch* (= pseudostigmatic notch, Jacot, 1930) (Pl. 7, fig. E:*nn*) is a posteriad invagination of the dorso-lateral region of the anterior rim. It may be so developed as to be partially covered by its anterior margin sweeping down over much of it or may be completely open and appear to be a rather abrupt invagination of the rim. It may also vary in the depth of invagination (deep or shallow) and in its dorso-ventral length (short or long). Its function appears to provide clearance for the sensillus and the atrium and scale, when the aspis is folded against the anterior margin of the notogaster. Study is difficult when the aspis is closed because the other structures in the path of light, legs, claws and mouth parts, absorb and deflect light.

The *lapet* (Pl. 7, fig. E:*oo*) (Jacot, 1930) is the ventral continuation of the lateral portion of the notogastral rim from the sensillar notch to the junction with the ventral plates. This region may be nearly straight or pronouncedly curved, may be very distinct (prominent) or relatively inconspicuous (reduced).

Sculpturing of the notogaster may take many forms, from apparently absent to deeply pitted. Märkel and Meyer (1959) show that even species formerly considered to lack sculpturing do have a very minute pattern. Statements about sculpturing should be accompanied by specification of the magnification used and the method of preparation.

The pattern of notogastral setation (Pl. 7, fig. C:*q-v*) remains relatively constant, considering the changes in the gross shape of the notogaster and number of setae, with *c*:1 the dorso-mesal seta and *c*:3 the ventro-lateral seta of the anterior row. The denomination of the other rows follows a similar pattern. The setae that seem to migrate most commonly from their usual site of insertion are *c*:3 and *d*:3. The species studied possess 14, or rarely 15, pairs of setae, hence are bideficient or unideficient according to Grandjean (1949*b*:213). The setal pair added, to result in 15 pairs, is commonly *ps*:4. Most species also have a vestigal pair of setae (*f*:1) although they may be lacking completely. The setae vary considerably between species from being very fine, short, smooth

and hair-like to strong, stout, barbed or spiculate, almost plumose structures. The notogastral setae are similar within a species, varying only slightly in relative size.

The *lateral gland* (= *glande latero-abdominale*, GLA, of Grandjean, 1933*a*; oil gland of Evans et al., 1961) (Pl. 7, fig. C:*w*) in these species was found to be either present or absent. Where present, it was obvious and often formed of a complex of openings, which apparently have not previously been described. The major opening is irregularly oblong, with two, or sometimes three, smaller accessory pores, one just anterior to the major opening, another just ventral to the major opening. The third pore, when present, is usually located ventro-anteriad from the major pore. The function of this organ may be glandular because an internal sac-like structure can be seen in rare instances leading to the pores.

Fissures (Pl. 7, fig. C:*x-aa;* Pl. 8, fig. D:*l*) are almost always clearly evident as small, round to elongate pits in the exoskeleton. Their position seems to be as constant as that of the setae, and they seem to migrate in association with the setae. Grandjean (1933*a*, *d*, 1950, 1961*a*) considers that the fissures are possibly associated with a rudimentary or vestigial respiratory system. Hughes (1959) points out that there are no sensory or glandular structures in the regions where the fissures occur in the Gamasina and, thus, considers the fissures to represent sites for muscle attachment. In dissecting more than 300 euphthiracaroid mites, I noted that the hysterosoma appears to have widespread muscle attachments rather than attachments restricted to the positions of the fissures. I am unable to accept Hughes' theory.

Ventral Plates

The *ventral plates* (Pl. 8, figs. A, B, D:*a,c,f,i,n*) in lateral view usually appear keel-like, since the plicature plates fold inward, dorso-mesad, from the latero-ventral margins of the notogaster and the aggenital, genital, anal, adanal complex of plates returns outward, ventro-mesad, forming an M-shape in cross-section, with the notogaster a ∩-shape joining with the bottom outside lines of the "M." The aggenital and adanal plates are always fused to some degree, frequently completely so. Fusion of these with the genitals and anals varies among the families and genera, resulting eventually in a single pair of plates where all these elements are fused one with the other on either side of the median line.

The *plicature plates* lack useful taxonomic characteristics, rarely showing some faint internal transverse variations of thickness, but

are always discrete and present in this superfamily. These non-setate plates are underlain by a weakly sclerotized membrane connecting the aggenito-adanal plate to the ventral margin of the notogaster.

The *genital plate,* or portion of a fused plate, may be either plain, with an inwardly projecting tip, or bear an external, ventrally emarginate, *anterior bar* (Pl. 8, fig. D) across the long axis of the plate and an internal rib at a slight angle to the bar, forming an apparent anterior triangle. The *genital setae* are considered to be the mesal row of setae, usually with insertions opening on or very near the mesal margin. They commonly are rather short, fine and simple, ranging in number from five to the more usual nine. Where the genital plate is separated from the aggenital, there is only a single row of setae on each plate.

The anterior surface of the *aggenital plate* region has a simple emarginate, rounded, transverse bar across it, unless it is fused with the genital plate when the anterior bar and rib will be evident across it also. It normally bears three setae, although varying from one to five in different species. The *aggenital setae* may be simple and similar to the genitals or perhaps more commonly will be somewhat spiculate or barbed. These are identified in the fused plate condition as being the lateral row of setae. There is an invagination of the external lateral surface of the aggenital portion of the ventral plate (*lateral pocket*) present and varying in shape and depth among several species of *Euphthiracarus* (Pl. 35, fig. B).

The *adanal plate* region of the ventral plates may be separated from the anal or completely fused, with the intermediate stages found in the species studied. It always bears three true *adanal setae* although some species descriptions indicate four, because one of the anals is morphologically indistinguishable from the adanals. The adanals include the setae of this area with insertions opening at some distance from the mesal margin, and which are distinguishable from the anals but are similar among themselves. Compared with the anals, they are usually shorter, stouter and often are either barbed or spiculate. Where four adanals are indicated, the anterior one (*ad*:1) is considered to be derived from the anal plate and to represent *a*:1 of the species with three anal setae and three adanal setae. This pattern of naming adanal setae has been followed for many years and by many authors. The *adanal fissure* is commonly present, anteriad to the first true adanal setae.

The *anal plate* may be present as a discrete entity or fused, in varying degrees, with the adanal. *Anal setae* are normally three in number but may be lacking as in *Oribotritia brachythrix.* They are often long, slender, whip-like, simple and with insertions opening on or very near the mesal margin. Between the anal and genital plates there is an internal connecting mechanism, commonly a simple internal apodeme which may be modified into a complicated system of interdigitating lobes as in the Euphthiracaridae. The latter system of lobes is referred to in the descriptions as an interlocking or *median triangle* since the lobes occur on the median line in a triangular pattern with the base anteriad and the apex posteriad (Pl. 27, figs. A, B:*b*). The anal plate fissure is absent in these mites (Grandjean, 1933*b*).

Genitalia

The *ovipositor* is divided transversely, with a proximal membranous portion into which the striate, slightly sclerotized distal portion may retract. The tip of the distal portion is separated into three setose lobes, each of which may have a rather strongly sclerotized plate surrounding the setal insertions (Pl. 9, figs. C, D). The unpaired but bilaterally symmetrical *ventral lobe* usually begins and ends slightly more proximad than do the paired *dorsal lobes.* The setae are named, beginning with the distad one proximad, for each kind of lobe. Toward the distal end of each dorsal lobe are found two setae (*od*:1,2); two other setae (*od*:3,4) may be found in varying degrees of reduction in size. The two pairs of ventral lobe setae are also distad, *ov*:1 usually being the strongest of the ovipositor setae and *ov*:2, directly proximad from *ov*:1, somewhat stronger than *od*:2. At the base of the distal portion of the ovipositor, but often inserted on the proximal membranous portion, may be found the three pairs of *coronal setae.* The coronal setae may be present or absent and, rarely, *od*:4 may be located so far proximad as to appear to be in the row of coronal setae. Grandjean (1956*a*) has published a general description of the ovipositor, defining and naming parts and giving the major modifications of the organ in the Oribatei. Table 1 shows the corresponding terms used for the ovi-

TABLE 1. Corresponding terms for ovipositor setae used by Grandjean (1956*a*) and the writer.

Grandjean (1956*a*)	$\tau 1$	$\tau 2$	$\tau 3$	$\tau 4$	$\psi 1$	$\psi 2$
Present usage	od:1	od:2	od:3	od:4	ov:1	ov:2

positor lobe setae by Grandjean (1956*a*) and the writer. The ovipositor has been figured and noted as a taxonomic character (Feider and Suciu, 1957), but it apparently has not been used before in drawing conclusions concerning relationships within this group.

The terminal portion of the *male genitalia* of these mites is very slightly sclerotized, setose and trilobate in structure (Pl. 9, fig. E.). The maximum number of setae observed on the lobes was 16. There is a trend toward reduction in number concurrent with the reduction in number of ovipositor setae in the female but the reductions in number are not identical. No setae clearly comparable in position to the coronal setae of the ovipositor were noted. The male genitalia of this group are discussed here for the first time. They are similar to those shown by Feider and Suciu (1957, figs. 44, 137) for two phthiracaroid mites but differ markedly from the male genitalia drawn by Michael (1884, Pl. F) for several species in other groups of oribatids.

Both sexes bear three pairs of genital sense organs (= suckers).

Gnathosoma

The gnathosoma of oribatid mites is the subject of an excellent series of papers by Grandjean (1947*a*, *b*, 1957) and is well described in summary by Evans et al. (1961). Hughes (1959) also discusses the gnathosoma. The infracapitulum, or ventral surface of the gnathosoma, of these mites is of the stenarthric type (Grandjean, 1957:262).

The *chelicerae* (Pl. 9, fig. B:*n-r*) are normal for oribatids, with chelate fixed and movable digits each bearing four cusps. The fixed digit has a series of tiny spiculations on the dorso-lateral surfaces as well as two setae. The posterior seta on the paraxial side (*cha*, Grandjean, 1947*a*) is usually shorter, slighter and smooth while the anterior seta (*chb*) is on the antiaxial side and is commonly longer, stouter and frequently spiculate. The species illustrated is atypical.

The *infracapitulum* (Pl. 9, fig. A:*a-m*) has been separated into a number of named parts (Grandjean, 1957). The paired *lateral lips* normally bear three *adoral setae* each. The *rutella* are dentate and heavily sclerotized. The *genae* bear two pair of long, whip-like, simple setae while the undivided *menton* bears a single pair of similar setae. The pedipalps, or *palpi*, vary in segmentation from five to three. When the palp is five segmented, the trochanter is nude, femur with three or two setae, genu nude, tibia with

three or two setae and the tarsus with nine or eight setae plus the one solenidion always present. When the palpal segments have undergone fusion resulting in three apparent segments, the basal segment is considered to be the result of fusion into a trochantero-femoro-genu which bears two setae, the tibia with two or one, and the tarsus with eight (but see *Rhysotritia* discussion of European species). If the palp consists of four segments including the trochanter, as in *Synichotritia spinulosa* (and *Eulohmannia*, Grandjean, 1933*a*) the trochanter is nude, femoro-genu and tibia each with two setae and tarsus with eight. The tarsal setae include four or fewer distal eupathidia (Grandjean, 1935*a*, 1940*a*, 1943, 1946), which may be either discrete or apparently somewhat fused basally, as well as a disti-medial seta, frequently the finest seta on the segment.

Legs

The leg setation (Pl. 10) of these mites differ in position only very slightly from one species to another. The solenidial pattern of the genu, tibia and tarsus may vary between major taxa. The shape and appearance of the famulus, on the tarsus of leg I, may differ among species but its placement hardly varies within a major taxon (Grandjean, 1941*b*). In *Euphthiracarus*, the postero-mesad coxal seta on leg IV was noted to have a basic machete-like shape (Pl. 27, fig. D), but to vary somewhat in shape among species. The number of claws per leg has been erroneously used, in the past, as a character of major significance. In the euphthiracaroids the usual number of claws is three per leg, two rather slender lateral claws and one stout median claw, but species are found with only a single stout, median claw per leg. The single claw condition may be correlated with over-all size because only the small species show the condition in this fauna.

Ova

The euphthiracaroids are oviparous and the eggs usually have two phases, the primovum and deutovum (Claparède, 1868; Grandjean, 1938, 1940*b*, 1962). The *primova* (Pl. 17) are generally non-sclerotized, rather ovoid, usually readily cleared by lactic acid, and are normally retained within the female while the embryo undergoes its early development into an early larval stage, the *pre-larva.* Then, commonly, the second egg shell is formed resulting in the *deutovum*, sclerotized, stiff, reticulate, commonly with numerous spine-like protuberances on the apices (Pls. 11, 12). The deutovum

is then laid and hatches, following further development and simultaneous molting of the pre-larva, as the larva. No deutova, as here defined, were seen within specimens of *Euphthiracarus* collected for taxonomic purposes, but eggs were laid that resembled this description during an early, unsuccessful and otherwise unreported, rearing attempt. It should be noted that not all euphthiracaroid species develop an obvious deutoval shell, as it is described above. The pre-larva of *Oribotritia gibbera* is surrounded by a clear, thin, non-sclerotized, non-sculptured shell (Pl. 18). It is possible that those species, described below, with the comment "deutova not seen" may have a developmental pattern similar to that of *O. gibbera*. The term pre-larva, as used here for the individual contained within the egg shell, does not correspond with Grandjean's usage (1962); his usage equals deutovum as used here.

The major features of larval and nymphal morphology are given in the description of *Plesiotritia megale*, following the pattern established by Grandjean (1933*a*, *b*, 1934*a*, 1941*c*, 1942, 1949*b*, 1961*b*).

EVALUATION OF TAXONOMIC CHARACTERS

The basic taxonomic character used in defining the superfamily Euphthiracaroidea is the presence of the discrete plicature plates, as an indication of the elongate ventral region with its contiguous plates. The major characters (see Table 2) used in defining the limits of the families and genera are: the relative degree of fusion exhibited in the ventral plates, including both the number united and the extent of their union; and the type of fusion device between the genital and anal plates (Pl. 6). Also of value in delimiting the family taxa, in most cases, are the presence or absence of: the coronal setae; the lateral gland; and the central rib, although the latter character is of use in delimiting only the Euphthiracaridae. Characters used in establishing generic limits include, in addition to the above: the position of the aspal scale; the number of palpal segments and their setation; and, for routine identification, the sculpturing of the notogaster. To arrange the species, in ascending order of specialization within the genus, use is made of: the number of ventral plate setae, the number and relative development of ovipositor setae, and in *Euphthiracarus* the presence and development or absence of the lateral pocket. Characters assumed to be of specific usefulness include: the shape and character of the sensillus; number and placement of aspal and notogastral setae; number of claws on legs; numbers and relative length and placement of setae on ventral plates; shape of scale; degree of spiculation

TABLE 2. Major taxonomic characteristics of the Euphthiracaroidea genera.

	Fusion Pattern of Ventral Plates	Palpal Segments	Palpal Setation Formulae	Leg IV Solenidial Formula	Ovipositor Setae Ventral Lobes	Ovipositor Setae Dorsal and Coronal	Ovipositor Setae Central Rib or Aspis	Aspis Sculpturing	Aspis Sensillus Position
Plesiotritia	G:AG;AD:A	5	0-3-0-3-9	1-1-0	12	6	0	DP	
Austrotritia	G-AG;AD:A	3[b]	?[c]	1-1-0	?[c]	+[c]	0	DP	
Oribotritia	G:AG±AD:A	3[b]	2-2-8	1-1-0	10,(12)[b]	6,(8)[b]	0	V	
Indotritia[a]	G+AG±AD:A	?	?	?	?	?	?	D	
Euphthiracarus	G-AG-AD+A	3	2-2-8	1-1-0	12-6[b]	0	++	V	
Rhysotritia	G-AG-AD±A	3	2-1-8[b], 2-2-8	0-1-0	10,(12)[b]	6,(8)[b]	+	P,D[b]	
Synichotritia	G-AG-AD-A	5,4[b]	0-2-0-2-8, 0-2-2-8[b]	0-1-0	10	0	0	PD,DP[b]	
Key	Fusion is -)=complete. ±)=over 2/3. +)=2/3 to 1/3. ;)=less 1/3. :=none.		Not including palpal solenidion. 0=lacking ?=unknown		( )=2 displaced -=to +=present			D=Dorsal P=Posterior V=Ventral	

a. No specimens are available and many characteristics are unknown.
b. See generic and specific descriptions and discussions for details.
c. The characteristic could not adequately be studied in the specimens available.

of setae and sculpturing of exoskeleton; general shape of notogaster and aspis; number of carinae on aspis; as well as other characters indicated in the specific descriptions, but considered to be of lesser taxonomic importance.

The relative importance given to the segmentation of the palpi in the present scheme does not agree with the family level of importance ascribed to this character in the past, especially by Grandjean (1954:423, personal communication of 1960); he was not completely aware of the diverse patterns presented here. While palpal segmentation may be a character of major significance in the rest of the Oribatei, this does not seem to be the case in this group.

Systematics

Results of the systematics study are presented in two sections: the first concerned primarily with the higher taxonomic categories of the world, the second concerned with the species defined and proposed on the basis of specimens obtained from redwood litter.

I. RECLASSIFICATION OF THE SUPRA-SPECIFIC TAXA OF EUPHTHIRACAROIDEA

The ptyctimous mites were classified for many years as a single major taxon, expressed by the subdivision of the Oribatei into the Ptyctima and Aptyctima. Grandjean (1954) clearly indicated the diverse nature of these mites and placed them in their more probable phylogenetic relationships among the other primitive oribatid mites, indicating that the ptychoid condition was the result of parallel evolution in several phyletic lines. Other recent classifications of the Oribatei have again placed all the ptyctimous mites in the cohort Ptyctima, with a single superfamily and with the presently discussed taxa included within the family Phthiracaridae: Woolley and Baker (1958); Woolley (1958); Baker, Camin, Cunliffe, Woolley and Yunker (1958). Grandjean (1954), van der Hammen (1959), Balogh (1961) and the present author contend that the ptyctimous mites are polyphyletic. The morphological diversity of the ptyctimous mites is indicated in the following key.

Key to the ptyctimous families of the Oribatei

1. With dorsal and lateral hysterosomal surface divided into distinct plates .....(Enarthronota)...PROTOPLOPHORIDAE Ewing 1917
— With dorsal and lateral hysterosomal surface entire, forming a single plate, the notogaster.....2
2. With discontiguous genital and anal plates encompassed by a discrete ventral plate; larva and nymphs sclerotized and ptychoid..... .....(Mesoplophoroidea)...MESOPLOPHORIDAE Ewing 1917
— With contiguous genital and anal plates, lacking a discrete ventral plate; larva and nymphs neither sclerotized nor ptychoid.....3
3. Ventral surface of opisthosoma rather broad between the ventro-lateral notogastral borders, covered by two pairs, genital and anal, of broad plates separated transversely at about the middle of the area..... .....(Phthiracaroidea)...PHTHIRACARIDAE Perty 1841
— Ventral surface of opisthosoma narrow and elongate between ventro-lateral notogastral borders, covered by complex of elongate plates, not all of which are completely separated transversely at the middle of the area.....(Euphthiracaroidea)...4
4. Anal plate discrete throughout its length, genital and aggenital plates separate to fused, aggenital and adanal plates partially fused..... .....ORIBOTRITIIDAE Grandjean 1954
— Anal plate either partially or entirely united with paired, completely fused genital, aggenital and adanal plates.....5
5. Anal plate partially discrete, forming definite median interlocking triangle in paired, otherwise united, plates covering the genito-anal area .....EUPHTHIRACARIDAE Jacot 1930
— Genito-anal region covered by two pairs of undivided elongate plates, one representing the united genital, aggenital, adanal and anal plates, the other being the plicature plates.....SYNICHOTRITIIDAE fam. n.

The group of supra-specific taxa, included here within the Euphthiracaroidea, have long been considered closely associated with the phthiracaroid mites, varying in relative status between tribe (Jacot, 1930, and others) to a group of families within a single superfamily (Grandjean, 1954, van der Hammen, 1959). The taxonomic status of the major taxa accepted and proposed here is equivalent to the status of similar taxa in the classifications of Grandjean (1954) and van der Hammen (1959).

Superfamily EUPHTHIRACAROIDEA stat. n.

Euphthiracarini Jacot, 1930, Proc. Boston Soc. Nat. Hist., 39: 214, 241; Jacot, 1938, Jour. New York Ent. Soc., 46: 114; Märkel and Meyer, 1959, Zool. Anz., 163: 327.

Euphthiracarinae: Vitzthum, 1941, *in* Bronns Klass. Ord. Tierreichs, 5(4)5(1-7): 924; Radford, 1950, Internatl. Union Biol. Sci., Sér. C (Sect. Ent.), No. 1: 209; Baker and Wharton, 1952, Introd. Acar., p. 437; Turk, 1953, Ann. and Mag. Nat. Hist., (12)6: 89; Feider and Suciu, 1957, Acad. Repub. Pop. Romîne, 7(1): 38; Sellnick, 1959, Occas. Papers Bernice P. Bishop Mus., 22:143.

Euphthiracaridae: Grandjean, 1933*e*, Bull. Mus. Natl. Hist. Nat., (2)5: 221; Grandjean, 1933*b*, ibid., 2(5): 309.

Tritinae Jacot, 1923, China Jour. Sci. Arts, 1: 161.

Diagnosis: ptychoid; with elongate ventral area covered by a complex of plates divided along the median axis and bounded laterally by a pair of distinct, undivided plicature plates; the genito-anal region covered by plates varying in degrees of fusion from nearly separate four pairs to a single pair.

The Euphthiracaroidea and the Phthiracaroidea are similar, because the notogaster is entire and the plates covering the genito-anal region are contiguous. They differ in the apparent pattern of fusion of the plates that cover the ventral portion of the hysterosoma. In many oribatid mites, the plate surrounding the genito-anal region is discrete; this plate is fused with the ventro-lateral notogastral margins in the Phthiracaroidea, but it is represented, in part, by the pair of plicature plates in the Euphthiracaroidea. No known phthiracaroid has subdivided genital or anal plates, but these plates may be divided in euphthiracaroid species. United genito-anal plates are found among the euphthiracaroids, but not in the phthiracaroids.

The superfamily Euphthiracaroidea is proposed to include Oribotritiidae, Euphthiracaridae and Synichotritiidae, in order of their assumed evolutionary development. This arrangement is based primarily on the varying patterns of plate fusion, and secondarily on the patterns of palpal segmentation and palpal setal formulae shown by the included genera.

Family Oribotritiidae Grandjean

Oribotritiidae Grandjean, 1954, Bull. Soc. Zool. France, 78: 430; Hammen, v. d., 1959, Zool. Verhandel., No. 40: 34; Aoki, 1959*b*, Jap. Jour. Sanit. Zool., 10: 128, 132.

Type-genus: *Oribotritia* Jacot, 1924.

Diagnosis: ptychoid mites with contiguous, elongate ventral plates, genital and aggenital plates either separate or partially to completely fused, aggenital and adanal plates fused to lesser or greater extent, anal plate separate; lacking central rib of aspis and interlocking triangle on ventral plates; with two pairs of exobothridial setae where known; palpi with five or three segments; leg solenidial formula, where known, (2-1-3) (1-1-2) (1-1-0) (1-1-0).

The concept of the family presented here is broader than was true of the originally proposed concept, because Grandjean (1954) discussed only those genera which he had studied and he had not seen specimens of all the genera included here within the family. I have seen examples of three of the four genera. There are no specimens of *Indotritia* Jacot known to be in collections.

Grandjean depends upon his concept of *Oribotritia berlesei* (Michael), 1898, for his characterization (1954) of *Oribotritia,* and accepts Michael's attribution of "*decumana* Koch" to *Phthiracarus* (see discussion under *Oribotritia*). Grandjean's description of the ventral plates (1933*b*) appears referable to *Oribotritia,* but his description of the five segmented palpi (1933*c*) is referable to *Plesiotritia,* although the tibia is stated to bear two setae instead of three. I have not seen specimens of *O. berlesei,* Grandjean and cannot attribute the species to any particular genus. *O. berlesei,* Grandjean may be a species with characteristics intermediate between those specified here for *Plesiotritia* and *Oribotritia,* or it may be a composite "species" based partially upon a misidentification or a grossly aberrant male (?) specimen. For my concept of *Oribotritia,* I have depended upon various redescriptions (Sellnick, 1925*b,* 1929, 1932; Willmann, 1931) of the type-species, *O. decumana* (Koch), as well as upon the definition of genera given by Sellnick (1959) and his unpublished comments made to me. At least until authentic specimens of both *O. decumana* (Koch) and *O. berlesei,* Grandjean are studied, the present characterization and nomenclatural status of these generic taxa are suggested.

Although no species have been recorded from Australia and New Zealand, the family Oribotritiidae is assumed to be cosmopolitan in distribution. I have seen published records or specimens referable

to the family from all the other major land masses with the exception of Antarctica.

To indicate generic relationships more clearly, two subfamilies are proposed, with two genera each. In comparison with Oribotritinae, Plesiotritinae is considered to be somewhat less specialized, because it has the more nearly separate aggenital and adanal plates, its palpal segmentation varies from five to three and its palpal setal formula varies from 0-3-0-3-9 to 2-2-8; Oribotritinae exhibits more nearly complete fusion between the aggenital and adanal plates and, so far as is known, a palpal segmentation of three with a palpal setal formula of 2-2-8. Within each subfamily appears the parallel specialization trend from separate genital and aggenital plates toward their fusion.

The members of this family often are the largest of the euphthiracaroid mites encountered, and some species rank among the largest of the Oribatei. The species known to me are generally smooth and commonly shiny.

Key to the subfamilies and genera of Oribotritiidae

1. Incision between aggenital and adanal plate regions extending more than one-half plate width ..... PLESIOTRITINAE...2
— Incision between aggenital and adanal plate regions lacking or extending less than one-half plate width ..... ORIBOTRITINAE...3
2. With completely separate genital and aggenital plates; with five palpal segments ..... *Plesiotritia*
— With completely fused genital and aggenital plates; with three palpal segments ..... *Austrotritia*
3. With completely separate genital and aggenital plates; aspal scale ventral from bothridium ..... *Oribotritia*
— With genital and aggenital plates fused in anterior one-third to one-half their length but separated posteriorly; aspal scale dorsal to bothridium ..... *Indotritia*

Subfamily **PLESIOTRITINAE** subfam. n.

Type-genus: *Plesiotritia* gen. n.

Diagnosis: with long incision, about two-thirds plate width, between aggenital and adanal plates; aspal scale dorsal or dorso-posterior to bothridium; palpal segmentation and palpal setal formulae varying.

This subfamily includes the new genus *Plesiotritia* described below and *Austrotritia* Sellnick, 1959.

Five palpal segments and the discrete genital and aggenital plates of *Plesiotritia* mark it as being less specialized than *Austrotritia*, with three palpal segments and the fused genito-aggenital plate. The palpal setal formula, 0-3-0-3-9, of *Plesiotritia* is considered to be less

specialized, because there is an additional seta on each of the setiferous palpal segments when compared with the known numbers of similar setae found on the other genera of the superfamily. I am not certain of the palpal setal formula for *Austrotritia*. The particulate co-types of *Austrotritia bryani* (Jacot), 1929*a*, and *A. lebronneci* (Jacot), 1934*a*, were unsatisfactory study specimens, because they were not carefully dissected but were torn apart; the palpi consist of three segments, but the setae could be accurately counted only on the basal two segments. Jacot does give (1934*a*, Fig. 4, *e*; 1934*b*, Fig. 1, *i*) drawings of the palpi from which can be derived the papal setal formula 2-2-9. *Plesiotritia* has, among the palpal tarsal setae, the usual four distal eupathidia; on the perhaps inconclusive basis of Jacot's drawings, *Austrotritia* has but two eupathidia (? three, or even four ?). *A. bryani* and *A. lebronneci* have deutova with patterns of sculpturing similar in type to that of *P. megale*.

Genus ***Plesiotritia*** gen. n.

Type-species: *Plesiotritia megale* sp. n.

Diagnosis: medium to large in size, with strongly sclerotized, practically smooth, often shiny exoskeleton; aspis rather low, flat, scale dorsal to bothridium; ventral plates with distinct genital, anal plates, and slightly fused aggenital and adanal plates separated by incision extending latero-anteriad more than one-half plate width; with five palpal segments and palpal setal formula 0-3-0-3-9; legs with three claws; ovipositor coronal setae present.

Adult: exoskeleton often dark red brown, apparently smooth. Aspis rather flat, broad, setae obvious, long, erect; with two pairs of exobothridial setae; scale obvious, dorsal to bothridium. Notogastral setae obvious. Anal, genital plates distinct from one another and from slightly fused aggenital and adanals, these separated about two-thirds plate width by incision directed antero-laterad from simple juncture of genital and anal plates. Palpi of five segments with setal formula 0-3-0-3-9. Legs with three claws. Ovipositor with 12 lobe setae, coronal setae present.

Eggs: deutova strongly sclerotized, sculptured.

Immatures: described in description of *Plesiotritia megale*.

The generic name is derived from the Greek *plesios* + *Tritia* meaning near + Tritia, a nymph of Greek mythology and used as a generic name by Berlese.

The aggenito-adanal incision may be hidden in a whole mount by the notogastral margin if the ventral plates are retracted. Because of this, and otherwise inadequate descriptions, it is uncertain how many previously described species should be ascribed to this genus; probably at least 7, and perhaps as many as 17, could be so considered.

Genus *Austrotritia* Sellnick

Austrotritia Sellnick, 1959, Occas. Papers Bernice P. Bishop Mus., 22: 143, ff.
Indotritia (in part): Jacot, 1929*a*, Psyche, 35: 213; Jacot, 1934*a*, Bull. Bernice P. Bishop Mus., No. 114: 234-237; Jacot, 1934*b*, ibid., No. 113: 114; Jacot, 1934*c*, ibid., No. 121: 82-84.

Type-species: *Austrotritia quadricarinata* Sellnick, 1959, by original designation.

Diagnosis: medium to large in size, with strongly sclerotized, practically smooth, often shiny exoskeleton; aspis with median carina, variously modified; scale dorsal to bothridium; ventral plates with completely fused genito-aggenital plate, which is slightly fused with adanal plate but separated by latero-dorsad incision about two-thirds plate width in length; with three palpal segments and apparent palpal formula 2-2-9; coronal setae present.

The *Austrotritia* species have been found on the islands of French Oceania and the Hawaiian chain. Attributed to it are three species, and three subspecies or forms of uncertain distinctness. Because this genus was not encountered in the study area, it is considered no further.

Subfamily Oribotritinae Grandjean, stat. n.

Type-genus: *Oribotritia* Jacot, 1924.

Diagnosis: with aggenital and adanal plates nearly fused, length of incision between them less than one-half width of plate or lacking; aspal scale either ventrad from or dorsad to bothridium; genital and aggenital plates either completely separate or fused only along the anterior one-third to one-half of the contiguous margin; as far as known, with three palpal segments and palpal setal formula 2-2-8.

This subfamily includes the genera *Oribotritia* Jacot, 1924 and *Indotritia* Jacot, 1929.

It is obvious, from reference to Table 2 and the discussion below, that little is known of the characteristics of *Indotritia.* The only major basis for comparison between the genera of this subfamily is the structure of the ventral plates; *Oribotritia,* with its completely separated genital and aggenital plates, is considered to be less specialized than is *Indotritia,* with its genital and aggenital plates fused along the anterior one-third to one-half. Both genera lack a conspicuous incision separating the aggential and adanal plates. The aspal scale of *Oribotritia* is ventral from the bothridium while that of *Indotritia* is dorsal.

Genus *Oribotritia* Jacot

Oribotritia Jacot, 1924, Jour. North China Br., Roy. Asiatic Soc., 55: 83; Jacot, 1930, Proc. Boston Soc. Nat. Hist., 39: 254; Sellnick, 1932, Zool. Jahrb., System., 63: 711; Jacot, 1933, Jour. Elisha Mitchell Sci. Soc., 48: 258; Jacot, 1934*c*, Bull. Bernice P. Bishop Mus., No. 121: 81; Jacot, 1938, Jour. New York Ent. Soc., 46: 114; Rohde, 1955, Ph. D. Diss. Northwestern Univ., p. 51; Hammen, v. d., 1959, Zool. Verhandel., No. 40: 34; Märkel and Meyer, 1959, Zool. Anz., 163: 339; Sellnick, 1959, Occas. Papers Bernice P. Bishop Mus., 22: 143; Sellnick, 1960, Tierw. Mitteleur., Nachtr., 3 (4): 126.

Oribotritia (in part): Sellnick, 1929, Tierw. Mitteleur., 3(4)9: 38; Willmann, 1931, Tierw. Deutschl., 22(5): 193; Vitzthum, 1931, *in* Kukenthal's Handb. Zool., 3(2)3: 152.

Hoplophora Koch (not Perty, 1830, Orthoptera) (in part), 1836, Deutschl. C. M. A., fasc. 2, p. 9; Michael, 1888, British Oribatidae, vol. 2, p. 543, 560; Oudemans, 1937, Krit. Hist. Overz. Acar., p. 2731. Type-species: *Hoplophora stricula* Koch, 1836, type fixation by elimination (see discussion).

Tritia Berlese (not Risso, 1826, Mollusca), 1883, Acari, Myr. Scorp. hucusque Italia reperta, fasc. 6(1); Berlese, 1896, Acari, Myr. Scorp. hucusque Italia reperta, Ordo Cryptostigmata, p. 20; Oudemans, 1915-16, Ent. Ber., 4: 245; Jacot, 1923, China Jour. Sci. Arts, 1: 162; Sellnick, 1923, Acari, No. 3: 7; Sellnick, 1925*b*, Ann. Hist. Nat. Mus. Natl. Hungarici, 22: 305. Type-species: *Hoplophora decumana* Koch, 1836, by original designation and monotypy.

Phthiracarus authors (in part, not Perty, 1839): Oudemans, 1896, Tijdschr. Ent., 39: 62; Michael, 1898, Das Tierreich, 3: 80; Oudemans, 1900*a*, Tijdschr. Ent., 43: 146; Banks, 1904, Proc. California Acad. Sci., Zool., 3: 367; Ewing, 1917, Ann. Ent. Soc. Amer., 10: 125.

Hoploderma: Oudemans, 1900*a*, Tijdschr. Ent., 43: 145, invalid subsequent designation of *Hoplophora decumana* Koch as type-species of genus and misidentified type-species so designated (see discussion).

Phtiracarus [sic]: (in part) Berlese, 1913, Acarotheca italica., p. 55.

Protoribotritia Jacot, 1938, Jour. New York Ent. Soc., 46: 114 (type-species, by original designation and monotypy, *Protoribotritia canadaris* Jacot, 1938). NEW SYNONYMY.

Type-species: *Hoplophora decumana* Koch, 1836, by original designation. Name proposed for *Tritia* Berlese, 1883, preoccupied.

Diagnosis: small to large in size, with well sclerotized, practically smooth, often shiny exoskeleton; aspis low to high; scale ventral from bothridium; ventral plates with distinct genital, anal plates; fused aggenito-adanal plates with short incision, either apparent or evident on dissection, extending less than one-half width of plate; palpi three segmented, setal formula 2-2-8; ovipositor coronal setae present.

Adult: exoskeleton light to dark brown, apparently smooth, often shiny. Aspis low to high, setae often obvious, long to short, erect to procumbent; with two pairs of exobothridial setae; scale obvious, ventral from bothridium. Notogastral setae long to short. Anal, genital plates distinct from one another and from nearly completely fused aggenito-adanals, these separated less than one-half plate width by slight incision, directed antero-laterad from simple juncture of genital and anal plates, incision apparent or evident upon dissection. Palpi with three segments with some species showing slight indication of fusion,

with setal formula 2-2-8. Legs with one or three claws. Ovipositor with 10 apparent lobe setae; six coronal setae, occasionally with one additional pair of lobe setae migrating to coronal row.

Eggs: deutova either smooth or with strongly rugose surface.

Immatures: in general similar to those of *Plesiotritia*.

It is most probable that, at least portions or all of, certain of the citations listed immediately following *Oribotritia* Jacot are actually referable to *Plesiotritia*. They have not been so treated because I have not seen all of the species involved and some of the decriptions are inadequate.

The synonymy of *Protoribotritia* is based upon study of 31 cotypes of *Protoribotritia canadaris* Jacot, 1938, and 5 other specimens so identified by Jacot, from the Museum of Comparative Zoology. In no specimens were the bases of the palpi obvious, so I was unable to verify the four segmented condition of the palpus described by Jacot (1938:115).

Species attributable to *Oribotritia* include an additional 4, and perhaps as many as 14, previously described species. In several cases it will be necessary either to see authentic determined specimens or to collect and study topotypes before the proper generic attributions can be made. Probably *Oribotritia* is cosmopolitan in distribution.

To clarify the obvious question concerning my use of *Oribotritia* Jacot, 1924, rather than *Hoploderma* Michael, 1898, for the taxon under discussion, a brief history of the problem is included, with a discussion of the pertinent points considered in settling the question. Koch (1836) described two species, *H. decumana* and *H. stricula* in the non-defined genus *Hoplophora* Koch. He later (1841) added more species, and (1842) presented a definition for the genus and invalidly designated an unavailable species, *H. laevigata* Koch, 1841, as type-species. *Hoplophora* Koch, 1836, is a junior homonym, and the two originally included species are now included in different superfamilies. Michael (1898) proposed *Hoploderma* as a new name for the preoccupied *Hoplophora* Koch, 1836, but Michael did not designate a type-species at that time, apparently depending upon his earlier (1888) invalid proposal of the unavailable *Hoplophora magna* Nicolet, 1855, as type-species for *Hoplophora* Koch. Oudemans (1900*a*) pointed out the omission of type-species in Michaels' 1898 work and proposed *Hoplophora decumana* Koch, 1836, an apparently valid subsequent designation of type-species for *Hoploderma* Michael, 1898, and thus for *Hoplophora* Koch, 1836. Prior to this time, Berlese (1883) had proposed *Tritia* as the generic name for the taxon under discussion,

with *Hoplophora decumana* Koch, 1836, as the monotypic and designated type-species. *Tritia* Berlese, 1883, proved to be another junior homonym and the taxon was given the name *Oribotritia* Jacot, 1924, explicitly with the same type-species as earlier designated for *Tritia* Berlese, 1883.

The basic nomenclatural question is whether Oudemans' (1900*a*) designation was necessary, hence valid. There were only two species originally included in *Hoplophora* Koch, 1836, and thus only two species were available for type-species designation. Berlese (1883) removed one species, *Hoplophora decumana* Koch, and this action established *Hoplophora stricula* Koch, 1836, as the type-species of *Hoplophora* Koch, by elimination. Type-species designation by elimination is recognized in Recommendation 69B (3) of the International Code of Zoological Nomenclature adopted by the XV International Congress of Zoology, London, July 1958 (Stoll, 1961) and was even more widely recognized by earlier codes as indicated by Mayr, Linsley and Usinger (1953:267) wherein they discuss this point as follows: "For the special case where there are only two originally included nominal species, the commission has ruled that type selection by elimination applies, *e.g.*, when one of the two originally included species is designated as the type of a new monotypical genus, that action automatically constitutes the selection of the remaining species as the type of the original genus." [1]

Acceptance of type-species designation by elimination for *Hoplophora* Koch, and thus for *Hoploderma* Michael as required by Article 67 (i) 1 of the Code (Stoll, 1961), represents the most direct, logically apt and least involved method of achieving that nomenclatural stability so stressed by the XV Congress. This solution for the nomenclatural question need not be referred to the International Commission on Zoological Nomenclature.

If this first solution is rejected, the problem presented is one of a misidentified type-species. Michael (1888:543) rejected the divergence of the generic concept of *Tritia* Berlese, 1883, questioning Berlese's identification of *Hoplophora decumana* Koch, 1836, and considered *H. decumana,* Michael as a synonym of *H. dasypus* (Duges), 1834; he specifically stated (1888:560) that this was "not *H. decumana* of Berlese." Michael's taxon *H. decumana* is now considered as a phthiracaroid species, a concept for *H. decumana* Koch which has not recently been and is not now generally held. Grandjean (1933*b*:309) is the only worker now active in this group

1. From "Methods and principles of systematic zoology," by E. Mayr, E. G. Linsley, and R. L. Usinger. Copyright 1953. McGraw-Hill Book Company, Inc. Used by permission.

who considers *decumana* as being a phthiracaroid. *Hoplophora stricula* Koch, 1836, and Koch's unavailable type-species *H. laevigata* Koch, 1841, have been and are now considered as phthiracaroids although in different genera (Jacot, 1936). Oudemans (1896, 1900*a,b*) obviously followed this phthiracaroid concept until he recognized the error and corrected it (1915-16). Thus the *H. decumana* concept which Oudemans followed at the time of his subsequent designation was not, as far as we are able to ascertain, the concept of Koch although it was Koch's concept that, by application of the Codes, was proposed as the type-species of the genus *Hoploderma* Michael, 1898. The later and infrequent usage of the *Hoploderma* name has invariably been in a phthiracaroid concept (Hammer, 1958; van der Hammen, 1959). Similarly, when separated from either *Hoploderma* or *Phthiracarus*, the concept of the taxon under discussion has always been referred to either *Tritia* Berlese or *Oribotritia* Jacot.

Any question of a misidentified type-species must be presented for consideration by the Commission, as required by Articles 41, 67 (j) and 70 (a) of the Code (Stoll, 1961), in order that it may, "designate as the type-species . . . whichever species will in its judgment best serve stability and uniformity of nomenclature . . . ." I consider the second solution unnecessary. If it should prove necessary, it appears (van der Hammen, 1959) that there are a number of somewhat similar problems concerning the valid type-species for several of Koch's genera which should be presented to the Commission for a uniform, or at least definitive, decision. I am not conversant with all of these other problems and would not be justified in placing this isolated question before the Commission. Article 80 of the Code (Stoll, 1961) would indicate that existing usage should be followed until the question is placed before and decided by the Commission; the usage, of *Oribotritia*, followed by the writer is the existing usage modified only by its being more restricted.

Genus *Indotritia* Jacot

Euphthiracarus (Indotritia) Jacot (in part), 1929*a*, Psyche, 35: 213.
Indotritia: Sellnick, 1959, Occas. Papers Bernice P. Bishop Mus., 22: 143, ff.
Tritia (in part): Sellnick, 1923, Acari, No. 3: 14-16; Sellnick, 1924, Treubia, 5: 372; Sellnick, 1925*a*, Treubia, 6: 459.

Type-species: *Tritia krakatauensis* Sellnick, 1923, by original designation.

Diagnosis: moderate to large in size; exoskeleton generally shiny; aspis with two lateral carinae; scale dorsal to bothridium; exoboth-

ridial setae not seen; ventral plates with separate anal plate; genital and aggenital plates fused along anterior two-fifths of plate length, separated posteriorly; aggenital and adanal plates apparently fused or with very short incision extending laterad from juncture of genital and anal plates; palpal segmentation and setation, ovipositor setation, unknown.

There are two species presently attributed to *Indotritia,* from Java and Krakatau.

Jacot's description for the genus (1929*a*:113) refers primarily to the characteristics of *Austrotritia* Sellnick, because those were the specimens before him at the time of the proposal of the genus. Jacot apparently both misinterpreted Sellnick's descriptions and drawings (1924) and was unaware of Sellnick's other descriptions and figures (1923, 1925*a*), with the result that he designated as type-species a species that was not congeneric with the species he was proposing. Jacot did not see specimens of the type-species prior to proposing the genus (Sellnick, personal communication). The specimens of *Indotritia* species either were returned to the Dammerman collection (? Buitenzorg, Indonesia?) or were retained in Dr. Sellnick's personal collection until it was destroyed during the last stages of World War II (Sellnick, personal communication).

This genus is considered no further, because it was not found in the region studied.

Family Euphthiracaridae Jacot

Euphthiracarini Jacot (in part), 1930, Proc. Boston Soc. Nat. Hist., 39: 214, 241; Jacot (in part), 1938, Jour. New York Ent. Soc., 46: 114; Märkel and Meyer (in part), 1959, Zool. Anz., 163: 327.

Euphthiracarinae (in part): Feider and Suciu, 1957, Acad. Repub. Pop. Romîne, 7(1): 38; Sellnick, 1959, Occas. Papers Bernice P. Bishop Mus., 22: 143.

Euphtiracarinae [sic] (in part): Feider and Suciu, 1958, Acad. Repub. Pop. Romîne, 10: 31.

Euphthiracaridae: Hammen, v. d., 1952, Zool. Verhandel., No. 17: 126; Hammen, v. d., 1959, Zool. Verhandel., No. 40: 35.

Pseudotritiidae Grandjean, 1954, Bull. Soc. Zool. France, 78: 430.

Tritinae Jacot (in part), 1923, China Jour. Sci Arts, 1: 161.

Type-genus: *Euphthiracarus* Ewing, 1917.

Diagnosis: ptychoid mites with elongate, ventral plates contiguous, plicature plates discrete, genital, aggenital and adanal plates fused and anal plate also fused to them along the posterior one- to two-thirds of its length, separated along anterior portion; anal plates interconnecting on median line by a series of interdigitating lobes resulting in a more or less complex sinuate median

Immatures: undescribed but apparently similar in general appearance to those described for *Plesiotritia megale.*

The type specimen of *Phthiracarus flavus* Ewing, 1908, is not to be found in the collections of the U. S. National Museum (Dr. E. W. Baker, personal communciation); in the collections of the Illinois Natural History Survey (Dr. L. J. Stannard, personal communication); in the Museum of Comparative Zoology (Dr. H. W. Levi, personal communciation); or in the Ewing Collection of Oregon State University, loaned by Dr. G. W. Krantz. Type material of *Phthiracarus americanus* Ewing, 1909, is deposited in the Museum of Comparative Zoology, Harvard University (Dr. H. W. Levi, personal communciation). I have not seen specimens of *Pseudotritia monodactyla* Willmann, 1920. On the basis of the descriptions and figures, there seems little question that the synonymy in each case is correct.

Of the known species of *Euphthiracarus* including those proposed here, the majority are North American in distribution. European species include only one definite and two other possible members of this genus (van der Hammen, 1959).

Genus *Rhysotritia* Märkel and Meyer

Rhysotritia Märkel and Meyer, 1959, Zool. Anz., 163: 329; Halašková and Kunst, 1961, Acta Univ. Carol., Biol., Sup. 1960, p. 48 (ecological notes).

Tritia (Pseudotritia) Willmann (in part), 1920, Abhandl. Naturwiss. Ver. Bremen, 24: 552; Sellnick, 1923, Acari, No. 3: 19.

Pseudotritia (in part): Sellnick, 1929, Tierw. Mitteleur., 3(4)9: 39; Willmann, 1931, Tierw. Deutschl., 22(5): 194; Märkel, 1958, Arch. f. Forstw., 7: 486; Märkel and Meyer, 1959, Zool. Anz., 163: 329; Sellnick, 1960, Tierw. Mitteleur., Nachtr., 3(4): 127.

Type-species: *Rhysotritia ardua* (C. L. Koch) 1836 [sic], by original designation; undoubtedly referring to *Hoplophora ardua* C. L. Koch, 1841.

Diagnosis: relatively small in size, with weak to moderately strong exoskeleton; aspis with weak central rib, rostral setae erect, scale posterior or dorsal to bothridium. Notogaster setae weak to strong; surface sculpturing usually inconspicuous. Ventral plates with simple sinuate interlocking triangle, without lateral pocket. Anal plate almost completely fused with adanal plate; adanal setae spiculate, longer than smooth anals; *a*:1 insertion on or very near interlocking triangle. Palpal setal formula of 1-1-8, 2-1-8 or 2-2-8. Leg IV solenidial formula 0-1-0; legs with one or three claws. Ovipositor coronal setae present.

Adult: exoskeleton usually whitish and smooth in appearance. Aspis often rather flat, setae either inconspicuous, relatively short and fine, or obvious,

short and relatively stout, all erect; with anterior exobothridial setae present, posterior setae rudimentary; central rib weak, not attaining midline of aspis; usually with one, rarely two, pair of rather weak lateral carinae; scale posterior or dorsal to bothridium and sensillus. Notogaster setae no longer than aspal setae, fine to rather strong; surface reticulations rather fine to apparently lacking under lower magnifications, shagreened under higher magnifications. Adanal setae longer, spiculate; anal setae either lacking, or smooth, shorter than adanals; *a*:1 shorter than or at most equal in length to shortest of adanals; insertions of *a*:1 on or very close to interlocking triangle. Interlocking triangle with rather simple, sinuate median margins. Palpal setal formula unusual in being divergent, 1-1-8, 2-1-8 or 2-2-8. Infracapitular menton setal insertions from normal to anteriad in position, more approximate than in *Euphthiracarus*. Leg IV solenidial formula 0-1-0; with usual setiform setae on coxa of leg IV. Legs with one or three claws. Ovipositor with differing numbers of lobe setae present but coronal setae present.

Eggs: primova and deutova could not be discriminated.

Immatures: not seen.

The generic description given here is somewhat amplified over that originally given by Märkel and Meyer (1959) and is primarily based upon the two species described here. In addition, I have altered the comparative emphasis originally given to several of the apparent characteristics of this taxon, principally becauses of the patterns of characteristics exhibited by the two species described here, but also based upon examination of the three European species originally attributed to this genus by its authors. These specimens, of *Rhysotritia ardua* (Koch), *R. minima* (Berlese) and *R. duplicata* (Grandjean), were identified and brought to me by Dr. M. Sellnick.

Even with the additions to and alterations in emphasis of the characteristics of *Rhysotritia*, the two new species, *R. paeneminima* and *R. scotti*, fail to fit into as close a pattern of similarities as are shown by species in the other genera of the Euphthiracaroidea. An example of the divergence found is a comparison of the formula for the palpal setation: *R. minima*, 1-1-8; *R. paeneminima*, 2-1-8; *R. ardua*, *R. duplicata* and *R. scotti*, 2-2-8, as is found in *Euphthiracarus*. However, all *Rhysotritia* species exhibit an identical leg solenidial formula of (2-1-3) (1-1-2) (1-1-0) (0-1-0), that of leg IV, 0-1-0, differing from that in *Euphthiracarus*, 1-1-0, but identical with that of *Synichotritia*. *Rhysotritia* exhibits a ventral plate arrangement much more like that of *Euphthiracarus* than like that of *Synichotritia*. Upon consideration of these and other characteristics given in the species descriptions, the two new species are proposed as being congeneric.

Rhysotritia is practically cosmopolitan in distribution, assuming that all of the many records for *R. ardua* (Koch) represent accurate identifications.

Family SYNICHOTRITIIDAE fam. n.

Type-genus: *Synichotritia* gen. n.

Diagnosis: ptychoid mites with a single pair of narrow elongate ventral plates resulting from the complete fusion of the genital, aggenital, anal and adanal plates of each side; a discrete pair of plicature plates present; aspis with two pairs of exobothridial setae; notogastral lateral gland absent; with separate, paired, median internal, lamellate structure, extending from near anterior margin to near posterior margin of fused genito-aggenito-ano-adanal plates, sclerotized near anal opening, surrounding anal and genital openings; ovipositor lacking all vestiges of coronal setae; leg solenidial formula: (2-1-3) (1-1-2) (1-1-0) (0-1-0).

As proposed, this family includes one genus with two species. It seems probable that the family's range is greater than reported here and that it will be found elsewhere, particularly to the north, when collections are made.

Genus *Synichotritia* gen. n.

Type-species: *Synichotritia caroli* sp. n.

Diagnosis: moderate in size; with strongly sclerotized and sculptured exoskeleton; setae obvious; aspis with median rib but lacking central rib; scale dorso-posterior to bothridium; notogaster without apparent vestigial setae; each united ventral plate with setose furrow on anterior vertical face; one pair of genital sensory structures much smaller, one-half diameter and length of others; dorsal ovipositor lobes lacking setae *od:*4; palpi of four or five segments; males present.

Adult: exoskeleton tannish in color, rough. Aspis with strong median rib, weak single lateral carina, lacking central rib, scale dorso-posterior to bothridium. Notogaster with strong setae, apparently lacking vestigial setae. Each united ventral plate anterior margin reinforced by strong, projecting bar; with setose furrow on anterior vertical face of bar extending most of plate width laterally; second furrow on ventral surface of bar triangular, extending laterally about one-half plate width from mesal margin of plate; remainder of plate with no obvious surface variation. With internal, lamellate, narrow, paired mesal structure obviously extending posteriorly two-thirds of combined ventral plate length, surrounding anal region when plates open, often apparent in ventral view even in uncleared specimens due to darker sclerotization. Three pairs of genital sensory structures with one pair much smaller than others, about one-half their diameter and length. Ovipositor lobe setae varying in development, *od:*4 lacking. Palpal segmentation pattern unusual, with four or five segments.

Eggs: primova only seen, or if deutova, very lightly sclerotized and not sculptured.

Larva and nymphs unknown.

The generic name is derived from the Greek *synichos* + *Tritia* meaning joined, with reference to the ventral plates + Tritia, a nymph of Greek mythology and to indicate a relationship with Berlese's generic usage of the term.

The genus *Synichotritia* is proposed to include the new species, *S. caroli* and *S. spinulosa,* described below. No other congeneric species has been recognized. Thus, this genus is known only from the western portion of the northern one-half of California.

Genus of uncertain affinities

A. C. Oudemans (1916) proposed *Hummelia,* with the type-species *Hoplophora ardua* Karpelles, 1894, (not *ardua* Koch, 1841), on the basis of a lateral projection between legs III-IV. While Oudemans had high regard for Karpelles' abilities as an observer, this genus has never been rediscovered and seems possibly based upon a teratological condition. For this reason, *Hummelia* is not considered further.

II. TAXONOMY OF EUPHTHIRACAROIDEA FROM *Sequoia* LITTER

A total of 14 species, with 1 divided into 2 subspecies, are recorded here.

Family Oribotritiidae Grandjean

Subfamily Plesiotritinae subfam. n.

Genus *Plesiotritia* gen. n.

Plesiotritia megale sp. n.

(Pls. and figs. 8, A-D; 9, A-E; 10, A-D; 11; 12; 13, A-D; 14)

Diagnosis: large mite with rather short, fine, setiform sensilli; two lateral aspal carinae present; 14 pairs of notogastral setae; 8 genital, 3 aggenital, 3 adanal, 3 anal, short, fine setae; 12 ovipositor lobe setae and 6 coronals.

Adult: very dark reddish-brown, large, smooth, shiny, almost globose. Notogastral setae simple, very thin and long, not as robust as would be expected from the relative size of this species.

Female size range: notogaster length 1580-1074, height 1137-769, width 1150-804; aspis length 769-520, height 277-166, width 596-402; ten specimens measured.

Male size range: notogaster length 1317-1041, height 887-707, width 901-783; aspis length 644-499, height 208-146, width 513-347; 13 specimens measured.

Sex ratio: 54% males among 155 specimens from ten samples.

Aspis: low, 750 long, 315 high, 645 wide. Median rib short. Without median carina but with a strong, low, acute, lateral carina on each side, more

obvious in lateral view; second carina indistinct, slight, straight, extending posteriad from about anterior point of attachment of major lateral carina, but diverging, ending below bothridium. Rostral setae simple, smooth, curving antero-mesad, longer, 185, than laterals, combined length greater than distance between their insertions; insertions rather remote from laterals. Lateral setae simple, smooth, appressed, short, 130, not as long as distance between lateral and vertical insertions. Vertical setae simple, smooth, very thin in proportion to their great length, 410; insertions rather approximate. Exobothridial setae very fine, as long as laterals; insertions not visible dorsally. Bothridia not projecting, about one-third as long as verticals. Scale dorso-posterior to bothridium, apex posteriad to sensillar opening; twice as long and as broad as bothridium, smoothly rounded, mammiform, more acutely curved posteriorly, thin, most obvious in dorsal aspect. Sensillus simple, setiform, directed laterad, relatively straight but tip upcurved slightly, 160 long, less than one-half as long as verticals.

Notogaster: subglobose, 1475 long, 1175 high, 1200 wide. Anterior rim rather narrow, collar area short, sensillar notch rather pronounced, curving into a rather weakly delimited lapet. Sculpturing of extremely fine, closely spaced, very short protuberances. With 14 pairs of obvious, simple, fine, whip-like setae, about one-half as long as verticals. Setae *f*:1 vestigial. Setae *c*:1,2 inserted well posteriad of anterior margin. Lateral gland present. Fissures present, frequently difficult to discern all on one specimen.

Ventral plates: 1080 long, 1125 including inward projecting genital plate spur, sculpturing like notogaster and aspis. Genital plate narrowed anteriorly; with eight, rarely nine, fine setae, about 35 long, in mesal row; *g*:1-4 grouped on anterior external portion of plate; *g*:5-8 insertions either in two groups or equidistant. Aggenital region of aggenito-adanal plate with three, rarely two, fine, smooth setae, about 40 long; *ag*:1 slightly shorter than others, in whole mounts frequently hidden by corner of lapet. Incision between aggenital and adanal regions extending diagonally two-thirds width of plate. Adanal region with three tiny setae, about 7 long, and fissure *iad*. Anal plate with three tiny, 15-5, fine setae decreasing in size from *a*:1-3.

Ovipositor: with slight pattern of irregularly wavy striations on membrane of lobes. Distal setae with sclerotized insertions, not included in setal lengths. Dorsal lobes with four setae each, distal three arranged in triangle; *od*:1 most robust, 125 long; *od*:2 about 55 long; *od*:3 slightest of distal setae, 33 long; *od*:4 slighter than *od*:3, short, 33 long, similar in appearance to coronal setae. Ventral lobe setae robust; *ov*:1 strongest of ovipositor setae, 130 long; *ov*:2 slighter, similar to *od*:3 except straight. Coronal setae alike, straight, spiniform, without obvious insertions, acuminate, 37-40 long, inserted as dorsal, lateral and ventral pairs on basal fold of ovipositor lobes.

Male genitalia: distal pair of ventral lobe setae frequently difficultly distinguished from sclerotized margin; dorsal setae varying in size from 23-33, proximal ventral setae 24 long, distal pair 15 long; all sharply pointed, spiniform, nearly straight.

Gnathosoma: chelicerae, 430 long, 160 high, possibly compressed in mounting, dorso-lateral surfaces with minute, 3-5, spicules. Infracapitulum ventral surface finely punctate, all setae more or less barbed, tapering evenly to fine tip.

Legs: lateral claws nearly as strong as central. Famulus somewhat rugose, moderately long, 28, slender, bending slightly, with fine blunt tip. Genu I pore present.

Eggs: an average of 22.9 per specimen, with range of 10 to 59 found in ten females examined; size of plump egg about ready to hatch, length 170, width 115, hence subglobose; deutova with strong, rugose, irregular striations longitudinal to main axis and, near larger pole, with flattened areas surrounded by striae; color changes described in life history section, pre-larva not seen.

Larva: white, glistening, smooth with no rugosities, or marked striations. In five living specimens, ranging in age and size from newly hatched to prepared to molt; overall length, 310-400, width, 210-230, height of body without legs, 150-170, hence subglobose. Flattened, mounted, drawn specimen 440 long, 250 wide.

Aspal region: bearing four pairs of setae and one pair of fissures, representing the bothridia. Rostral and vertical setae long; laterals somewhat shorter; with exobothridial setae shortest, inserted on side of region behind and below bothridial fissures.

Notogaster: with 10 pairs of setae, excluding vestigial setae *f*:1; four pairs of fissures. Venter with anus a rather weakly defined slit, often irregularly sinuate in mounted specimens.

Gnathosoma: similar to adult.

Legs: relatively short, stout, legs I and II with protective scale and Claparède's organ. Famulus strongly rugose as in adult. Tarsal solenidia strongest with genual weakest.

Formulae: palpal setation 1-0-2-0-8, with usual solenidion on tarsus; leg setae, (2-0-2-2-4-11) (1-0-2-2-4-9) (2-0-2-1-3-11), solenidia (2-1-1) (1-1-1) (1-1-0).

Protonymph: similar in general appearance to larva, sizes of five living specimens ranging in age and size from recently molted to ready to molt; length, 460-290, width, 250-150, height without legs, 250-180.

Aspal region: similar to larva except sensillar setae present.

Notogaster: similar to larva, but with 14 pairs of setae, venter bearing three pairs of short, spiniform pseudoanal (*ps*) setae, and one pair of genital setae as well as one pair of genital sensory organs.

Legs: I with added coxal seta replacing protective seta, for Claparède's organ of larva; leg IV with one coxal seta; hence coxal formula differs from larva, here 3-1-2-1.

Formulae: palpi as in larva, leg solenidia: (2-1-2) (1-1-1) (1-1-0) (0-0-0), leg tarsi with 14-10-10-7 setae.

Deutonymph: while no positively identified deutonymphs were sacrificed for description, sizes of four individuals at various stages of development within the deutonymphal stadium; length, 700-520, width, 350-280, height not measured.

Tritonymph: no specimens were sacrificed for study.

Type data: holotype female and allotype from; 4 miles north of Santa Cruz, Henry Cowell Redwoods State Park, Santa Cruz County, California, March 20, 1957 (N. A. Walker), in coast redwood litter selected at random over a large area to include all apparent microhabitats; type number 2966 in the U. S. National Museum. Paratypes include 83 females and 57 males from the type locality and 357 other specimens reported in distribution records from Santa Cruz and Monterey Counties.

Distribution (see Pl. 14):

ALAMEDA CO.: Oakland, Mountain Boulevard, on the north and south banks of Palo Seco Creek, IX-12-55; X-8-55; S., XI-20-55; N. and S., XII-12-55;

S., I-13-56; S., II-12-56; N. and S., V-18-56; N. and S., VI-11-56; S., VII-13-56; S., VIII-14-56 (N. A. Walker).

DEL NORTE CO.: Smith River, 3.2 miles S., III-22-56 (N. A. Walker). Crescent City, 9.2 miles S., Del Norte Coast Redwoods State Park, III-22-56 (N. A. Walker). Klamath, 1 mile S., IX-20-55 (N. A. Walker).

HUMBOLDT CO.: Klamath, 6.4 miles S., Prairie Creek Redwoods State Park, IX-20-55; III-22-56 (N. A. Walker). Klamath, 8 miles S., Prairie Creek Redwoods State Park, VI-26-53 (J. D. Lattin). Klamath, 18 miles S., IX-19-53 (E. E. Gilbert, R. O. Schuster). Freshwater, VIII-13-53 (G. A. Marsh, R. O. Schuster). Freshwater, 0.6 mile E., III-22-56 (N. A. Walker). Carlotta, 4.1 miles E., IX-20-55 (N. A. Walker). Pepperwood, 2.7 miles N., III-23-56 (N. A. Walker). Pepperwood, 0.2 mile S., IX-5-61 (N. A. Walker). Pepperwood, 6.3 miles S., The Avenue of the Giants, Humboldt Redwoods State Park, III-23-56 (N. A. Walker). Dyerville, 1 mile S., Humboldt Redwoods State Park, IX-19-53 (E. E. Gilbert, R. O. Schuster). Dyerville Bridge, Eel River, 1.7 miles S., Humboldt Redwoods State Park, III-23-56 (N. A. Walker). Weott, 3.7 miles S., S. R. Boardman Grove, Humboldt Redwoods State Park, III-23-56 (N. A. Walker). Miranda, 2.5 miles N., Blair Grove, Humboldt Redwoods State Park, III-23-56 (N. A. Walker). Garberville, 3.9 miles S., III-23-56 (N. A. Walker). Garberville, 5 miles S., Richardson Grove State Park, VII-30-55 (W. R. Kellen). Hartsook Grove, Richardson Grove State Park, IX-19-53 (E. E. Gilbert, R. O. Schuster).

MARIN CO.: Samuel P. Taylor State Park, N. entrance, X-24-53 (V. D. Roth). Samuel P. Taylor State Park, 0.2 mile from ESE. entrance, III-14-57; VII-11-57; VII-23-57; XI-2-57; XI-18-57 (N. A. Walker). Mill Valley, IX-2-53 (G. A. Marsh, R. O. Schuster).

MENDOCINO CO.: Garberville, 11 miles S., III-23-56 (N. A. Walker). Piercy, 6.4 miles S., III-23-56 (N. A. Walker). Fort Bragg, 6.6 miles NE., IV-21-56 (N. A. Walker). Russian Gulch State Park, 2.5 miles into, IV-21-56 (N. A. Walker). Mendocino, 4.7 miles E., IV-21-56 (N. A. Walker). Mendocino, 7.1 miles E., IV-21-56 (N. A. Walker). Navarro, 12.4 miles W., IV-21-56 (N. A. Walker). Navarro, 6.6 miles W., Paul M. Dimmick Memorial Grove State Park, IV-21-56 (N. A. Walker). Yorkville, 26 miles WSW., IV-21-56 (N. A. Walker). Yorkville, 27 miles WSW., IV-21-56 (N. A. Walker).

MONTEREY CO.: Big Sur, 8 miles N., Bixby Creek Canyon, XII-12-53 (1) (M. S. Wasbauer). Pfeiffer-Big Sur State Park, VIII-30-56 (3); III-20-57 (17) (N. A. Walker). Big Sur, 7 miles S., XII-22-53 (22) (V. D. Roth). Big Sur, 14 miles S., XII-22-53 (12) (V. D. Roth). Pfeiffer-Big Sur State Park, 25.3 miles S., VIII-30-56 (50); III-20-57 (111) (N. A. Walker). Pfeiffer-Big Sur State Park, 43 miles S., VIII-30-56 (6); III-20-57 (52) (N. A. Walker).

SAN MATEO CO.: San Mateo County Memorial Park, IV-18-54 (R. O. Schuster, E. E. Gilbert); VIII-31-56 (N. A. Walker).

SANTA CLARA CO.: Mount Madonna, I-6-54 (D. J. Burdick). Saratoga, 4 miles W., VIII-4-57 (B. J. Adelson).

SANTA CRUZ CO.: Santa Cruz, 4 miles N., Henry Cowell Redwoods State Park, VIII-31-56 (59); III-20-57 (142 total, type sample) (N. A. Walker). Mystery Spot, near Santa Cruz, III-27-54 (2) (J. R. Helfer). Santa Cruz, 1 mile N., XII-23-53 (22) (V. D. Roth).

SONOMA CO.: Annapolis, 5.4 miles W., IV-22-56 (N. A. Walker). Annapolis, 3.9 miles SE., IV-22-56 (N. A. Walker). Plantation, 7 miles N., IV-22-56 (N. A. Walker). Plantation, IV-5-56 (D. J. Burdick). Fort Ross State Historical Monument, 0.2 mile S., IV-22-56 (N. A. Walker). Monte Rio, 3.9 miles W., IV-22-56 (N. A. Walker). Monte Rio, 0.9 mile W., IV-22-56 (N. A. Walker). Monte Rio, 1 mile E., IV-22-56 (N. A. Walker). Armstrong Redwoods State Park, III-14-54 (J. R. Helfer). Guerneville, 1.2 miles N., IV-22-56 (N. A. Walker). Guerneville, 2.7 miles E., IV-22-56 (N. A. Walker). Mark West Springs, XII-31-53 (V. D. Roth, G. A. Marsh, R. O. Schuster).

The specific name is derived from the Greek *megas* (m.), *megale* (f.) meaning large or great, with reference to the size of the species.

Analysis of the collection data indicates that *Plesiotritia megale* is a common member of the coast redwood litter community. Judging from the size and the feeding preferences indicated in artificial culture, it is assumed that the preferred food is rather well-decayed wood and compact insect frass, as found in stumps, logs and larger limbs occurring in the upper to middle layers of the forest floor. The distribution pattern suggests that the coast redwood region probably represents the majority of the north-south range of the species and very possibly represents much of the east-west range also. One specimen supposedly taken in Calaveras and two in Tulare County are not represented in the distribution primarily because no others were found in repeated collections; they are regarded as being accidental inclusions, because collections from the coastal area were separated concurrently with sierran collections.

In perhaps 10% of *Plesiotritia megale* adults, the vertical aspal setae tend to be procumbent.

Plesiotritia megale is the only member of the genus encountered in the area surveyed. At the present time it cannot be placed in relation to the other members of the genus, because the characters presumed to be of use in so doing have not been described for the other species.

The number of specimens at a 5% probability level that should be measured to obtain the range in size was calculated (Johnson and Jackson, 1959:488), using the ratio of notogastral height to length; for males "N" was found to be nine, while it was six for females, indicating a greater variability in size among males.

Because it appeared that males were smaller than females, the samples were compared by use of "Student's" *t* test (Goulden, 1952: 56), using the same ratios as before. While the results showed a significant difference at a 5% probability level, they did not prove significantly different at the 2% level. From these results it is concluded that, although males generally appear to be smaller in size, the samples compared are not adequate to establish this beyond question. Using data both of samples from north to south and of different months throughout the year, comparisons were made of possible size variation within and between sexes. The results of these comparisons were negative; it is assumed that *Plesiotritia megale* does not vary markedly in size range throughout either its recorded distribution or in different seasons of the year. A study

of sex ratio data, from samples throughout the recorded range, indicates that males tend to be more abundant in the spring while females predominate to some extent in the fall.

Genus *Oribotritia* Jacot

Morphological characteristics indicate that *O. gibbera* and *O. sellnicki* are more closely related to one another than either is to *O. brachythrix*. The characters shared by the former include; almost all setae long, erect and obvious, aspal lateral carinae lacking, 15 pairs of notogastral, nine genital and four adanal setae; while *O. brachythrix* has short, fine often procumbent setae, a single aspal lateral carina present, 14 pairs of notogastral, five genital and three adanal setae. However, *O. gibbera* has three anal setae and is humpbacked while *O. sellnicki* has a single anal seta and is rounded above in lateral view. *O. brachythrix* is rather closely related, morphologically, to some of the species of eastern North America. Characteristics considered of major importance in ranking these species, from simpler to more advanced, include: the character of the ovipositor; the setal patterns of the ovipositor, anal and adanal regions, and the notogaster.

Two of the three species proposed, *O. gibbera* and *O. brachythrix*, are found under both *Sequoia sempervirens* and *S. gigantea* while *O. sellnicki* is restricted in its known distribution to the coastal region under *S. sempervirens*.

Key to the *Oribotritia* species from *Sequoia* litter

1. Notogastral and aspal setae erect, obvious, long; aspal carinae lacking; with anal setae 2
— Notogastral and aspal setae procumbent, inconspicuous, fine, short; with single lateral aspal carina; anal setae lacking ..... *brachythrix*
2. In lateral view with definite hump on notogaster dorsum; with 7 setae on posterior ventral plates; with 6 coronal ovipositor setae ..... *gibbera*
— In lateral view notogaster smoothly rounded; with 5 setae on posterior ventral plates; with apparently 8 coronal ovipositor setae ..... *sellnicki*

Oribotritia gibbera sp. n.

(Pls. and figs. 15, A-E; 16, A-D; 17; 18; 19)

Diagnosis: moderately large in size, with moderately long, recurved, slightly ciliate sensilli; no aspal carinae present; aspal setae in nearly perfect axial rows; 15 pairs of long notogastral setae; 9 rather short genital, 2 somewhat longer aggenital, 4 long adanal, 3 medium to long anal setae; ovipositor setae *od*:4 lacking, 6 coronal setae.

Adult: medium to dark tannish-brown, large, smooth, shiny. Setae long, rather stout, with acuminate tips, generally slightly spiculate on region between one-half to three-quarters their length, standing out from body. No obvious sculpturing but with light surface shagreening.

Female size range: notogaster length 1365-915, height 936-658, width 866-603; aspis length 617-471, height 215-180, width 430-333; 13 specimens measured.

Male size range: notogaster length 1317-888, height 845-534, width 818-478; aspis length 610-432, height 215-152, width 430-271; 12 specimens measured.

Sex ratio: 51% males among 74 specimens from seven samples.

Aspis: 560 long, 230 high, 430 wide. Rim narrow posteriad, very narrow latero-anteriad. Lacking aspal ribs, median and lateral carinae. Rostral setae semi-erect, slender, curving somewhat mesad, shorter than other aspal setae, 245; in lateral view insertions rather high on rostrum. Lateral setae erect, slender, slightly undulating, longer than rostrals but shorter than verticals, 320; insertions nearly equidistant between rostrals and verticals. Vertical setae erect, strong, rather undulate, as long, 370, as longest notogastral setae; insertions slightly more laterad than rostrals or laterals. Exobothridial setae fine, straight, spiculate to barbed, approximately 90 long; insertions low, near marginal rim, even with anterior margin of bothridia. Bothridia lobulate internally, opening centered, rather large, obvious in dissected specimens. Scale latero-posteriad from bothridial opening, smooth posteriad, with a basal bulge anteriad. Sensillus slender basally, slightly thicker in distal half due to very short spiculae, relatively short, about 140, with rather abrupt ensiform tip; in unmounted specimens sinusoid recurved, directed laterad, posteriad, then laterad and slightly dorsad, in mounted specimens frequently only undulating.

Notogaster: 1200 long, 830 high, 780 wide, giving humpbacked impression, drawn specimen possibly somewhat widened by compression. In lateral view very frequently with noticeable hump at center of dorsal line. With rather prominent lapet, without marked sclerotization, and nonpronounced sensillar notch and collar. With 15 pairs of long, 315-370, undulating, erect setae, save for *ps*:3 being shorter and slighter, all usually spiculate but with occasional exceptions. Seta *f*:1 vestigial, less distinct than fissures. Lateral gland present, some specimens with two extra pores close beside and below it. Fissures present, usually obvious.

Ventral plates: approximately 970 long, 130 wide, extend posteriorly up nearly to mid-line; in whole mount lateral view frequently retracted sufficiently to be hidden by ventral margin of notogaster. Genital plate with very slight constriction at anterior external end, 25, inflected; with nine, rarely eight or ten, finely setiform setae, 50-65 long. Aggenital portion of aggenito-adanal plate with two very fine, smooth, slender, rather long setae; *ag*:1 about 50 long; *ag*:2 about 65 long. Incision between aggenital and adanal portions nearly lacking. Adanal region with four slightly spiculate, acuminate setae; *ad*:1, 245 long; *ad*:2, 150 long; *ad*:3, 140 long; *ad*:4, 300 long, spiculate. Fissure *iad* rather inconspicuous, located antero-laterad from *ad*:1. Anal plate rod-like, with three finely spiculate, acuminate setae, somewhat shorter than adanals; *a*:1,2 about 100 long; *a*:3, 230 long, slightly more spiculate, inserted midway between *a*:2 and *ad*:4.

Ovipositor: with very faint irregular wavy pattern of striations. All setae spiniform, stout at base, tapering to sharp point and curving slightly. Dorsal lobes with three setae each, arranged in triangle; *od:*1 slightly stronger than others, 21 long; *od:*2 somewhat slighter, perhaps 20 long; *od:*3 slightest, about 18 long, inserted directly laterad of *od:*2; *od:*4 lacking. Ventral lobe with two pairs of setae; *ov:*1 similar to *od:*1 in size and appearance; *ov:*2 slightly shorter than *od:*3, 13 long. Proximal row of six coronal setae spiniform, lengths vary, 13-17.

Male genitalia: setae short, 15-25, usually clearly differentiated, sharply spiniform, nearly straight.

Gnathosoma: chelicerae 300 long, 140 high; with spiculae about 5 long; setae similar, 50 long, simple, rather stout, almost bluntly spiniform, curving slightly. Infracapitulum normal. Palpal trochantero-femoro-genu showing evidence of femoro-genual fusion. Two of palpal tarsal eupathidia fused basally, sharing common insertion; disti-medial seta very small, 16 long, slight, other setae larger, spinose; solenidion rather fine.

Legs: lateral claws broadened slightly toward sharp tip, about one-third as wide as stout median claw. Famulus relatively long, 33, slender, erect, slightly rugose, almost straight. Genual pore not evident.

Eggs: an average of 9.3 primova and deutova per specimen with range of zero to 16 found in ten females examined (see Pls. 17, 18).

Immatures: not seen.

Type data: holotype female and allotype from; 3.7 miles south of Weott, Humboldt State Redwoods Park, north edge of Samuel R. Boardman Grove, Humboldt County, California, March 23, 1956 (N. A. Walker), in damp coast redwood litter and humus washed into a trough-like depression but above usual flood line of the South Fork, Eel River; type number 2967 in the U. S. National Museum. Paratypes include 21 females and 24 males, same data as above, and all other specimens listed in distribution record from Humboldt County.

Distribution (see Pl. 19):

Contra Costa Co.: Redwood Regional Park, V-18-53 (E. E. Gilbert, R. O. Schuster).

Del Norte Co.: Crescent City, 9.2 miles S., Del Norte Coast Redwoods State Park, III-22-56 (N. A. Walker). Klamath, 1 mile S., III-22-56; IX-5-61, litter, decayed redwood log (N. A. Walker).

Humboldt Co.: Klamath, 8 miles S., Prairie Creek Redwoods State Park, VI-26-53 (3) (J. D. Lattin). Klamath, 18 miles S., IX-19-53 (1) (E. E. Gilbert, R. O. Schuster). Freshwater, VIII-13-53 (4) (G. A. Marsh, R. O. Schuster); X-10-53 (1) (J. W. MacSwain). Carlotta, 4.1 miles E., IX-20-55, rather coarse redwood litter (1) (N. A. Walker). Dyerville, 1 mile S., Humboldt Redwoods State Park, IX-19-53 (10) (E. E. Gilbert, R. O. Schuster). Dyerville Bridge, Eel River, 1.7 miles S., Humboldt Redwoods State Park, III-23-56, redwood litter, humus, decayed wood, moss (1) (N. A. Walker). Weott, 3.7 miles S., S. R. Boardman Grove, Humboldt Redwoods State Park, III-23-56, redwood litter, humus, (type sample) (N. A. Walker). Franklin Lane Grove, Humboldt Redwoods State Park, X-10-53 (4) (J. W. MacSwain). Garberville, 3.9 miles S., III-23-56, mixed redwood and other litter, humus (35) (N. A. Walker).

Mariposa Co.: Yosemite National Park, Mariposa Grove, V-26-56 (N. A. Walker).

Mendocino Co.: Garberville, 11 miles S., III-23-56 (N. A. Walker). Piercy, 14.7 miles S., III-23-56, redwood litter, humus (N. A. Walker). Laytonville, 13.3 miles W., Admiral William H. Standley State Park, IX-5-61, very dry

redwood litter (N. A. Walker). Fort Bragg, 28 miles E., IV-20-56, redwood litter, decayed wood (N. A. Walker). Yorkville, 6 miles WSW., IV-21-56, redwood litter, humus (N. A. Walker).

PLACER CO.: Foresthills, 27 miles E., Placer County Big Trees Park, (American River Grove) VI-19-58 (N. A. Walker).

SANTA CRUZ CO.: Boulder Creek to Big Basin State Park, III-27-54 (J. R. Helfer).

TULARE CO.: Sequoia National Park, Giant Forest, III-18-55 (M. S. Wasbauer, P. D. Hurd, Jr.). Deer Creek Grove, V-24-56 (N. A. Walker).

TUOLUMNE CO.: Calaveras Big Trees State Park, South Grove, VI-8-57, litter, humus, all sides of tree (N. A. Walker). Yosemite National Park, Tuolumne Grove, V-26-56; VI-11-57, litter, humus, on all sides of tree but east, 5900 feet elevation (N. A. Walker).

Non-redwood distribution:

SHASTA CO.: Hat Lake, Lassen National Forest, VI-13-54, poplar, fir litter (R. O. Schuster).

The specific name is derived from the Latin *gibber, -a, -um,* meaning humped or humpbacked.

Analysis of the distribution data shows that this species is found throughout the range of the Sierra redwood, and in the northern portion of the coast redwood range, with only one sample reported from the southern region. Also reported is one non-redwood sample from an area between the two study areas. These data indicate that the reported distribution includes the southwestern portion of the range of the species. The data of individual collections, as well as the sierran distribution, indicate that this species is frequently found in rather dry areas.

Both sexes may be somewhat smaller toward the southern coastal region and in the eastern portions of the distribution; the dorsal notogastral hump tends to be reduced in the sierran specimens.

Oribotritia sellnicki sp. n.

(Pls. and figs. 20, A-E; 21; 22)

Diagnosis: moderately large in size with moderately long, simple sensilli enlarged slightly toward middle; no aspal carinae present; rostral and lateral setae more approximate than are verticals but in axial rows; 15 pairs of rather long notogastral setae; 9 short genital, 2 rather short aggenital, 4 moderately long adanals, 1 moderately long anal setae; ovipositor setae *od:*4 so situated as to appear associated with 6 coronal setae.

Adult: medium tan, moderate in size, smooth, slight shagreening overall. Setae very finely spiculate on distal two-thirds, long, slender, standing out from body.

Female size range: notogaster length 1143-679, height 832-520, width 832-492; aspis length 582-402, height 222-132, width 416-263; 13 specimens measured.

Male size range: notogaster length 832-624, height 561-444, width 554-423; aspis length 423-347, height 152-125, width 277-270; 14 specimens measured.

Sex ratio: 44% males among 173 specimens from seven samples.

Aspis: 465 long, 175 high, 320 wide (not compressed). Rim narrow posteriad, nearly lacking latero-anteriad. Lacking aspal ribs, median and lateral carinae. Rostrum rather high. Rostral setae erect for rostrals, slender, curving mesad, very finely, sparsely spiculate, 155, longer than distance from insertion to anterior margin; laterally inserted high in apparent line with others, dorsally inserted more mesad and posteriad than usual. Lateral setae erect, slightly undulate, spiculate, longer than rostrals, 220; much more mesad than usual. Vertical setae erect, slightly undulate, spiculate, longer than laterals, 295. Exobothridial setae fine, sparsely spiculate, short, 50; in lateral view insertions low. Bothridia with finger-like lobes pointing primarily antero-laterad; opening large, centered, often not obvious in unmounted specimens. Scale below bothridia with apex posteriad to sensillar opening, anterior margin even with anterior margin of opening, smoothly rounded posteriad, slightly lobulate or recurved anteriad. Sensillus bladelike, wider toward middle, with sharp point, 125 long, very slightly roughened surface; not particularly obvious in lateral view, projecting nearly straight laterad, dorsally curving slightly postero-dorsad, then nearly laterad.

Notogaster: 855 long, 600 high, 590 wide, somewhat lemon-shaped. Lapet relatively pronounced, definite sensillar notch, nonprominent collar. With 15 pairs of slender, erect, slightly undulate, fine, sparsely spiculate, acuminate setae; mesal row longer, 180-230, than lateral, 90-115, or ventral, 80-115, rows. Setae *c*:3 and *d*:3 inserted somewhat more dorsad than usual. Setae *f*:1 vestigial, more distinct than fissures. Lateral gland with two additional pores anteriad and ventrad to it. Fissures present, obvious.

Ventral plates: about 650 long, 110 wide, extend postero-dorsally about one-third of notogastral height; in whole mount lateral view often withdrawn sufficiently to hide setal insertions, much of aggenital portion and genital plate frequently covered by posteriad directed leg IV. Genital plate anteriorly somewhat narrower than posterior margin, inflexed portions fused at inward tip, making dissection without damage difficult; with nine short, fine, nearly straight setae, 20-25 long; *g*:1 inserted at posterior margin of overhanging bar of genital plate; *g*:2-9 inserted about a setal length apart, near mesal margin; *g*:9 inserted posteriad about four-fifths of plate length. Aggenital portion of aggenito-adanal plate prominent, with mesad projecting bar above anterior inflexion of genital plate, bar with interlocking device composed of notch and expanded lobe; with two very fine, short, 35, setae; *ag*:1 inserted nearly in antero-lateral corner of plate; *ag*:2 inserted almost directly posteriad. Incision between aggenital and adanal portions of plate inconspicuous. Adanal region with four setae, increasing in length posteriad, all slender, fine, smooth, acuminate; *ad*:1 rather short, 45, inserted near anal plate margin; *ad*:2 slightly longer, 50; *ad*:3 curved, perhaps 60 long; *ad*:4 longer, 150. Fissure *iad* often antero-laterad to *ad*:1, near lateral margin. Anal plate rod-like, bearing only one seta, similar to adanals, 70 long; insertion two-thirds length of plate posteriad, distance between *a*:1 and *ad*:3 equal to *ad*:1 to *ad*:2.

Ovipositor: with definite herringbone striae pattern on membranous lobe surfaces. Dorsal lobes pointed, slightly longer than ventral lobe, with four setae each, three arranged in distal triangle; *od*:1 straight to somewhat sinu-

ously curved depending on aspect, with mesal basal enlargement then tapering smoothly to sharp point, rather short, 60, inserted slightly proximo-laterad from tip of lobe; *od*:2,3 stout, spiniform, with sharp tip, short, 24, *od*:2 inserted its length directly proximad from *od*:1, *od*:3 inserted in transverse line laterad of *od*:2 on or nearly on latero-mesal surface of lobe; *od*:4 short, similar to *od*:2 and indistinguishable from *k*:1-6, inserted at base of lobes in line with coronal (*k*) setae. Ventral lobe rounded, bilobulate distally, setae in two paraxial rows; *ov*:1 nearly straight, similar to *od*:1 but slightly longer, 66, inserted on tips of lobe; *ov*:2 similar to *od*:2 but with blunt tip, also inserted on papillae, less than its length directly proximad of *ov*:1. Six coronal setae similar to *od*:2, apparently eight because of proximad insertions of *od*:4.

Male genitalia: setae short, 15-20, sharply spiniform, similar to those of *Oribotritia gibbera.*

Gnathosoma: chelicerae 270 long, 140 high; spicules on fixed digit somewhat stronger than usual, 5-7 long, very sharply pointed, nearly spiniform; setae sharp, not stout, *cha* straight, rather fine, short, 20, *chb* longer, 45, with 30° bend at midpoint, stronger than *cha.* Palpi three segmented, with feeble dorsal indication of differentiation at line of fusion of femoro-genu; tarsal disti-medial seta very fine, 24 long, setiform, acuminate; eupathidia separate at bases; solenidion strong.

Legs: lateral claws narrow, central claw strong, leg IV tarsus with eupathidiform ventral and terminal setae smooth, stout, strong. Famulus short, 15, slender, erect, slightly curved, slightly rugose.

Eggs: an average of 3 per specimen, with range of zero to six found in 39 females examined; deutova common, about 370 long, 185 wide, elongate ovoid with rounded, slightly roughened base and broadly pointed apex, shell showing narrow sub-parallel crenulate, punctate ridges, ending before the smooth apex, moderately heavily sclerotized (Pl. 21).

Larva: similar in general appearance to *Plesiotritia megale;* decayed prior to detailed study; nymphs unknown.

Type data: holotype female and allotype from; 9.2 miles south of Cresent City, Del Norte Coast Redwoods State Park, Del Norte County, California, March 22, 1956 (N. A. Walker), in mixed, thin, damp litter under coast redwood, other evergreen and deciduous trees and understory plants; type number 2968 in the U. S. National Museum. Paratypes include 17 females and 9 males, same data as above, and all other specimens listed in distribution records from Del Norte County.

Distribution (see Pl. 22):

Del Norte Co.: Smith River, 3.2 miles S., III-22-56, litter (12); decayed wood, stump, humus, soil (6) (N. A. Walker). Fort Dick, 2 miles N., XI-21-53 (73) (V. D. Roth). Fort Dick, 0.8 mile S., III-22-56, decayed redwood, litter (130) (N. A. Walker). Fort Dick, 1 mile S., IX-20-55 (16) (N. A. Walker). Crescent City, 5.9 miles S., III-22-56 (9) (N. A. Walker). Crescent City, 9.2 miles S., Del Norte Coast Redwoods State Park, III-22-56 (type sample) (N. A. Walker).

Humboldt Co.: Klamath, 6.4 miles S., Prairie Creek Redwoods State Park, III-22-56 (N. A. Walker). Klamath, 16 miles S., IX-5-61, decayed redwood, dry litter (N. A. Walker). Klamath, 18 miles S., IX-19-53 (E. E. Gilbert, R. O. Schuster). Freshwater, VIII-13-53 (G. A. Marsh, R. O. Schuster). Freshwater, 0.6 mile E., III-22-56, redwood litter, decayed log (N. A. Walker). Carlotta, 4.1 miles E., IX-20-55; III-22-56 (N. A. Walker). Pepperwood, 0.2 mile S., IX-5-61, dry redwood litter, decayed branches

(N. A. Walker). Pepperwood, 6.3 miles S., The Avenue of the Giants, Humboldt Redwoods State Park, III-23-56, litter, humus, decayed wood (N. A. Walker). Weott, 3.7 miles S., S. R. Boardman Grove, Humboldt Redwoods State Park, III-23-56 (N. A. Walker).

MARIN CO.: Samuel P. Taylor State Park, N. entrance, X-24-53 (V. D. Roth). Samuel P. Taylor State Park, 0.2 mile from ESE. entrance, XI-8-53 (E. E. Gilbert, V. D. Roth, G. A. Marsh, R. O. Schuster); VII-5-56, well-decayed redwood log; redwood tree hole litter; decayed redwood log; different redwood tree hole and well-decayed logs; litter; litter and redwood log (E. E. Gilbert, N. A. Walker); III-14-57, decayed redwood logs, litter; VII-11-57, redwood litter, decayed log; VII-23-57; XI-2-57 (N. A. Walker). Muir Woods National Monument, II-11-53 (R. Wagner); I-10-54 (N. A. Walker).

MENDOCINO CO.: Fort Bragg, 13 miles E., IV-20-56 (N. A. Walker). Fort Bragg, 15 miles E., IV-20-56 (N. A. Walker). Russian Gulch State Park, 2.5 miles into, IV-21-56 (N. A. Walker). Mendocino, 4.7 miles E., IV-21-56 (N. A. Walker). Mendocino, 5.5 miles E., IV-21-56 (N. A. Walker). Navarro, 6.6 miles W., Paul M. Dimmick Memorial Grove State Park, IV-21-56 (N. A. Walker). Yorkville, 27 miles WSW., IV-21-56 (N. A. Walker).

MONTEREY CO.: Big Sur, 8 miles N., Bixby Creek Canyon, XII-12-53 (M. S. Wasbauer).

SAN MATEO CO.: San Mateo County Memorial Park, IV-18-54 (E. E. Gilbert, R. O. Schuster); VIII-31-56 (N. A. Walker).

SANTA CRUZ CO.: Mystery Spot, near Santa Cruz, III-27-54 (J. R. Helfer).

SONOMA CO.: Monte Rio, 0.9 mile W., IV-22-56 (N. A. Walker). Armstrong Redwoods State Park, III-14-54 (J. R. Helfer).

The specific name is derived from and in honor of Dr. Max Sellnick, an outstanding student of the group.

The distribution data indicate that this species is restricted to a relatively humid habitat as indicated by its more frequent occurrence toward the central and northern areas of the coast redwood range and its absence in the Sierra redwood area. For this reason, the distribution reported is assumed to represent only the southern portion of the species range. Collection data suggest that *Oritotritia sellnicki* is associated with decaying wood rather than humus.

Observations, of the presence of primova and deutova in preserved specimens, indicate that the peak of oviposition activity is reached in April or May under natural conditions.

Oribotritia brachythrix sp. n.

(Pls. and figs. 23, A-E; 24, A-D; 25; 26)

Diagnosis: relatively smaller in size, with short, stout, scrimitar-like sensilli with barbs on membraneous portion; singe aspal carina present; longer rostral and lateral setae in transverse row with short verticals posteriad of laterals; 14 pairs of fine, short, inconspicuous notogastral setae; 5 short, fine genital, 2 short, fine aggenital, 3 moderate to rather long adanal and no anal setae; ovipositor setae *od*:4 lacking, with 6 coronal setae.

Adult: yellowish, moderate to small in size. Setae very thin, difficult to see, in general short. Smooth and shiny in alcohol, very finely punctate after clearing and under higher magnifications.

Female size range: notogaster length 762-554, height 547-347, width 527-374; aspis length 353-305, height 159-83, width 277-229; 13 specimens measured.

Male size range: notogaster length 658-428, height 437-304, width 437-267; aspis length 347-244, height 125-92, width 236-184; 12 specimens measured.

Sex ratio: 46% males among 173 specimens from seven samples.

Aspis: broad and low, 345 long, 130 high, 260 wide. Sculpturing general, in dorsal view more obvious mesally and basally. Rim narrow posteriad, almost lacking latero-anteriad. Lacking aspal ribs, median carinae. Lateral carina single; in lateral view sharply delimited. Rostrum low, flat. Rostral setae appressed, not seen laterally, straight, slender, long acuminate, 90; insertions unusually approximate and proximal. Lateral setae straight, setiform, slender, length equal to rostrals, 90; insertions rather anteriad and remote. Vertical setae fine, bent almost at right angle midway of length in lateral view, in dorsal view nearly straight, appressed, short, 40; insertions inconspicuous dorsally. Exobothridial setae straight, setiform, fine, as long as verticals. Bothridia relatively far forward on aspis, nearly one-third aspal length anteriad to posterior margin, rather high on aspis in lateral view, due to flatness of aspis; internal lobulations numerous, finger-like; opening large, oval, at angle to lateral margin. Scale in lateral view obvious, an obtuse triangle below, slightly behind bothridial opening, dorsally continued from fine carinae extending from postero-lateral corner, sloping gently outward to mammiliform tip, then sharply rejoining aspal margin. Sensilli relatively short, 70, in lateral view recurved dorsad, in dorsal view straight, slanting slightly anteriad, with stronger core extending five-sixths of length, sharp, continued by thinner, more fragile, serrate, sharply pointed tip.

Notogaster: 715 long, 515 high, 450 wide (possibly flattened slightly) giving a high, thin appearance in alcohol. With moderately produced lapet, slight sensillar notch, collar not well delimited. Ventrally with rather narrow opening. Sculpturing even overall. Setae very thin, difficult to observe in nonpermanent mount, usually recurved basally with acuminate tip, appressed or directed outward; 14 pairs, smooth setae, short, about 50; insertions obvious; *d*:3 more dorsad than usual. Setae *f*:1 vestigial, insertions obvious but smaller than others. Lateral gland markedly anteriad and ventrad of usual position, below *d*:3, with accessory pores closely adherent, one on anteriad, other on ventrad margin. Fissures present, obvious.

Ventral plates: in whole mount lateral view usually so retracted that little can be seen, in ventral view, rather narrow, 80, but long, 530, plates appearing almost fused at meeting of genital and anal plates. Incision dividing aggenital and adanal portions of plate practically absent. Genital plate as broad anteriad as posteriad, with five setae, fine, slightly curved posteriad, short, 15; *g*:1 inserted at edge of overlapping flap of aggenital region. Aggenital region of aggenito-adanal plate with a protruding rim extending over anterior inflexed portion of genital plate; with two fine, slight setae; *ag*:1 short, 9, inserted toward antero-lateral corner, one-third of plate width from lateral border, in transverse line with *g*:1; *ag*:2 longer, 23, inserted one-half of plate width from lateral margin. Adanal region with three fine, acuminate setae, inserted very near anal plate margin; *ad*:1 erect, 25 long; *ad*:2 erect, 50 long; *ad*:3 erect but curved posteriad, about 70 long. Fissure *iad* inserted posteriad one-tenth length of adanal portion and equidistant from meso-lateral margins. Anal plates rod-like, covered anteriorly by genital plate, setae lacking completely.

Ovipositor: with normal herringbone plicate pattern. Setae rather large for size of species, spiniform, smaller setae with inconspicuous bases, larger bases not as prominent as in *Oribotritia gibbera.* Surfaces of coaptation sclerotized somewhat. Dorsal lobes with setae in triangle; *od*:1 strongest, 60 long, inserted nearly on tip of lobe; *od*:2 intermediate in length, 34; *od*:3 relatively straight with sharp tip, shortest, 20, inserted laterad of and slightly distad of *od*:2 on very lateral margin of lobe in dorso-ventral aspect; *od*:4 lacking. Ventral lobe setae in paraxial rows; *ov*:1 strongly recurved basally, as long and strong as *od*:1, inserted at tip of lobe; *ov*:2 straight to slightly curved, like *od*:2, inserted less than its length directly proximad from *ov*:1. Coronal setae six, 13-18 long, spiniform, inserted on base of dorsal lobes.

Male genitalia: ventral lobe very slightly sclerotized laterally, distal ventral lobe setae slightly shorter, 10, than all other setae, 13, all sharply spiniform.

Gnathosoma: chelicerae 220 long, 90 high, hence elongate; dorso-laterad surfaces with very sparse spiculae, 2-3 long; setae *cha* slightly curved, setiform, bare, with dull point, 30 long, *chb* similar, perhaps slightly longer. Lateral bulge of genae unusually large, almost square. Three segmented palpi with no trace of lines of fusion in trochantero-femoro-genu; larger setae strongly barbed; disti-medial seta relatively long, 29, fine, straight; all tarsal eupathidia distinct, separately inserted.

Legs: lateral claws perhaps one-third as heavy as stout median claw; all tarsi rather slender, particularly leg III, compared with other species. Famulus rather slender, moderately long, 21, sharp tip, with sharp spur at nearly two-thirds length distad.

Eggs: an average of 3.5 per specimen, with range of one to eight found in ten females examined; deutovum an elongate ovoid, slightly larger at one end than at other, outside of shell deeply, brokenly, infolded in relatively straight rows, the larger end with strongest, squarely lobulate projections (Pl. 25). Six found in drawn specimen, size (maximum, average, minimum), 276, 265, 248 long, 170, 160, 154 wide.

Larva and nymphal stages unknown.

Type data: holotype female and allotype from; 0.2 mile from ESE. entrance of Samuel P. Taylor State Park, Marin County, California, March 14, 1957 (N. A. Walker), in moderately dry decayed coast redwood log; type number 2969 in the U. S. National Museum. Paratypes include 26 females and 18 males, data as above, and all others from the same locality as listed in distribution records.

Distribution (see Pl. 26):

Alameda Co.: Oakland, Mountain Boulevard, on the north and south banks of Palo Seco Creek, V-26-55; N., I-13-56; N. and S., II-12-56; N., III-12-56; S., VI-11-56; S., VII-13-56 (N. A. Walker).

Contra Costa Co.: Redwood Regional Park, V-18-53 (E. E. Gilbert, R. O. Schuster).

Del Norte Co.: Crescent City, 5.9 miles S., III-22-56 (N. A. Walker). Crescent City, 9.2 miles S., Del Norte Coast Redwoods State Park, III-22-56 (N. A. Walker).

Fresno Co.: McKinley Grove, VI-12-57, primarily from protected, damper, north and east sides of trees (N. A. Walker).

Humboldt Co.: Garberville, 3.9 miles S., III-23-56 (N. A. Walker).

Marin Co.: Samuel P. Taylor State Park, 0.2 mile from ESE. entrance, XI-8-53 (17) (E. E. Gilbert, V. D. Roth, G. A. Marsh, R. O. Schuster); VII-5-56, well-decayed redwood log (43); redwood tree hole litter (3) (E. E. Gilbert, N. A. Walker); III-14-57, rather moist well-decayed redwood log

(20); rather moist not well-decayed redwood log (2); dryer well-decayed redwood log (type sample); redwood litter (2); VII-16-57, redwood litter, non-redwood log (14) (N. A. Walker). Woodacre, 0.4 mile S., XI-1-53 (E. E. Gilbert, V. D. Roth, G. A. Marsh, R. O. Schuster). Mill Valley, IX-2-53, redwood, laurel litter (G. A. Marsh, R. O. Schuster).

MENDOCINO CO.: Russian Gulch State Park, 2.5 miles into, IV-21-56 (N. A. Walker). Mendocino, 6.6 miles E., IV-21-56 (N. A. Walker). Yorkville, 6 miles WSW., IV-21-56 (N. A. Walker). Yorkville, 27 miles WSW., IV-21-56 (N. A. Walker).

NAPA CO.: Oakville, III-14-54 (J. R. Helfer).

SAN MATEO CO.: San Mateo County Memorial Park, IV-18-54 (R. O. Schuster, E. E. Gilbert).

SANTA CLARA CO.: Saratoga, 4 miles W., VIII-4-57 (B. J. Adelson).

SANTA CRUZ CO.: Redwood Estates, near Holy City, III-27-54 (J. R. Helfer).

SONOMA CO.: Annapolis, 3.9 miles SE., IV-22-56 (N. A. Walker). Monte Rio, 3.9 miles W., IV-22-56, decayed redwood log, litter (N. A. Walker). Mark West Springs, XII-31-53 (V. D. Roth, G. A. Marsh, R. O. Schuster); III-14-54 (J. R. Helfer).

TULARE CO.: Camp Nelson, 1 mile E., Belknap Camp Ground, VI-13-56 (N. A. Walker).

The specific name is derived from the Greek *brachys* + *thrix* (f.) meaning short + hair.

Study of the distribution data results in the conclusion that this species is more commonly found in the somewhat dryer collection areas; it is notably lacking in collections from the humid area of heaviest concentration of coast redwoods in Humboldt and northern Mendocino Counties. It is also possible that *Oribotritia brachythrix* is primarily associated with some plant other than *Sequoia;* such an association could also explain the absence of the species under nearly pure redwood stands. The recorded distribution apparently represents the western, and possibly southern, portion of the range of *O. brachythrix*. The data associated with the type collection strongly suggests that this species is an inhabitant of well-decayed wood.

Family Euphthiracaridae Jacot

Although all of the species discussed here have 14 pairs of notogastral setae, it is not noted as a characteristic of the family, because some earlier authors give only approximations of the numbers of these setae, and I have not yet seen all of these species to determine the actual numbers. The numbers of notogastral setae vary in the other families and may do so in this taxon.

Under low magnifications as in sorting samples in alcohol, the smaller species of *Euphthiracarus* can be mistaken for *Rhysotritia* species; the opposite identification error is rarely made. With practice, one notes that the interlocking triangle of *Euphthiracarus* species is somewhat longer, in relation to the size of the mite, than is that of *Rhysotritia.*

Genus *Euphthiracarus* Ewing

The species of *Euphthiracarus* treated here may be segregated into groups of species on two criteria, by length of the vertical aspal setae relative to the length of the notogastral setae, and upon the presence or absence of a lateral pocket on the aggenital plate region. The groupings based upon the different criteria are not identical. In the group of new species with vertical aspal setae clearly longer than the notogastral setae are: *E. alazon, E. monyx, E. tanythrix tanythrix* and *E. tanythrix sierriensis;* while those having the vertical setae shorter than the notogastrals, or equal in length but depressed toward the aspis, include: *E. cernuus, E. polytretos* and *E. longirostralis.* Those species with the lateral pocket present include: *E. monyx, E. tanythrix tanythrix, E. t. sierriensis* and *E. cernuus;* and those without the lateral pocket include: *E. longirostralis, E. polytretos* and *E. alazon.* Previously described American species are generally so poorly defined and figured that they cannot be accurately placed in these groupings. Neither set of criteria alone is of sufficient taxonomic importance to propose subgeneric rank for the groupings now, but they may be helpful in the future.

Characteristics considered of major importance in ranking these species, from simpler to more advanced, include: the presence or absence of the lateral pocket, the setal patterns of the ovipositor and exobothridial setae, and the number of claws on the legs.

Euphthiracarus species are commonly found in well-decayed wood, although the ecological preferences of the group were not specifically investigated. The genus shows a preference for relatively humid habitats.

Key to the *Euphthiracarus* species from *Sequoia* litter

1. Vertical aspal setae obviously longer than notogastral setae, verticals erect 2
— Vertical aspal setae shorter than or equal to notogastral setae, if equal in length then verticals depressed toward aspis at 60° angle 5
2. With lateral pocket on aggenital plate portion of ventral plate 3
— Without lateral pocket on ventral plate (legs with one claw) ..... *alazon*
3. Lateral pocket rather short, almost as broad as long; legs with one claw ..... *monyx*
— Lateral pocket clearly longer than wide; legs with three claws 4
4. Sensillus with few fine spiculae; vertical aspal setae slender, few spiculae, long; genital setae gradually becoming longer from *g*:1-9; from coastal area ..... *tanythrix tanythrix*
— Sensillus with brush-like spiculation; vertical aspal setae more obviously spiculate, long; genital seta *g*:7 somewhat, *g*:8,9 abruptly longer than other genital setae; from sierran area ..... *tanythrix sierriensis*

5. With narrow lateral pocket; vertical aspal setae not erect, depressed toward aspis ..... *cernuus*
— Without vestige of lateral pocket; vertical aspal setae short, erect 6
6. All aspal setae very fine, slender, with few, fine spiculae; sensillus with enlarged bulb-like tip, ciliate fringe on distad margin of bulb; sculpturing very strong, depressions deep ..... *polytretos*
— All aspal setae strong, appearing almost stubby, strongly spiculate; sensillus with tuft of spiculae at tip but not enlarged; sculpturing moderate in intensity and depth ..... *longirostralis*

Euphthiracarus longirostralis sp. n.

(Pls. and figs. 27, A-F; 28)

Diagnosis: moderate in size; surface reticulation of shallow, well defined pockets containing tiny pores; sensilli gradually tapering to brushy ciliate tip; rostral seta plain, longer than the rather short, erect, slightly plumose laterals and verticals; notogastral setae similar to, slightly longer than verticals; ventral plate pocket lacking; legs with three claws; ovipositor lobe setae *od*:3,4 and *ov*:2 nearly vestigial.

Adult: off white to pale yellow or tan, reddish tan on heavily sclerotized margins, moderate in size; setae stout, rather blunt, spiculate to barbate. Sculpturing on notogaster of rather deep circular depressions, about equal in diameter to fissures, with six or seven punctations in bottom, frequently not apparent in permanently mounted specimens, also minute spiculate protuberances on all external surfaces.

Female size range: notogaster length 679-554, height 478-374, width 485-360; aspal length 353-277, height 152-132, width 249-208; 12 specimens measured.

Male size range: notogaster length 638-492, height 485-367, width 444-353; aspis length 340-277, height 132-90, width 249-194; 11 specimens measured.

Sex ratio: 38% males among 115 specimens from two samples.

Aspis: 330 long, 130 high, 215 wide. Sculpturing of tiny tubercules on dorsal surface to major lateral carinae, smooth below. Posterior rim narrow, about 7, with single median rib, equal in width; lateral rim narrow, slight; anterior rim nearly lacking. Median carina lacking. Lateral surface with two carinae, major carina relatively strong in lateral view, may be irregular or interrupted near bothridium, may continue dorsad of bothridium to end on posterior bothridial margin; minor lateral carina thin, weak in lateral view, questionably present in some. Central rib present, in lateral view extending dorsad to major lateral carina as strong, demarked sclerotized bar, then continuing dorsad somewhat weaker; in dorsal view, posterior margin particularly well demarked, less than setal length anteriad to laterals, first apparent anterior margin being slightly anteriad to posterior margin, about at tips of laterals, second anterior margin beginning near level of latero-anterior notch, running meso-anteriad slightly before rostral insertions. Rostral setae setiform, with few very fine, slight spiculae, nearly smooth, with acuminate tip, emerging at near 45° angle from aspis, directed anteriad, curving to roughly parallel rostral curve, about 40 long; insertions high on rostrum, approximate, less than setal length apart. Lateral setae short, 25, stocky, stout, straight, tip so blunt appearing broken, strongly barbed on distal one-half, emerging about 60°

angle to aspis; insertions moderately high on aspis in lateral view, dorsally less approximate than rostrals. Vertical setae similar to laterals, more strongly barbed, emerge nearly vertically, slightly longer, about 30. With two pairs tiny, indistinct, very slender, setiform exobothridial setae; anterior pair curving antero-dorsad, about 10 long; posterior pair smaller, very indistinct, curving dorso-anteriad, perhaps 5 long. Bothridia in dorsal view with lateral emargination obvious, opening dorso-laterad; with about 14 very fine, thin-walled lobes extending mesad from sclerotized lobulations of bothridia. Scale ventro-posteriad to bothridia, strong, thick in lateral view, dorsally somewhat obscured by emarginate dorsal portion of bothridium. Sensillus stocky, stout, with very little taper from insertion to apex, smooth except for barbate tip, 130 long, directed outward, bending somewhat dorsad then laterad and slightly mesad.

Notogaster: 660 long, 470 high, 435 wide, with posterior slit from ventral region extending up just past midline. Anterior rim rather narrow, about 15, collar strongly sclerotized, sensillar notch rather shallow but broad dorso-ventrally, lapet moderately developed. Sculpturing of minute projections particularly evident on lateral, ventral, surfaces. With 14 pairs of setae, all stocky, rather stout, spiculate to barbed on distal one-half, often giving nearly bearded appearance, ending rather abruptly, directed distad, medial row about 80, lateral row about 70, ventral row about 60 long. Insertions deep, with channel through integument frequently continued as emarginate line. Setae *f*:1 vestigial. Lateral glands present, each with two accessory pores. Fissures present, obvious because of strong sclerotization.

Ventral plates: length 550, width 80. No lateral pocket present. Ventral surface of reinforcing bar, at anterior margin, with triangular furrow, base mesad, point distad one-half plate width; bar also with postero-ventrad overhanging margin. No indication of weakness at fusion between genital and aggenital plates, fusion between aggenital and adanal complete except for slight laterad slit at anterior margin of anal plate, anal completely fused with adanal along posterior two-thirds of ano-adanal plate length. Genito-aggenital portion of plate bearing two rows of setae. Genital row of nine short, fine, smooth setae; anterior three shorter, 7, projecting mediad, inserted in longitudinal row on median margin of ventral furrow of anterior reinforcing bar; posteriad six, longer, 12-15, emerging mediad but recurving laterad, inserted on median margin behind rim, *g*:4 inserted at posterior margin of overhanging lip, *g*:5 one setal length posteriad from *g*:4, others about two to three setal lengths apart. Aggenital row of two stout setae, strongly spiculate, rather short, 18, directed posteriad, inserted into base of anterior reinforcing bar dorsad to overhanging margin, with perhaps one-third their length concealed beneath overhang. Four adanal setae rather stout, slightly, finely spiculate, rather short, inserted relatively near mesal margin; *ad*:1 short, about 35 long, inserted immediately behind and laterad to anterior margin of anal plate; *ad*:2 similar, 35 long; *ad*:3 slightly longer, 40, inserted just posteriad to dorsad curving portion of plate in lateral view; *ad*:4 somewhat longer, 55, inserted just below dorsad medial internal projection apparent in lateral view. Two anals slender, smooth, longer, with long acuminate tip, inserted on mesal margin; *a*:1 long, 85, inserted just anteriad to dorsad curve of plate; *a*:2 slightly shorter perhaps, about 80, inserted at dorsad bend of ventral plate in lateral view. Adanal fissure confusingly similar to setal insertion in appearance but elongate, situated directly posteriad to *ad*:1 about equidistant between *ad*:1,2.

Ovipositor: with moderately strong, simple pattern of slightly wavy striae; lobes slender, relatively well sclerotized most of length on at least non-apposed or lateral faces, apparently not sclerotized on apposed faces, with membranous, sharp tips; setae with small, slightly sclerotized bases. Dorsal lobes with four setae; *od*:1 moderately stout, smooth, with sharp tip, about 20-25 long, bending nearly at right angle near middle, inserted nearly at distal end of sclerotized area of lobe; *od*:2 short, 5, spiniform, stout, smooth, pointed tip, straight, inserted proximad of *od*:1; *od*:3,4 very short, 2-3, stubby, bluntly rounded at end, one-half as wide as long, inserted directly proximad of *od*:2; *od*:4 perhaps its insertion diameter laterad from *od*:3. Ventral lobe with two pairs of setae; *ov*:1 moderately stout, smooth, with sharp point, long, 42, bending gently in region between one-third and one-half its length, insertions near distal tip of sclerotized area, almost touching; *ov*:2 similar to *od*:3, short, stubby, rounded tip, insertions directly proximad of *ov*:1 two-thirds length of sclerotized area, nearly touching. Coronal setae lacking.

Male genitalia: small, setae similar, sharply pointed, spiniform, about 8-9 long.

Gnathosoma: chelicerae 200 long, 90 high, dorsal and lateral surfaces with sparse, tiny spiculae; seta *cha* slender, acuminate, slightly spiculate, 45 long, surpassing *chb* insertion; *chb* heavier, stocky, barbate, shorter, 35 long. Menton setae inserted nearly on lateral margins of plate. Palpi three segmented, no vestige of fusion lines; setae weakly to strongly spiculate or barbed; disti-medial seta very fine, slender, short, 10, inconspicuous; with four stout, separate eupathidia.

Legs: lateral claws rather weak compared with strong, stout, central claw. Coxa IV machete-like seta with two strong, spinate, distad directed points near acute tip. Famulus straight, rugose, about 16 long.

Eggs: an average of 2.5 per specimen, with range of one to five found in ten specimens examined; deutova ovoid, 230 long, 145 in diameter, sculpturing not strong, consisting of irregularly hexagonal papillate lobulations with papillae somewhat stouter at apices, strongest at broader apex.

Larva and nymphal stages unknown.

Type data: holotype female and allotype from; 6.4 miles south of Klamath, Prairie Creek Redwoods State Park, 0.3 mile south from north border of Humboldt County, California, March 22, 1956 (N. A. Walker), in deep coast redwood litter, humus, soil and some well-decayed redwood branches; type number 2970 in the U. S. National Museum. Forty-seven female and twenty-two male paratypes with same data.

Distribution (see Pl. 28):

Del Norte Co.: Fort Dick, 2 miles N., XI-21-53 (V. D. Roth). Crescent City, 5.9 miles S., III-22-56 (N. A. Walker). Crescent City, 9.2 miles S., Del Norte Coast Redwoods State Park, III-22-56 (N. A. Walker). Klamath, 3.7 miles N., IX-5-61, decayed redwood log, stump, litter (N. A. Walker). Klamath, 1 mile S., IX-20-55, litter (2); III-22-56, decayed redwood log (5); redwood litter (3); IX-5-61; decayed log, litter (N. A. Walker).

Humboldt Co.: Klamath, 5.7 miles S., Prairie Creek Redwoods State Park, IX-5-61 (N. A. Walker). Klamath, 6.4 miles S., Prairie Creek Redwoods State Park, IX-20-55; III-22-56 (type sample) (N. A. Walker). Klamath, 9.3 miles S., Prairie Creek Redwoods State Park, IX-5-61 (N. A. Walker). Klamath, 16 miles S., IX-5-61 (N. A. Walker). Klamath, 18 miles S., IX-19-53 (E. E. Gilbert, R. O. Schuster). Freshwater, 0.6 mile E., III-22-56 (N. A. Walker).

Mendocino Co.: Fort Bragg, 16 miles E., IV-20-56, decayed redwood log (N. A. Walker). Mendocino, 6.6 miles E., IV-21-56 (N. A. Walker).

Sonoma Co.: Plantation, IV-5-56 (D. J. Burdick).

The specific name is derived from the Latin *longus* + *rostralis* (m.) meaning long + rostral, with reference to the unusual long rostral setae of the aspis.

An analysis of collection data indicates that *Euphthiracarus longirostralis* feeds in almost any decaying litter but probably most commonly in rather small, well-decayed branches or twigs. The distribution recorded probably includes only the southern, or southwestern, area of its range. This species is apparently restricted to rather humid areas with a thick layer of litter and humus.

Euphthiracarus polytretos sp. n.

(Pls. and figs. 29, A-D; 30)

Diagnosis: moderate in size, punctation of deep, strong pits; no pores evident; sensilli slender, with bulbous, distally ciliate knob-like tip; aspal setae nearly simple, verticals longest, rostrals shortest, and both somewhat depressed; laterals erect; notogastral setae similar to aspals; ventral plate pocket lacking; legs with three claws; ovipositor setae *od*:3, *ov*:2 nearly vestigial, *od*:4 lacking.

Adult: moderate to dark tan in color, moderate in size. Sensilli with distinctly enlarged distally ciliate knob. Aspal and notogastral setae very slightly barbed, appearing slender but with rather blunt tips, barbules barely apparent at magnifications of 156 diameters. Sculpturing of large, obvious, strong, circular, deep depressions, larger than fissures and setal insertions, randomly distributed over all surfaces, rather tightly spaced, sculpturing certainly most obvious of species treated.

Female size range: notogaster length 686-534, height 450-374, width 444-367; aspis length 319-284, height 159-97, width 222-187; ten specimens measured.

Male size range: notogaster length 554-499, height 367-326, width 353-305; aspis length 291-256, height 125-97, width 201-187; ten specimens measured.

Sex ratio: 30% males among 47 specimens from three samples, weighted by two predominently female spring collections.

Aspis: 271 long, 115 high, 189 wide. Lacking strongly demarked notch. Sculpturing depressions very marked to major lateral carinae, then smooth below carinae and bothridia. Anterior rim nearly lacking, with very slight emarginate lip; lateral rim narrow but strong; posterior rim rather narrow, about 10 wide; median rib extending forward to line between centers of bothridia. Central rib obvious, broad in dorsal view, posterior margin slightly anteriad to lateral setae, anterior margin slightly posteriad from rostrals. Median carina lacking. With two lateral carinae; major carina not obviously dorsally, in lateral view strong, apparently connecting margins of surface depressions, undulating; minor carina not apparent dorsally, in lateral view ventral to major carina, very weak, becoming faint, ending about one bothridial width anteriad to bothridium. Rostral setae rather fine, moderately acuminate, smooth, directed anteriad, 30 long; insertions approximate, combined setal lengths equal to distance between insertions, slightly mesad of laterals. Lateral setae fine, smooth or very nearly so, straight, erect, 36 long, insertions slightly laterad from rostrals. Vertical setae fine, smooth or very nearly so, sometimes erect,

46 long; insertions slightly laterad of laterals. Aspal setae no longer than notogastrals, more slender, not obviously barbate at magnification of 156 diameters. Apparently only anterior exobothridial setae present, short, about 5, almost stubby, strong basally, sharp tip; posterior setae not seen, if present. Bothridia slightly oblong in lateral view; in dorsal view with almost rectangular emarginate atrium opening laterad, sclerotized inner portion leading to 12 to 18 practically non-sclerotized elongate lobes or "tracheae." Scale ventrad to, extending posteriad from but practically an integral part of emergent atrium; strong, non-mammiform. Sensillus smooth, about 76 long, slender basally, diameter approximately equal for proximal four-fifths, then smoothly, evenly enlarged to form knob terminating in about 15 cilia, in alcohol appearing to end in reverse truncate cone; emerging directly laterad from bothridium then curving dorso-anteriad, distal four-fifths straight.

Notogaster: 538 long, 322 high, 290 wide. In dorsal aspect an elongate ovoid with definitely pointed posterior margin; in lateral view with definite posterior point. Collar distinct, rather narrow, about 14 wide, leading to sensillar notch, then to very slight lapet. Sculpturing evenly distributed over notogaster. With 14 pairs of similar setae, slender, almost blunt, very slight barbules on distal one-third to one-half, erect, ranging in length, and strength, from 54 to 45 long; *c*:1,2,3, *d*:1,2,3 inserted in nearly straight lines at right angles to medial line; *d*:3 inserted high, anteriad to usual position. Setae *f*:1 not apparent among sculpturing. Lateral gland present, not obvious because of strong surface pits. Fissures discrete, small, about one-fourth diameter of sculpturing depressions.

Ventral plates: 446 long, 88 wide. No lateral pocket evident. Anterior reinforcing bar, anterior triangle present, rather indistinct due to surface sculpturing. Genital setae, nine, very fine, slight, smooth, emerging barely laterad of medial plate rim; *g*:1-3 short, perhaps 5 long, indistinct, insertions in anterior triangle; *g*:4-6 similar in size, *g*:4 insertion below emarginate posterior margin of reinforcing bar, *g*:5,6 insertions about three setal lengths posteriad from next anteriad seta; *g*:7 longer, perhaps 10, insertion nearly one and one-half its setal length posteriad from *g*:6; *g*:8 longer, 15, insertion slightly more than three setal lengths posteriad from *g*:7; *g*:9 similar to *g*:8, insertion twice its setal length posteriad from *g*:8, or one-third of entire ventral plate length posteriad from anterior margin. Two aggenital setal pairs fine, not obvious because of surface sculpturing, insertions at base of emergent posterior margin of reinforcing bar; mesad seta about 6 long, insertion slightly more than one-half plate width laterad of mesal margin; lateral seta similar, insertion almost three-fourths plate width laterad from mesal margin. Four adanals rather fine, very slightly barbate under magnification of 500 diameters, appear almost blunt, range from 25-30 long, emerging somewhat laterad of plate margin; *ad*:3 insertion postero-laterad from *a*:2. Two anals smooth, long, slender, acuminate tip, emerging from mesal margins of plate; *a*:1 about 50 long, insertion about one-fifth of plate length anteriad to posterior point; *a*:2 similar to *a*:1 or slightly longer, insertion one-sixth of entire plate length anteriad to posterior point. Adanal fissure small, round, distinguishable from surface sculpturing by smaller size and greater depth; slightly mesad of line between *ad*:1-2, two-thirds that distance posteriad from *ad*:1.

Ovipositor: distal shaft with strong, wavy pattern of striae, proximal margin of mesal sclerotized plates of lobes not distinct because of strength of overlying striae, membranous lobe tips apparent. Dorsal lobes more slender

than ventral lobe, about one-third as wide as apparent length; *od*:1 spiniform, strong at base, acuminate tip, bending gently throughout length, about 18 long; *od*:2 relatively slender, short, about 6, insertion about its setal length directly proximad from *od*:1; *od*:3 nearly vestigial but present; *od*:4 lacking. Ventral lobe equal to dorsal lobes in length; *ov*:1 stoutly spiniform, tapering to acuminate tip, bending slightly, insertions approximate, nearly at distal sclerotized area margin, *ov*:2 similar to *od*:3, nearly vestigial. Coronal setae lacking.

Male genitalia: setae spiniform, nearly straight, ventral setae about 16 long; dorsal setae about 5 long.

Gnathosoma: chelicerae 172 long, 87 high, dorso-lateral surface with rather abundant tiny spiculae with relatively broad bases, short, pointed tip; setae *cha* setiform, smooth, nearly straight, 20 long; *chb* smooth, stout at base, tapering to acuminate tip, perhaps slightly longer than *cha*. Menton setae insertions about four-sevenths length of menton posteriad from anterior point, so much laterad as to result in slight emargination of plate. Palpi three segmented, femur about equal in length to combined tibia and tarsus; disti-medial seta, while fine, stronger than in some species, slender, straight, about 8 long; eupathidia discrete; solenidion somewhat longer than longest palpal seta.

Legs: with three claws, lateral claws much more slender than heavy, almost blunt, median claw. Machete-like seta of coxa IV with single almost abruptly narrowed, fine tip. Famulus stout, blunt, annulate, nearly straight, about 12 long.

Eggs: an average of 2.2 per specimen, with range of zero to four found in ten females examined.

Larva and nymphal stages unknown.

Type data: holotype female and allotype from; 3.2 miles south of Smith River, Del Norte County, California, (along former U. S. 101) March 22, 1956 (N. A. Walker), in partially decayed coast redwood stump material and litter, humus, soil on stump; type number 2971 in the U. S. National Museum. Paratypes include 11 females and 6 males with same data as holotype and all other 68 specimens listed in distribution records.

Distribution (see Pl. 30):

Del Norte Co.: Smith River, 3.2 miles S., III-22-56 (type sample) (N. A. Walker). Fort Dick, 2 miles N., XI-21-53 (3) (V. D. Roth). Fort Dick, 0.8 mile S., III-22-56, decayed redwood log, stump (1) (N. A. Walker). Crescent City, 5.9 miles S., III-22-56 (17 females, 3 males) (N. A. Walker). Klamath, 1 mile S., IX-20-55 (1); III-22-56, decayed redwood log (2) (N. A. Walker).

Humboldt Co.: Klamath, 6.4 miles S., Prairie Creek Redwoods State Park, III-22-56, well-decayed redwood litter, branches (1) (N. A. Walker). Klamath, 16 miles S., IX-5-61, decayed redwood, litter (1) (N. A. Walker). Freshwater, X-10-53 (2) (J. W. MacSwain). Freshwater, 0.6 mile E., III-22-56, redwood litter, decayed log (1) (N. A. Walker). Carlotta, 4.1 miles E., IX-20-55, redwood litter, decayed branches (1); well-decayed redwood log, moss covered bark (8); III-22-56 (3) (N. A. Walker). Pepperwood, 2.7 miles N., III-23-56, redwood litter, decayed wood (1) (N. A. Walker). Weott, 3.7 miles S., III-23-56, deep litter, humus (8) (N. A. Walker).

Mendocino Co.: Fort Bragg, 15 miles E., IV-20-56, redwood litter, old stump (2) (N. A. Walker). Russian Gulch State Park, 2.5 miles into, IV-21-56 (1) (N. A. Walker). Navarro, 12.4 miles W., IV-21-56 (1) (N. A. Walker).

Monterey Co.: Big Sur, 8 miles N., Bixby Creek Canyon, XII-12-53 (4 females, 4 males) (M. S. Wasbauer).

Santa Clara Co.: Mount Madonna, I-6-54 (1) (D. J. Burdick).

SANTA CRUZ CO.: Boulder Creek, 3 miles NW., VIII-31-56, redwood litter, decayed wood (1) (N. A. Walker).

SONOMA CO.: Plantation, IV-5-56 (1) (D. J. Burdick).

The specific name is derived from the Greek *polytretos* (m.) meaning full of holes, with reference to the surface sculpturing.

The distribution data indicate that *Euphthiracarus polytretos* is found in association with relatively decayed wood since all but two collections, for which detailed information is available, definitely included such material and the other collections could well have included decayed branches without this being indicated. This may explain the apparently discontinuous pattern of distribution because well-decayed wood was not always available in the collection area. The species is not present in all the collections that include decayed wood. It is assumed that the coast redwood area is marginal as far as ecological requirements of this species are concerned and that the distribution listed does not represent more than the southern or southwestern region of its range.

This species may be readily separated from *Euphthiracarus longirostralis* and *E. alazon* because E. *polytretos* has an enlarged sensillar tip bearing a ciliate brush and very deep sculpturing depressions.

Euphthiracarus alazon sp. n.

(Pls. and figs. 31, A-D; 32; 33)

Diagnosis: surface reticulation of simple, small, slight depressions; sensilli nearly uniform, slender, with sharp, slightly barbed to very sparsely ciliate tip; aspal setae simple, erect, vertical long, rostral rather short; notogastral setae similar to aspal; ventral plate pocket lacking; legs with single claw; ovipositor setae *od*:3 nearly vestigial, *od*:4 lacking.

Adult: off white to pale yellow, darker along plate margins and other heavily sclerotized areas; moderate in size. Setae slender, setiform, very slightly spiculate under magnifications greater than 156 diameters. Sculpturing of minute, moderately shallow, round depressions 2-3 in diameter, about one-half diameter of fissures, evident on entire body surface with careful focusing, more obvious on sloping surfaces.

Female size range: notogaster length 560-471, height 345-291, width 317-270; apis length 276-222, height 115-90, width 193-152; nine specimens measured.

Male size range: notogaster length 589-374, height 381-263, width 381-263; aspis length 305-208, height 125-90, width 222-152; six specimens measured.

Sex ratio: 45% males among 20 specimens from two samples.

Aspis: 276 long, 115 high, 193 wide. With pronounced notch. Sculpturing present on dorsal surface to major lateral carinae, then smooth ventrad. Anterior and lateral rim nearly lacking, posterior rim obvious, about 12 wide, leading into single median rib. Central rib obvious, posterior margin slightly

anteriad of midpoint between laterals and rostrals, anterior margin weaker, at bases of rostral insertions. Median carina lacking. With two lateral carinae; major carina apparent in dorsal view, strong laterally, weakening or interrupted about a bothridial diameter anteriad to bothridium, ending slightly anteriad to bothridium; minor carina not apparent dorsally, in lateral view ventrad to major carina, very weak, rather irregular, directed toward but not attaining center of anterior bothridial margin. Rostral setae practically smooth, setiform, slender, rather erect, bending slightly ventrad in lateral view, 48 long; insertions rather high on rostrum, approximate, separated by less than a setal length. Lateral setae very slightly spiculate, slender, straight in both lateral, dorsal views, rather erect, 67 long; insertions laterad of rostrals, high, approximate, separated by less than a setal length. Vertical setae slightly, sparsely spiculate, slender, erect, bending slightly anteriad, longest, 106; insertions separated by less than a setal length. Exobothridial setae very fine, not obvious, directed antero-dorsad, anterior pair about 10 long, posterior pair perhaps 7 long. Bothridia round in lateral view, in dorsal view with rounded, slightly emarginate atrium, opening laterad and slightly dorsad, with sclerotized mesad directed lobulations leading to about 10 slightly sclerotized internal elongate lobes. Scale ventral to, extending posteriad from and extending well beyond emarginate atrium of bothridium, strong in all aspects, smoothly mammiform, non-mammillate, somewhat more sharply curved anteriorly, apex slightly posteriad of bothridial center. Sensilli slender basally, bearing about 16 short, fine spiculae on dorso-distal portion of slightly enlarged distal one-half, with almost acuminate tip, about 120 long, leaving atrium directed laterad, bending ventro-anteriad, then antero-dorso-laterad.

Notogaster: 560 long, 345 high, 317 wide. Anterior rim obvious, moderately sclerotized, 14-18 wide, collar obvious, sensillar notch rather shallow, lapet nearly pronounced. Sculpturing evenly distributed. With 14 pairs of similar setae, slender, slightly spiculate, with almost acuminate tip, erect, between 60-70 long; *d*:3 in antero-posteriad line with *c*:3, hence somewhat more dorsad than usual; insertions rather deep, may be prolonged by slight emarginate line. Setae *f*:1 vestigial. Lateral gland small, directly dorsad of *h*:3, with small accessory pores anteriad and ventrad. Fissures obvious.

Ventral plates: length 470, width 78. Sculpturing even; with more heavily sclerotized internal, narrow area extending length of plate near lateral margin. No lateral pocket present. Ventral surface of anterior margin reinforcing bar with triangular furrow, base mesal, point distad about one-half plate width, without obvious overhanging posterior margin, but with narrow antero-ventral furrow. Genital row of nine short, fine, smooth setae; *g*:1 shortest, perhaps 5 long, almost rudimentary, inserted in mesal base of antero-ventral furrow, seen with difficulty; *g*:2-4 slightly longer, 8, inserted in equidistant mesal row at base of triangle of reinforcing bar; *g*:5 about 10 long, inserted barely posteriad to postero-mesal margin of reinforcing bar; *g*:6 about 14 long, inserted two setal lengths posteriad from *g*:5; *g*:7-9 about 18 long, insertions separated by about three setal lengths. Aggenital row of two relatively strong, stout, erect, bending anteriad, sharply pointed setae, short, perhaps 10, not obvious in nonpermanent mounts, projecting from postero-ventral margin of reinforcing bar; insertion of mesal seta barely laterad of point of triangular furrow or about three-fourths plate width, with lateral one directly laterad of mesal seta, about seven-eighths plate width from mesal

margin. Four adanal setae, relative to anals, being shorter, slightly stouter, tip more acute to almost blunt, slightly spiculate, inserted slightly more laterad; *ad:*1 short, 45, inserted postero-laterad to anterior margin of discrete portion of anal plate; *ad:*2 similar, inserted about two setal lengths directly posteriad from *ad:*1; *ad:*3 longer, 55, similar distance from *ad:*2; *ad:*4 longest of these, 60, slightly less than its length posteriad from *ad:*3. Two anals smooth, longer, slender, with acuminate tip, emerging from mesal margin of plate through channel in rim, insertions more mesad than adanals; *a:*1 about 60 long, inserted its length posteriad from *ad:*2; *a:*2 longest, 70, inserted less than its length posteriad from *a:*1, or about equidistant between *a:*1 and *ad:*3. Adanal pore in line with, equidistant between *ad:*1,2. Plicature plates lacking sculpturing.

Ovipositor: distal shaft with obvious, regular, wavy pattern of striation; lobes rather blunt, moderate in length, rather wide, sclerotized area surrounding setal insertions, with membranous tips. Dorsal lobes with relatively strongly sclerotized apposed faces, setae spiniform, relatively stout; *od:*1 longest, 25, smooth, sharply pointed, bending slightly at middle, inserted at tip of sclerotized area; *od:*2 much shorter, 6-7, sharply pointed, emerging at about 45° angle, inserted slightly more than its length proximad from *od:*1; *od:*3 shortest, 2-3, erect, tip obtusely sharp, inserted four-fifths length of sclerotized area proximad from distal margin; *od:*4 lacking. Ventral lobe sclerotized area nearly as broad as long; *ov:*1 long, 35, not as stout compared with length as *od:*1, spiniform with sharply pointed elongate tip, sinuously curved, inserted one-fifth of sclerotized area proximad from distal margin, insertions contiguous; *ov:*2 short, 6-7, similar to *od:*3, inserted nearly one-half length of sclerotized area proximad from *ov:*1, about one-fourth width of area mesad from apparent lateral margins, without obvious insertion base. Coronal setae lacking.

Male genitalia: small, setae alike, sharply pointed, almost spiniform, curving slightly, rather well sclerotized, about 9 long.

Gnathosoma: chelicerae 173 long, 80 high, dorso-laterad surfaces with very few, sparse, short spiculae; seta *cha* smooth, setiform, acuminate, 23 long, bending strongly at middle; *chb* similar but slightly longer, 25, bending gently at middle. Menton setae inserted more than one-half length of menton posteriad from anterior tip on lateral margin. Palpi three segmented, no vestige of lines of fusion; disti-medial seta very fine, short, 7, inconspicuous; solenidion stout, stronger than usual; with four stout, separate eupathidia.

Legs: with single, stout median claw. Coxa IV machete-like seta with abruptly narrowed acuminate tip, without spike-like accessory tips. Famulus straight, blunt at tip, strongly rugose, 12 long, nearly laterad in insertion.

Eggs: an average of 2.2 per specimen, with range of one to three found in nine females examined; deutova elongate ovoid with pointed smaller apex, 255 long, 125 in diameter, sculpturing weakly sclerotized, of small, approximate, irregular papillose protuberances covering surface, somewhat longer, stouter at apices, especially at broadly rounded apex (Pl. 32).

Larva and nymphal stages unknown.

Type data: holotype female and allotype from; 5.9 miles south of Crescent City, Del Norte County, California, March 22, 1956 (N. A. Walker), in damp litter of coast redwood, with strong admixture from deciduous understory,

near top of hill at approximately 750 feet elevation; type number 2972 in the U. S. National Museum. Other 20 specimens reported in distribution data are paratypes; deposited in the California Insect Survey collection, U. S. National Museum, British Museum (Natural History), National Museum of Natural History, Paris, and my collection.

Distribution (see Pl. 33):

Del Norte Co.: Smith River, 3.2 miles S. (on former U. S. 101), III-22-56, redwood litter, rather thin, 2-3 inches deep (4 females, 3 males); partly decayed redwood stump, dirt, roots of plants growing on stump (1) (N. A. Walker). Fort Dick, 0.8 mile S. (on former U. S. 101), III-22-56, well-decayed redwood and litter, 1-2 inches deep (1) (N. A. Walker). Crescent City, 5.9 miles S., III-22-56 (6 female, 5 male paratypes, type sample) (N. A. Walker).

The specific name is derived from the Greek *alazon* meaning wanderer, with reference to the probability that this species is not a usual inhabitant of redwood litter.

The distribution and collection data are not sufficient to suggest habitat preferences for this species. Probably the reported distribution represents the very southern-most, or southwestern, tip of the species range.

Euphthiracarus tanythrix tanythrix sp. et ssp. n.

(Pls. and figs. 34, A-C; 36)

Diagnosis: surface reticulation faint, of rather large, very shallow depressions obvious only toward edges of areas; sensilli slender, even in diameter but with sharp tip, bearing sparse cilia on distal one-half to one-fourth; aspal setae simple, long, erect; notogastral setae shorter than aspals, similar; notogaster in dorsal view rounded posteriorly; ventral notogastral margin finely sinuate; ventral plate pocket present, with almost strongly arched mesal margin; legs with three claws; ovipositor setae *od*:3, *ov*:2 nearly vestigial, *od*:4 lacking.

Adult: off white to light tan, darker along heavily sclerotized areas; one of the smaller *Euphthiracarus* species in size. Setae appearing to be rather slender and sharp under low magnification (to 100 diameters), with very short fine but stout barbs or spiculae under greater magnification. Sculpturing not obvious in nonpermanent mounts, but of shallow, ill-defined circular depressions.

Female size range: notogaster length 568-471, height 360-298, width 346-298; aspis length 277-243, height 125-104, width 194-159; ten specimens measured.

Male size range: notogaster length 561-367, height 388-229, width 381-243; aspis length 284-201, height 118-91, width 194-132; ten specimens measured.

Sex ratio: 62% males among 47 specimens from four samples.

Aspis: 265 long, 120 high, 170 wide. Sculpturing not obvious. Anterior rim lacking; lateral rim strong from notch posteriad to origin of central rib, posterior rim rather strong, 18 wide, leading into median rib extending anteriad

to level of posterior bothridial margins. Central rib rather obvious laterally, not obvious dorsally, located between rostrals and laterals. Median carina lacking. With two lateral carinae, neither obvious dorsally; major carina in lateral view rather strong, ending one bothridial diameter antero-dorsad to bothridium; minor carina weak, broadly undulating, extending to antero-ventral bothridial margin. Rostral setae acuminate, smooth, directed antero-mesad, 52 long; insertions rather high, approximate, separated by less than a setal length. Lateral setae rather slight for length, 74, sparsely spiculate on distal one-half, erect, bending anteriad; insertions approximate, separated by about one-half a setal length. Vertical setae slight for their length, 106, very sparsely spiculate on distal one-half, erect; insertions high on aspis, separated by about three-fourths setal length. Verticals especially, laterals, longer than notogastral setae, notogastrals more abundantly spiculate than aspals. Exobothridial setae present, fine; anterior pair about 7 long; posterior setae about 3 long, indistinct save for tiny insertion. Bothridia round in both dorsal, lateral views; in dorsal view with almost round emarginate atrium opening laterad, with sclerotized lobulations leading to eight to 12 slightly sclerotized elongate lobes. Scale ventral to and extending posteriad from bothridial atrium, strong; in lateral view curving dorso-anteriad merging with ventro-anterior bothridial margin; in dorsal view emerging at gentle angle anteriorly, bending postero-laterad to smoothly rounded point, then more sharply, but smoothly, curving mesad, vaguely mammiform, non-mammillate. Sensillus simple, slender basally, becoming slightly thicker distally, about 110 long; with few, about six, slender long spicules on distal one-fourth, tip sharp, not acuminate; emerging latero-posteriad, curving gently dorsad and definitely anteriad.

Notogaster: 483 long, 290 high and wide. Collar rather moderate, sensillar notch rather short, shallow; lapet distinct, rather prominent, curved. Sculpturing indistinct. With 14 pairs of similar setae, slender, sharp, with short spiculae on distal one-half, erect, majority about 60 long; *c*:1-3, *d*:1-3 inserted normally. Setae *f*:1 vestigial, obvious because of smoothness of surface. Lateral gland rather small, with accessory pores. Fissures discrete, small, about one-half diameter of setal insertions.

Ventral plates: 407 long, 69 wide. In ventral aspect with lateral pocket, with additional, slight, longtitudinal, internal line between opening and apex of pocket. Ventral surface smooth save for anterior bar, without obvious triangle, with slightly emarginate margins medially, slight ventrally emarginate posterior margin. Genital row of nine fine, slight, smooth setae emerging on or very near mesal margin; *g*:1-3 about 7 long, emerging from relatively deep pockets between projecting anterior and posterior margins of anterior bar, equidistant from one another; *g*:4-9 gradually increasing in length to about 20; *g*:4 insertion about width of reinforcing bar posteriad from its posterior margin; *g*:5-9 insertions between two and three times the individual setal length posteriad from next anteriad seta. Aggenital row of two setae, very fine, non-spiculate, curving postero-ventrad; origins posteriad to but opening near posterior emarginate margin of bar; mesal one, at least, frequently visible on nonpermanent mounts; mesal seta about 14 long, insertion about one-half plate width laterad from mesal margin; lateral seta shorter, about 12, insertion closer to bar, about two-thirds plate width laterad from mesal margin. Four adanal setae relatively stouter, shorter than anals, much longer than genitals, somewhat finer, shorter than notogastral setae; slender, sharp, with moderately

short rather sparse spicules, insertions laterad to mesal plate margin; *ad:*1 about 44 long, insertion normal; *ad:*2 approximately 41 long; *ad:*3 about 48 long, insertion rather markedly postero-laterad from *a:*2; *ad:*4 about 55 long, *ad:*3,4 insertions about one-half plate width laterad from mesal margin. Two anals smooth, long, acuminate, slender, emerging from mesal plate margin; *a:*1 perhaps 64 long; *a:*2 slightly longer, 70. Adanal fissure rather small, circular, about same diameter as other fissures; on line and about equidistant between *ad:*1-2.

Ovipositor: distal shaft with well delimited pattern of irregularly wavy striae, lobes well sclerotized to distal setal insertions. Dorsal lobes rather slender, with slightly sclerotized distal recurved tips; *od:*1 slender, smooth, bending rather abruptly about 45° at one-half its length distad, about 15 long, insertion disti-laterad on sclerotized area; *od:*2 short, about 6 long, stout, spiniform, almost sharp, nearly straight, insertion almost one-half length of sclerotized lobe area directly proximad from *od:*1; *od:*3 practically vestigial, about 2 long, apparently stubby, broad, blunt, insertion nearly on proximal margin of sclerotized lobe area; *od:*4 lacking. Ventral lobe placed somewhat more proximad than dorsal lobes, apparently ending at distal margin of sclerotized area; *ov:*1 stronger than *od:*1, slender spiniform, sharp, about 26 long, insertions nearly at distal margin of sclerotized area; *ov:*2 almost vestigial, similar to *od:*3, insertions about one-half length of sclerotized area proximad from *ov:*1. Coronal setae lacking.

Male genitalia: setae moderately sclerotized, slender, sharp, straight; ventral setae 13 long; dorsal setae about 9 long.

Gnathosoma: chelicerae 152 long, 73 high, dorso-lateral surface with moderate number of tiny spiculae; setae *cha* slender, smooth, slightly bent, about 16 long; *chb* similar, somewhat stouter, about 25 long. Menton setal insertions slightly over one-half length of menton posteriad from anterior point, on lateral margin. Palpi three segmented, femur slightly longer than tibial and tarsal lengths combined; disti-medial seta relatively stout, still generally fine, slender, straight, about 5 long; with discrete eupathidia; solenidion somewhat longer than any palpal setae.

Legs: with three claws, lateral pair much more slender than heavy median claw. Machete-like seta of coxa IV simple, accuminate, curving gently, broad throughout much of its length. Famulus about 10 long, straight, stout, blunt.

Eggs: an average of 1.6 per specimen, with range of zero to three found in ten females examined.

Larva and nymphal stages unknown.

Type data: holotype female and allotype from; Pfeiffer-Big Sur State Park, Monterey County, California, August 30, 1956 (N. A. Walker), in wet to dry coast redwood litter, humus, soil and well-decayed log; type number 2973 in the U. S. National Museum. Female and male paratypes include 85 other specimens listed in distribution from Alameda and Monterey counties.

Distribution (see Pl. 36):

Alameda Co.: Oakland, Mountain Boulevard, on the north and south banks of Palo Seco Creek, IV-3-55 (1); IV-11-55 (1); S., X-8-55 (1); N., XII-12-55 (3); N. (2) and S. (4), II-12-56; N. (3) and S. (3), III-12-56; N. (16) and S. (9), IV-15-56; N., V-18-56 (7); S., VII-13-56 (5) (N. A. Walker).

Contra Costa Co.: Redwood Regional Park, V-18-56 (7) (E. E. Gilbert, R. O. Schuster).

HUMBOLDT CO.: Pepperwood, 0.2 mile S., IX-5-61 (1) (N. A. Walker). Pepperwood, 6.3 miles S., The Avenue of the Giants, Humboldt Redwoods State Park, III-23-56 (1) (N. A. Walker). Dyerville, 1 mile S., Humboldt Redwoods State Park, IX-19-53 (2) (E. E. Gilbert, R. O. Schuster). Weott, 3.7 miles S., S. R. Boardman Grove, Humboldt Redwoods State Park, III-23-56 (3) (N. A. Walker). Garberville, 3.9 miles S., III-23-56 (2) (N. A. Walker).

MARIN CO.: Samuel P. Taylor State Park, N. entrance, X-24-53 (2) (V. D. Roth).

MENDOCINO CO.: Fort Bragg, 27 miles E., IV-20-56, well-decayed redwood, bark (2) (N. A. Walker). Fort Bragg, 28 miles E., IV-20-56, redwood litter, decayed wood (2) (N. A. Walker). Russian Gulch State Park, 2.5 miles into, IV-21-56 (1) (N. A. Walker). Mendocino, 7.1 miles E., IV-21-56 (1) (N. A. Walker). Mendocino, 8 miles E., IV-21-56 (6) (N. A. Walker). Navarro, 6.6 miles W., Paul M. Dimmick Memorial Grove State Park, IV-21-56 (1) (N. A. Walker). Yorkville, 6 miles WSW., IV-21-56 (2) (N. A. Walker).

MONTEREY CO.: Big Sur, 8 miles N., Bixby Creek Canyon, V-20-56 (1) (M. S. Wasbauer). Pfeiffer-Big Sur State Park, VIII-30-56 (5 total, type sample) (N. A. Walker). Pfeiffer-Big Sur State Park, 25.3 miles S., VIII-30-56 (23); III-20-57 (1) (N. A. Walker). Pfeiffer-Big Sur State Park, 43 miles S., VIII-30-56 (1); III-20-57 (1) (N. A. Walker).

NAPA CO.: Oakville, III-14-54 (3) (J. R. Helfer).

SONOMA CO.: Annapolis, 3.9 miles SE., IV-22-56 (1) (N. A. Walker). Monte Rio, 0.9 mile W., IV-22-56 (1) (N. A. Walker). Monte Rio, 1 mile E., IV-22-56 (1; 5) (N. A. Walker).

The specific name is derived from the Greek *tanyo* + *thrix* (f.) meaning long + hair, with reference to the long aspal setae.

The collection data do not definitely indicate any specific preferred habitat for *Euphthiracarus tanythrix tanythrix,* although there is some indication that it may be associated with well-decayed bark. The data also suggest that the ecological conditions under the coast redwoods may be marginal for this species, but that the distribution recorded may include the majority of its north to south range; the San Francisco Bay area appears to be the center of abundance under redwoods when the random litter collections are considered. The monthly series taken in Alameda County indicate a population peak in April.

Euphthiracarus t. tanythrix differs from *E. t. sierriensis* in that it has only slightly barbate lateral and vertical setae, sensilli with few long spiculae, a sinuate ventral notogastral margin and genital setae gradually increasing in length.

Euphthiracarus tanythrix sierriensis ssp. n.

(Pls. and figs. 35, A-C; 36)

Diagnosis: surface reticulation of simple, rather large, slight, discrete depressions; sensilli slender, bearing numerous short cilia on distal one-third, tapering to sharp tip; notogaster in dorsal view somewhat pointed posteriad; ventral notogastral margin smooth; ventral plate pocket with smoothly arcuate mesal margin; posterior 3 genital setae rather abruptly longer than anteriad 6.

Adult: off white to pale yellow, moderate in size. Setae slender, with rather long, sparse spiculae. Sculpturing of relatively large, shallow, round depressions, 4 in diameter, more than twice diameter of fissures or about diameter of setal insertions, rather faint, distributed evenly over surface of mite.

Female size range: notogaster length 617-534, height 437-333, width 381-326; aspis length 305-263, height 139-111, width 208-187; six specimens measured.

Male size range: notogaster length 561-458, height 388-322, width 347-292; aspis length 298-239, height 125-101, width 201-166; seven specimens measured.

Sex ratio: 37% males among 35 specimens from two samples.

Characteristics of the species except for the following divergences.

Aspis: 280 long, 115 high, 198 wide; in lateral view with slight interruption in dorsal arc at rostral setal insertion. Sculpturing in dorsal view with minute protuberances on anterior region, especially on rostrum, to insertions of lateral setae, may hold debris resulting in cap-like mass, depressions more obvious posteriorly. Aspal posterior rim strong, slender, 9 wide. Major lateral carina visible dorsally. Rostral setae emerging from depressed region on dorsal surface. Scale ventral to and extending both anteriad and posteriad of bothridium, strong in all aspects, both anterior and posterior margins emerging nearly directly laterad from margin of aspis then curving smoothly to nearly straight lateral margin, non-mammiform. Sensillus with long spiculae on distal one-half, terminating acutely with spiculae giving bi- or tri-furcate impression, 120 long, directed distad then often sharply bent, to elbowed, dorso-anteriad and distad.

Notogaster: 570 long, 385 high, 360 wide. Anterior rim rather narrow, 12-20 wide, collar narrow, distinct, sensillar notch rather long, moderately deep, lapet broader, with nearly straight anterior margin, not prominent. Sculpturing distinct, evenly distributed over notogaster. Notogastral setae with rather long, sparse spiculae on distal one-half, dorsal setae about 75, lateral row about 65, ventro-lateral setae about 55 long; *c*:3 inserted above dorsal margin of sensillar notch, high; insertions may show prolongation of external opening by emarginate line.

Ventral plates: length 506, width 90 (flattened). Genital row of nine fine, slight, smooth setae increasing in length from anterior to posterior, emerging through channels in medial plate margin; *g*:1 perhaps 4 long, directed mesad, straight, inserted at antero-medial margin of plate; *g*:2 perhaps slightly longer, similar, inserted centrally on mesal margin of triangular portion of anterior reinforcing bar; *g*:3 similar, inserted at posterior margin of anterior reinforcing bar; *g*:4 somewhat longer, recurved, inserted its length posteriad from *g*:3, distance equal to length of insertion and channel; *g*:5 perhaps 12 long, similar to *g*:4, inserted its length posteriad from *g*:4; *g*:6 about 15, *g*:7 about 18, *g*:8 25, *g*:9 40 long, each inserted posteriad from preceding one by its length. Aggenital pair of setae often not visible, or lateral one visible rarely, in non-permanent mounts; mesal seta about 30 long, slightly spiculate, lateral seta about 10 long, erect, slightly spiculate.

Eggs: an average of two per specimen, with range of zero to four found in ten females examined; about 262 long, 198 in diameter.

Type data: holotype female and allotype from; Calaveras Big Trees State Park, North Grove, Calaveras County, California, June 4, 1957, (N. A. Walker), in Sierra redwood litter mound, on north and east side of tree across from

picnic area; type number 2974 in the U. S. National Museum. Paratypes include 20 females, 10 males with same data as holotype, and all other specimens listed in distribution data.

Distribution (see Pl. 36):

CALAVERAS CO.: Calaveras Big Trees State Park, North Grove, IX-27-55 (1); V-12-56 (3); VI-4-57 (type sample) (N. A. Walker); XI-19-57 (1) (H. Ruckes, Jr.); V-6-58 (9) (N. A. Walker).

MADERA CO.: Sugarpine, 6-7 miles E., Nelder Grove, VI-12-57 (1) (N. A. Walker).

TULARE CO.: California Hot Springs, 18 miles NE., Redwood Meadow Grove, VI-12-56 (2) (N. A. Walker).

TUOLUMNE CO.: Calaveras Big Trees State Park, South Grove, VI-8-57 (1) (N. A. Walker). Yosemite National Park, Tuolumne Grove, VI-11-57 (35) (N. A. Walker).

Non-redwood distribution:

SHASTA CO.: Viola, VI-18-54, fir litter (1 male, 1 female) (R. O. Schuster).

The subspecific name is derived from the Sierra Nevada Mountains and the Sierra redwood under which it is found.

Euphthiracarus tanythrix sierriensis is the only representative of the genus found under the Sierra redwood. Considering both collections where this species was and was not found, it appears capable of existing in relatively dry areas, but is not found in the dryest microhabitats; it was not found in litter from the exposed south and west sides of the tree at the type locality. Presumably the distribution recorded here represents the southern and perhaps central regions of its range. It was not found in the Placer County Big Trees Park, American River grove collection, but this collection was of rather dry litter.

Uncleared specimens of *E. t. sierriensis,* under magnifications of 90 diameters or less, are very similar in appearance to specimens of *E. t. tanythrix.* However cleared specimens, under greater magnification, show differences in that *E. t. sierriensis* has clearly spinose lateral and vertical aspal setae, sensilli with abundant spiculae, almost plumose, a smooth ventral notogastral margin and with genital setae 7-9 markedly longer than *g*:1-6.

Euphthiracarus cernuus sp. n.

(Pls. and figs. 37, A-C; 38)

Diagnosis: surface reticulations faint, rather small, very shallow depressions obvious only toward edges of areas; sensilli almost stout, slightly larger toward brushy tip; rostral setae simple, longer than laterals, about equal to verticals, laterals short, sparsely ciliate, verticals often appressed, sparsely ciliate; notogastral setae similar to verticals; ventral plate pocket present, usually rather narrow

with mesal margin almost straight; legs with three claws; ovipositor setae *od:*3 vestigial, *od:*4 lacking, *ov:*2 rudimentary.

Adult: off white to light tan, darker along plate margins and other heavily sclerotized areas; moderate in size. Setae generally spiculate on distal one-half. Sculpturing of rather large, relatively inconspicuous, shallow, low, almost round depressions, larger than fissures and setal insertions, distributed over notogaster.

Female size range: notogaster length 679-464, height 450-333, width 471-340; aspis length 353-249, height 139-90, width 243-180; ten specimens measured.

Male size range: notogaster length 603-430, height 402-319, width 388-319; aspis length 298-243, height 118-90, width 215-180; ten specimens measured.

Sex ratio: 49% males among 146 specimens from five samples.

Aspis: 269 long, 104 high, 207 wide. In dorsal aspect, of fully opened specimen, an elongate ovoid; in lateral aspect with sharp notch at insertion of rostrals. Sculpturing of dorsal surface of short, rather blunt, fine protuberances frequently hidden by debris, much less obvious ventrad of major carina. Antero-lateral rim not apparent, with small anterior emarginate lip; lateral rim strong, extending from minor carina posteriad; posterior rim strong, 14 wide, leading into single median rib extending anteriad to level of anterior bothridial margins. Central rib obvious, posterior medial margin at lateral insertions, anterior margin at rostral insertions, rather strong, clearly demarked in dissected specimen. Median carina lacking. With two lateral carinae, major carina not obvious dorsally, in lateral view rather strong, not attaining dorsal margin of bothridium; minor carina weak, straight, extending toward but not attaining center of bothridium. Rostral setae rather slender, nearly acuminate, smooth, directed antero-ventrad, 50 long; insertions set in notch, high, approximate, separated by one-half setal length. Lateral setae rather stout, spiculate distally, straight, erect, short, 30 long; insertions slightly more than their setal length posteriad from and very slightly laterad of verticals, approximate. Vertical setae rather stout, spiculate to barbed distally, moderately appressed, frequently at approximately 30° angle to aspal surface, 85 long; insertions often hidden by debris. Vertical and lateral setae somewhat smaller, finer than notogastral setae, but of similar appearance. Exobothridial setae very fine, anterior pair directed antero-dorsad, indistinct, about 6 long; posterior setae not definitely seen. Bothridia rather oblong in lateral view; in dorsal view with emarginate atrium opening latero-dorsad, with short, rather indefinitely sclerotized lobes leading to 12 to 16 slightly sclerotized lobes. Scale ventral to, extending slightly posteriad and laterad of atrium, postero-lateral margin bilobed slightly, lateral margin slanting slightly mesad from postero-lateral margin, non-mammiform. Sensillus strong, nearly constant in diameter until near distal tip, then enlarged, bearing strong barbs at tip, about 90 long, emerging laterad, then curving dorso-anteriad, in some specimens almost elbowed.

Notogaster: 529 long, 368 high and wide, hence broadly ovoid. Anterior rim distinct, rather narrow, 13 wide, collar narrow, moderately deep, smooth sensillar notch; lapet not pronounced, nearly straight. Sculpturing evenly distributed over notogaster, often not obvious in direct horizontal plane but on sloping surfaces. With 14 pairs of similar setae, almost thick, rather heavy, with short spiculae on distal one-half, erect, ranging in length from 50 to 90; insertions normal in position. Setae *f:*1 vestigial. Lateral gland with accessory pores present. Fissures discrete, moderate in size, usually elongate.

Ventral plates: 425 long, 70 wide. With moderately sclerotized, elongate, rather narrow pocket, extending nearly one-third length of entire plate, opening laterally, connecting with sclerotized carina extending from anterior margin of pocket to posterior margin of plate. Ventral surface with narrow anterior reinforcing bar emarginate posteriorly. Genital row of nine fine, slight, smooth setae, increasing in size from anterior posteriad, *g:*1-3 emerging anteriad to reinforcing bar, *g:*4-9 posteriad, *g:*1-7 emerging through mesal plate margin, *g:*8-9 emerging slightly laterad of margin; *g:*1 short, perhaps 4 long, insertion at antero-mesal margin of plate; *g:*2 slightly longer, perhaps 6, insertion posteriad from anterior plate margin one-third of distance from anterior margin to posterior margin of reinforcing bar; *g:*3 similar, insertion two-thirds of same distance posteriad to anterior margin; *g:*4 slightly longer, perhaps 8, insertion immediately below mesal emarginate margin of reinforcing bar; *g:*5-9 from 8-15 long, insertions from one to two setal lengths apart, length and insertion placement increasing for each next posteriad seta. Aggenital row of two stronger, finely spiculate, short, stubby setae emerging beneath protruding margin of reinforcing bar, mesal seta about 10 long, emerging almost one-half of plate width laterad from mesal margin, lateral seta shorter, perhaps 8, emerging about six-sevenths of plate width laterad from mesal margin, frequently obscured in whole mount preparations by notogastral margin or debris. Four adanal setae stout, relatively strong although weaker than notogastrals, finely spiculate, bluntly ended, emerging slightly laterad to mesal plate margin; *ad:*1 about 35 long, insertion normal for genus; *ad:*2 slightly longer, 38, insertion four-sevenths length of ano-adanal portion of plate posteriad from anterior margin of anal triangle; *ad:*3 stouter, longer, 45, insertion just laterad, slightly posteriad, of *a:*2; *ad:*4 slightly longer, about 48. Two anals smooth, long, slender with very acuminate tip, emerging from mesal plate margin; *a:*1 about 65 long, insertion about two-thirds length of ano-adanal portion of plate posteriad from anterior margin of anal triangle; *a:*2 about 75 long, insertion barely antero-mesad from *ad:*3. Adanal fissure obvious, elongate in transverse direction to length of plate, slightly mesad of line between *ad:*1-2, about two-fifths of distance between *ad:*1-2 posteriad from *ad:*1.

Ovipositor: shaft with well delimited, even pattern of wavy striae, lobes rather well sclerotized to insertions of distal setae, with decidedly membranous tips. Dorsal lobes about one-third as wide as long, normal in size; *od:*1 slender, smooth, spiniform, gently arcuate throughout its length, bending about 45°, about 16 long, insertion on median line at tip of sclerotized area of lobe; *od:*2 shorter, about 7 long, stout, straight, spiniform, with sharp tip, insertion nearly one-half length of sclerotized portion of lobe directly proximad from *od:*1; *od:*3 apparently vestigial, site barely visible, *od:*4 lacking, possible site barely visible. Ventral lobe projecting very slightly less than dorsals; *ov:*1 setae stronger than *od:*1, nearly straight, sharply pointed spiniform, about 34 long, insertion about one-fourth length of sclerotized area proximad from tip; *ov:*2 rudimentary, about 2 long, inserted three-fifths length of sclerotized plate proximad from *ov:*1. Coronal setae lacking.

Male genitalia: setae moderately sclerotized, slender spiniform, sharp, nearly straight; ventral setae about 14 long; dorsal setae about 9 long.

Gnathosoma: chelicerae about 165 long, 75 high, dorso-lateral surface with very few, tiny spiculae; seta *cha* slender, smooth, bending slightly, 20 long; *chb* much stouter, almost spiniform, with acuminate tip, longer, 30; teeth of both movable and immovable digits rather slight. Menton setae insertions

about two-thirds length of menton posteriad from anterior point, on lateral margin. Palpi three segmented, femur almost equal to combined length of tibia and tarsus; disti-medial seta very fine, slender, straight, short, about 5; with discrete eupathidia.

Legs: with three claws, laterals very slight, long, slender, sharp, central claw much stouter, rather slender, with abruptly sharpened tip. Machete-like coxa IV seta so shaped, with single tip. Famulus about 10 long, almost slender, straight, blunt.

Eggs: an average of 3.3 per specimen, with range of two to five found in ten specimens examined; deutova about 230 long, including prominent projections, 23 long, on larger apex and about 120 in diameter, moderately well sclerotized.

Larva similar in general appearance to that of *Plesiotritia megale,* decayed prior to preservation; nymphal stages unknown.

Type data: holotype female and allotype from; 0.2 mile from ESE. entrance of Samuel P. Taylor State Park, Marin County, California, March 14, 1957 (N. A. Walker), in coast redwood litter and moderately decayed redwood logs; type number 2975 in the U. S. National Museum. Sixty-one paratypes, females and males, same data as above.

Distribution (see Pl. 38):

Del Norte Co.: Klamath, 1 mile S., IX-5-61, redwood litter, decayed log (N. A. Walker).

Humboldt Co.: Pepperwood, 3.5 miles S., Humboldt Redwoods State Park, IX-5-61 (N. A. Walker). Pepperwood, 6.3 miles S., The Avenue of the Giants, Humboldt Redwoods State Park, III-23-56 (N. A. Walker). Dyerville, 1 mile S., Humboldt Redwoods State Park, IX-19-53 (E. E. Gilbert, R. O. Schuster). Weott, 3.7 miles S., S. R. Boardman Grove, Humboldt Redwoods State Park, III-23-56 (N. A. Walker). Miranda, 2.5 miles N., Blair Grove, Humboldt Redwoods State Park, III-23-56 (N. A. Walker). Franklin Lane Grove, Humboldt Redwoods State Park, X-10-53 (J. W. MacSwain). Garberville, 5 miles S., Richardson Grove State Park, VII-30-55 (W. R. Kellen).

Marin Co.: Samuel P. Taylor State Park, 0.2 mile from ESE. entrance, XI-8-53 (E. E. Gilbert, V. D. Roth, G. A. Marsh, R. O. Schuster); VII-5-56, well-decayed redwood log; redwood litter, soil; moderately decayed redwood log; redwood tree hole litter, decayed log; redwood, oak litter, soil; redwood litter; redwood litter, decayed log (E. E. Gilbert, N. A. Walker); III-14-57, (type sample); VII-11-57, decayed redwood log, litter; VII-16-57, redwood litter, decayed non-redwood log, soil; VII-17-57, redwood logs, stumps in various stages of decay; VII-23-57 (N. A. Walker).

Mendocino Co.: Garberville, 11 miles S., III-23-56 (N. A. Walker). Piercy, 6.4 miles S., III-23-56 (N. A. Walker). Piercy, 14.7 miles S., III-23-56 (N. A. Walker). Fort Bragg, 13 miles E., IV-20-56 (N. A. Walker). Fort Bragg, 16 miles E., IV-20-56, redwood litter; decayed log (N. A. Walker). Russian Gulch State Park, 2.5 miles into, IV-21-56 (N. A. Walker). Mendocino, 7.1 miles E., IV-21-56 (N. A. Walker). Mendocino, 6.6 miles E., IV-21-56, redwood litter; decayed log (N. A. Walker). Mendocino, 5.5 miles E., IV-21-56 (N. A. Walker). Mendocino, 4-7 miles E., IV-21-56 (N. A. Walker). Navarro, 12.4 miles W., IV-21-56 (N. A. Walker). Navarro, 6.6 miles W., Paul M. Dimmick Memorial Grove State Park, IV-21-56 (N. A. Walker). Yorkville, 27 miles WSW., IV-21-56 (N. A. Walker).

Monterey Co.: Pfeiffer-Big Sur State Park, 43 miles S., III-20-57 (N. A. Walker).

Santa Clara Co.: Saratoga, 4 miles W., VIII-4-57 (B. J. Adelson).

Sonoma Co.: Fort Ross State Historical Monument, 0.2 mile S., IV-22-56 (N. A. Walker). Monte Rio, 3.9 miles W., IV-22-56, redwood litter, decayed

log (N. A. Walker). Monte Rio, 0.9 mile W., IV-22-56 (N. A. Walker). Armstrong Redwoods State Park, III-14-54 (J. R. Helfer). Monte Rio, 1 mile E., IV-22-56 (N. A. Walker).

The specific name is derived from the Latin *cernuus* meaning drooping, with reference to the unusual appressed condition of the aspal vertical setae.

Distribution data show that *Euphthiracarus cernuus* is the most abundant *Euphthiracarus* species taken, with over 500 specimens examined, although its pattern of distribution is not quite so broad as some other species. These data also indicate that *E. cernuus* is most successful under conditions of moderate humidity. There possibly was a northward expansion of its range between 1956 and 1961, since the identical localities sampled with positive results in the fall of 1961 were negative in 1955 and 1956. But in the northern portion of its range, this species was rarely encountered in the fall, prior to 1961, while it was found almost year around in the central part of its range. The type locality is toward the southern portion of its region of greatest abundance.

Observations of feeding habits and collection data indicate that this species is associated with decayed wood rather than humus.

Euphthiracarus monyx sp. n..

(Pls. and figs. 39, A-D; 40)

Diagnosis: surface reticulations fine, sparse, shallow, obvious; sensilli recurved, enlarged toward bluntly ended tip, bearing short ciliate brush on leading margin; rostral setae rather long, simple; laterals perhaps as long as rostrals, erect, ciliate on distal one-half, similar to longer verticals; notogastral setae similar to laterals but with finer ciliate brush; ventral plate pocket present, very strongly arched on mesal margin; legs with single claw; ovipositor setae *od*:2 nearly rudimentary; *od*:3,4 and *ov*:2 lacking.

Adult: off white to light tan, darkest along plate margins and other heavily sclerotized areas; one of the smaller *Euphthiracarus* species in size. Setae tapering slightly, appearing stout because of short, sharp spiculae on distal one-half, spiculae apparent at magnification of 156 diameters. Sculpturing of rather small, almost strong, round, smooth, obvious depressions, about size of fissures, smaller than setal insertions, distributed in irregular longitudinal rows over surface of mite.

Female size range: notogaster length 506-464, height 346-284, width 333-277; aspis length 284-229, height 118-111, width 201-173; five specimens measured.

Male size range: notogaster length 464-360, height 298-236, width 298-243; aspis length 249-215, height 97-90, width 166-146; five specimens measured.

Sex ratio: 58% males among 24 specimens from four samples.

Aspis: 262 long, 115 high, 182 wide. In lateral aspect with slight dorsal notch barely posteriad to central rib area. Sculpturing depressions obvious, present latero-dorsally between dorsal bothridial margins anteriad to lateral setal insertions; anteriad to this, sculpturing apparently consisting of very tiny projections laterad to major lateral carinae, smooth below carinae and bothridia. Anterior rim nearly lacking, with very slight emarginate lip; lateral rim strong from notch posteriad; posterior rim strong, 14 wide, leading into single median rib extending nearly to level of posterior margins of bothridia. Central rib obvious, posterior margin midway between laterals and rostrals, anterior margin not obvious in dorsal view, laterally with rostrals inserted equidistantly between anterior and posterior margins. Median carina lacking. With two lateral carinae, major carina not obvious dorsally, in lateral view strong, ending one bothridial width anteriad of anterior bothridial margin; minor carina not apparent dorsally, in lateral view ventral to major carina, weak, directed toward ventral margin of bothridium, ending about one bothridial width anteriad of anterior bothridial margin. Rostral setae rather long, acuminate, with very few, slight spiculae on dorsal surface midway along setae, directed anteriad, 66 long; insertions high, approximate, separated by less than a setal length. Lateral setae rather strong, definitely spiculate on distal one-half, nearly straight, erect, bending slightly anteriad, 62 long; insertions less than their setal length posteriad and very slightly laterad from rostrals, about their setal length antero-mesad from verticals, high, approximate. Vertical setae stout, strongly barbed to spiculate on distal one-half, erect, long, 87. Vertical and lateral setae somewhat stronger than notogastral setae in size and spiculation. Exobothridial setae extremely fine, indistinct, directed anteriad, anterior pair about 2 long, posterior setae lacking. Bothridia low on aspis; slightly oblong in lateral view, in dorsal view with almost square emarginate atrium opening laterad, with short, mesad directed sclerotized lobulations leading to eight to 12 slightly sclerotized elongate lobes. Scale ventral to, extending posteriad from but barely beyond, emarginate atrium of bothridium, strong, in lateral view curving dorsad to merge with ventro-anterior margin, in dorsal view emerging at gentle angle posteriorly but recurving anteriorly to meet aspal margin, non-mammiform. Sensillus strong, slender basally, becoming gradually thicker distally, with strong spiculae on antero-disti-ventral one-third becoming longer distally, almost bearded toward sharp, acute tip, about 90 long, emerging latero-posteriad from bothridium then curving antero-laterad and slightly dorsad, with tip recurving postero-dorsad. In true dorsal aspect, appearing only slightly spiculate because of ventral position of spiculae.

Notogaster: 485 long, 310 high and wide. Anterior rim distinct, 23 wide; collar narrowing to rather shallow but long sensillar notch; lapet distinct, not prominent, almost straight. Sculpturing evenly distributed over notogaster. With 14 pairs of similar setae, slender, rather blunt, with short spiculae on distal one-half, erect, ranging in length from 46-58, majority about 48; *c*:3 insertion near to and centered on sensillar notch, *d*:3 insertion high and anteriad to usual position. Setae *f*:1 vestigial. Lateral gland small, apparently lacking accessory pores. Fissures discrete, small, about equal in diameter to sculpturing depressions.

Ventral plates: 450 long, 90 wide (flattened somewhat). With strongly sclerotized, rather small pocket, shaped about like a normal curve, nearly one-fourth length of entire plate, opening laterally connecting with sclerotized external carina extending length of plate. Ventral surface with narrow anterior

reinforcing bar bearing short, antero-mesal narrow triangular furrow with emarginate margins medially, triangle base at mesal plate margin, point one-seventh plate width laterad of mesal margin; rest of ventral surface smooth although internal, dorsal, portion of anterior reinforcing bar, in whole mounts, gives appearance of having large triangle similar to other species, but reversed, with base at lateral margin, point on mesal margin. Genital row of nine fine, slight, smooth setae emerging slightly laterad of mesal plate margin; *g:*1 short, perhaps 5 long, seen with difficulty, insertion in narrow antero-ventral furrow of anterior reinforcing bar between mesal projections; *g:*2 perhaps 5 long, insertion in antero-mesal portion of plate immediately posteriad of antero-mesal rim extension of external posterior border of anterior reinforcing bar; *g:*3-4 similar, insertion about two setal insertion diameters posteriad of next anteriad seta; *g:*5 similar, insertion about four setal insertion diameters posteriad from *g:*4; *g:*6 perhaps slightly longer, 7, similar, insertion about four times its setal length posteriad from *g:*5; *g:*7 about 10 long, insertion as drawn; *g:*8 about 15 long, emerging at a right angle to plate surface, bending laterad; *g*·9 about 18 long, similar to *g:*8, emerges diameter of its insertion laterad of lateral margin of mesal plate rim. Aggenital row of two setae, rather strong basally but rapidly becoming slender, nearly erect; inserted width of bar posteriad to narrow anterior reinforcing bar on smooth ventral plate surface directly ventrad from internal portion of reinforcing bar, appearing to originate from posterior margin of an apparent broad triangle as found in other species; frequently obvious on nonpermanent mounts; mesal seta about 15 long, smooth, emerging one-half plate width laterad from mesal margin; lateral seta similar, emerging three-fourths plate width laterad from mesal margin. Four adanal setae stout, strong, with short strong spiculae, tip acute, insertions laterad to mesal plate margin, somewhat finer than notogastral setae; *ad:*1 about 40 long; *ad:*2 about 50 long, insertion one-fourth plate width laterad to mesal margin; *ad:*3 about 55 long, insertion barely posteriad to *a:*2; *ad:*4 about 65 long; *ad:*3,4 emerging one-half plate width laterad to mesal margin. Two anals smooth, long, slender with acuminate tip, emerging from mesal plate margin; *a:*1 about 60 long, insertion about one-half length of ano-adanal portion posteriad from anterior margin of anal; *a:*2 about 70 long, insertion barely antero-mesad from *ad:*3. Adanal fissure small, slightly mesad of line between *ad:*1-2, about three-fifths of distance between *ad:*1-2 posteriad of *ad:*1.

Ovipositor: distal shaft with well delimited wavy pattern of striae, lobes rather strongly sclerotized to insertions of distal setae, with membranous tips. Dorsal lobes rather broad, moderately long; *od:*1 slender, smooth, sharply spiniform, bending at about 30° angle at distal two-thirds length, about 16 long, insertion on median line at tip of sclerotized area of lobe; *od:*2 short, about 4, rather stout, almost blunt, insertion one-half length of sclerotized lobe area directly proximad from *od:*1; *od:*3 lacking, site barely visible; *od:*4 lacking. Ventral lobe slightly shorter than dorsals, with broad unsclerotized region distad of *ov:*1 setae; *ov:*1 stronger than *od:*1, almost blunt, straight, about 28 long, insertion at distal margin of lobe sclerotization, *ov:*2 lacking. Coronal setae lacking.

Male genitalia: setae rather strongly sclerotized, slender, sharp, nearly straight; ventral setae about 9 long; dorsal setae about 6 long.

Gnathosoma: chelicerae 165 long, 80 high, dorso-lateral surface with few, tiny spiculae; setae *cha* slender, smooth, slightly bent, 20 long, *chb* similar, longer, 30. Menton setae insertions about two-thirds length of menton pos-

teriad from anterior point, on lateral margin. Palpi three segmented, femur about equal to combined length of other segments; disti-medial seta fine, slender, straight, short, about 5; with discrete eupathidia; solenidion long, more than twice as long as any palpal setae.

Legs: with only single rather stout median claw. Machete-like seta of coxa IV with single acuminate tip, appearing scimitar-like but with blade broadened somewhat at bend. Famulus about 10 long, stout, straight, blunt.

Eggs: an average of 1.2 per specimen, with range of zero to three found in eight specimens examined.

Larva and nymphs unknown.

Type data: holotype female and allotype from; 0.8 mile south of Fort Dick, Del Norte County, California (along former U. S. 101), March 22, 1956 (N. A. Walker), in well-decayed coast redwood log and stump; type number 2976 in the U. S. National Museum. Paratypes include all 24 other specimens listed in distribution; deposited in the California Insect Survey collection, U. S. National Museum, British Museum (Natural History), National Museum of Natural History, Paris, and my collection.

Distribution (see Pl. 40):

Del Norte Co.: Fort Dick, 0.8 mile S., III-22-56, decayed redwood log, stump (10 total, type sample); litter, decayed wood (3) (N. A. Walker). Crescent City, 5.9 miles S., III-22-56, redwood and other litter (3) (N. A. Walker). Klamath, 1 mile S., III-22-56, decayed redwood log (4) (N. A. Walker).

Humboldt Co.: Klamath, 5.7 miles S., Prairie Creek Redwoods State Park, IX-5-61, decayed redwood, litter (2) (N. A. Walker). Klamath, 16 miles S., IX-5-61, decayed redwood, litter (3) (N. A. Walker). Carlotta, 4.1 miles E., IX-20-55, litter between redwood stumps (8); decayed redwood log, bark (5) (N. A. Walker). Pepperwood, 0.2 mile S., III-22-56, decayed redwood log (1) (N. A. Walker).

Mendocino Co.: Fort Bragg, 6.6 miles NE., IV-21-56, redwood litter (1) (N. A. Walker). Fort Bragg, 16 miles E., IV-20-56, decayed redwood log (1) (N. A. Walker). Russian Gulch State Park, 2.5 miles into, IV-21-56, redwood litter (1) (N. A. Walker).

Santa Cruz Co.: Ben Lomond, VII-5-53, redwood litter (1) (C. D. MacNeill).

Sonoma Co.: Plantation, IV-5-56, redwood litter (1) (D. J. Burdick).

The specific name is derived from the Greek *monyx* (m.) meaning uncloven hoof, with reference to the single claw per leg.

Collection data indicate that *Euphthiracarus monyx* is more abundant in decayed wood than in litter. The distribution data suggest two related possibilities, that the distribution shown represents only the southern or southwestern portion of its range, and that the ecological conditions in the coast redwood area are marginal for this species.

Genus *Rhysotritia* Märkel and Meyer

The reasons for the relative position of these species within the genus are the palpal setation patterns, the reduction in numbers and size of the genital and anal setae and the presence and absence of ovipositor seta *od*:4. *Rhysotritia scotti*, in many of its character-

istics, resembles the small *Euphthiracarus* species, and has the greater development of the characters listed above when compared with *R. paeneminima.*

Key to the *Rhysotritia* species from *Sequoia* litter

1. Sensillus smoothly curved, tapering to sharp tip; aspal and notogastral setae stout, obvious..... *scotti*
— Sensillus geniculate, enlarged distally, acute tip usually broken off leaving roughened blunt end; aspal and notogastral setae fine, slender..... *paeneminima*

Rhysotritia scotti sp. n.

(Pls. and figs. 41, A-E; 42)

Diagnosis: small; under low magnification exoskeleton appearing strong, shiny between obvious, shallow depressions; under high magnification depressions less obvious, with numerous tiny spiculae; aspis with superficial pattern of irregular reticulations; sensilli slender, smoothly curved, acuminate, sparsely beset with minute barbules on distal one-half to one-third; aspal setae rather short, erect, stout; notogastral setae twice length of aspal setae, similar, very sparsely beset with tiny barbules toward tip; anterior notogastral rim narrow, collar and lapet reduced; 9 very fine, tiny genital setae and 1 minute aggenital seta; *a:*1 very fine, other 5 anal, adanal setae subequal to notogastrals; ovipositor setae *od:*4 so far proximad as to be included in row with usual 6 coronal setae.

Adult: off white, occasionally tending toward light tan; exoskeleton appearing thicker than in *R. paeneminima.*

Female size range: notogaster length 416-277, height 256-194, width 249-187; aspis length 222-166, height 104-55, width 152-118; ten specimens measured.

Male size range: notogaster length 333-263, height 243-180, width 229-173; aspis length 187-159, height 83-69, width 132-111; ten specimens measured.

Sex ratio: 49% males among 116 specimens from four samples.

Aspis: 212 long, 87 high, 150 wide. In dorsal aspect with rather gently but acutely rounded anterior tip; in lateral aspect with slight dip in dorsal surface in line with anterior bothridial margin and verticals. Rostral region smoothly arcuate to anterior margin; ventral margin with broad notch ventrad. Surface sculpturing apparent in lateral view similar to notogaster, also with superficial reticulate pattern on dorsum. Anterior rim lacking; lateral rim extending from posterior portion of notch, not particularly pronounced. Central rib present, not strongly marked, in lateral aspect slightly stronger posterior margin leading toward insertion of lateral seta; anterior margin not particularly evident. Median carina lacking. With single strong lateral carina obvious in lateral aspect, gently, smoothly curving to dorso-anterior margin of scale. Rostral setae almost stout, smooth, erect, curving slightly dorsad, about 23 long; insertions high, rather approximate, slightly more than a setal length apart. Lateral setae slender, smooth under lower magnifications, very slightly, finely spiculate under magnification of 312 diameters, erect, curving slightly anteriad,

25 long; insertions high, approximate, separated by less than a setal length. Verticals shorter than but similar to laterals, spiculae slightly stronger, 20 long; insertions rather widely separated. Exobothridial setae; posterior pair vestigial; anterior pair very fine, about 7 long. Bothridium in lateral aspect slightly below center, oblong; opening laterad, without emarginate atrial border; in dorsal aspect broadly comma-shaped, with "tracheae." Scale dorsal to bothridial atrium, prominent, with small, distinct posterior nubbin then major portion anteriad, centered over bothridium, non-mammiform. Sensillus rather slender, under low magnifications appearing sharp compared with *R. paeneminima,* with very slight spiculae on postero-disti-dorsal surface of distal one-half, smooth on proximal and inner, meso-ventral, surfaces, about 75 long, emerging laterad then bending smoothly anteriad, slightly dorsad.

Notogaster: 384 long, 244 high, 242 wide, sub-globose. Collar distinct, rather narrow, nearly covering obvious sensillar notch, leading to non-prominent, straight lapet. Surface shiny but with obvious depressions under low magnifications; under higher magnifications depressions small, perhaps one-half diameter of setal insertions, not obvious in direct view, without pores obviously restricted to depressions; surface with minute spiculae closely spaced over entire notogaster and, less markedly so, on aspis; not shagreen-like. With 14 pairs of similar setae, relatively strong, rather slender, erect, 45-50 long, very slightly spiculate on distal one-third, spiculae obvious under magnifications greater than 150 diameters; *c*:3 insertion high, above sensillar notch. Setae *f*:1 vestigial. Lateral gland present, inconspicuous, smaller than fissures. Fissures discrete, nearly as long as setal insertion diameter, elongate, obvious.

Ventral plates: 314 long, 55 wide (not flattened). Mesal triangle relatively simple; antero-lateral corners rounded, with about four internal convolutions; small, discrete in appearance, without lateral fissures extending beyond triangle margins. With anterior reinforcing rod but without strongly emarginate posterior border. Genito-aggenital portion of plate rather short, somewhat less than one-half total plate length, with two rows of setae. Genital row of nine fine, slight, slender, smooth setae; *g*:1-3 located equidistant from one another in base of triangle formed by anterior margin and reinforcing rod, particularly fine, about 6 long; *g*:4 similar, insertion immediately posteriad of posterior margin of reinforcing rod; *g*:5-9 insertions about twice their setal length posteriad from next anterior seta, lengths of setae *g*:5-9 gradually increasing from *g*:5 about 7 long to *g*:9 perhaps 11 long. Lateral row consisting of a single aggenital seta, rudimentary, about 3 long, insertion almost one-half plate width laterad from mesal margin, barely posteriad from reinforcing rod, in area of protuberances on ventral plate, nearly hidden by them. Ano-adanal region with six setae separable into two groups of three setae each. Adanal setae erect, subequal to notogastrals, about 35-40 long; spiculae slightly smaller; *ad*:1 insertion about one-third length of plate portion posteriad from anterior margin of median triangle; *ad*:2 insertion about one-fourth in arc line, one-tenth in straight line of plate portion length anteriad to posterior point; *ad*:3 insertion mid-way between posterior point and *ad*:2, *ad*:2,3 more obviously removed from mesal margin than *ad*:1. Anal setae smooth, *a*:1 very fine, short, about 12 long, inconspicuous, insertion on lateral margin of median triangle; *a*:2,3 long, about as long as adanals, insertion of *a*:2 nearly two-thirds of plate portion length posteriad from anterior margin of median triangle; *a*:3 insertion about three-fourths posteriad similar distance. Adanal fissure lacking.

Ovipositor: distal shaft with distinct, irregular pattern of striae. Dorsal lobes with indistinct, indefinite membranous tips extending beyond sclerotized portions, setal bases more heavily sclerotized than rest of lobe; *od:*1 rather stout basally, rapidly becoming slender, acuminate, strongly recurved at about one-sixth its length distally, then gently curving remainder of length, about 42 long; *od:*2 slender spiniform, about 18 long; insertion less than its setal length proximo-laterad from *od:*1; *od:*3 similar to *od:*2, somewhat more slender, about as long, curving gently; insertion about its setal length proximo-mesad from *od:*1; *od:*4 so far proximad as to be included among, and similar to, coronal setae. Ventral lobe with slight indication of bilobate tip; *ov:*1 similar to *od:*1 but somewhat weaker, perhaps as long; *ov:*2 similar to *od:*2, slightly weaker, about 14 long, insertion directly proximad, about one-half its setal length, from *ov:*1. Apparently four pairs of coronal setae present, including similar *od:*4, on lateral, dorsal, ventral surfaces of proximal membranous portion, fine spiniform, similar to *od:*3 but smaller, about 7-9 long.

Male genitalia: setae slender spiniform, sharp, nearly straight, similar in size, about 8 to 10 long.

Gnathosoma: chelicerae 135 long, 65 high, rather few, sparse spiculae on dorso-lateral surfaces; seta *cha* rather fine, obvious, curving slightly, smooth, sharp tipped, about 16 long; *chb* stronger, similar, about 25 long. Anterior pair aboral setae indistinct, perhaps lacking, posterior two pairs obvious. Menton setal insertions slightly more than one-half length of menton posteriad from anterior point, about equidistant from one another and lateral borders, more approximate than in *Euphthiracarus.* Palpi three segmented, femur slightly longer than combined length of tibia, tarsus; disti-medial seta extremely fine, apparently almost stubby, short, about 4 long; eupathidia discrete; solenidion normal. Palpal formula 2-2-8, without common exception.

Legs: with single, stout, simple claw. Famulus blunt, stout, not well sclerotized, about 8 long.

Eggs: an average of 0.7 per specimen, with range of zero to one found in ten females examined.

Larva and nymphal stages unknown.

Type data: holotype female and allotype from; 0.2 mile from ESE. entrance of Samuel P. Taylor State Park, Marin County, California, July 5, 1956 (E. E. Gilbert, N. A. Walker), in coast redwood tree hole litter, decayed logs; type number 2977 in the U. S. National Museum. Paratypes include 181 specimens, data as above, and all other specimens from the same locality as listed in the distribution records.

Distribution (see Pl. 42):

ALAMEDA Co.: Oakland, Mountain Boulevard, on the north and south banks of Palo Seco Creek, V-26-55 (2); N., XII-12-55 (2); S., IV-15-56 (3); S., V-18-56 (2); S., VI-11-56 (1); S., VII-13-56 (25) (N. A. Walker).

CONTRA COSTA Co.: Redwood Regional Park, V-18-53 (5) (E. E. Gilbert, R. O. Schuster).

DEL NORTE Co.: Smith River, 3.2 miles S., III-22-56, litter, decayed redwood stump (143) (N. A. Walker). Fort Dick, 0.8 mile S., III-22-56, litter, decayed redwood (2) (N. A. Walker). Crescent City, 5.9 miles S., III-22-56, redwood and other litter (23) (N. A. Walker). Klamath, 1 mile S., IX-20-55 (21); IX-5-61, decayed redwood log, litter (14) (N. A. Walker).

HUMBOLDT Co.: Klamath, 5.7 miles S., Prairie Creek Redwoods State Park, IX-5-61, decayed redwood, litter (1) (N. A. Walker). Klamath, 18 miles S., IX-19-53 (4) (E. E. Gilbert, R. O. Schuster). Klamath, 31.2 miles S., IX-

20-55 (2) (N. A. Walker). Freshwater, X-10-53 (1) (J. W. MacSwain). Dyerville, 1 mile S., Humboldt Redwoods State Park, IX-19-53 (2) (E. E. Gilbert, R. O. Schuster).

MARIN Co.: Samuel P. Taylor State Park, 0.2 mile from ESE. entrance, XI-8-53 (5, 6) (E. E. Gilbert, V. D. Roth, G. A. Marsh, R. O. Schuster); VII-5-56, decayed redwood log, litter (5); redwood litter (1); redwood tree hole litter, decayed wood (183, type sample); litter (10); litter, decayed redwood log (26) (E. E. Gilbert, N. A. Walker); III-14-57, moderately decayed redwood log (1); VII-16-57, redwood litter, non-redwood log (11); VII-17-57, redwood logs, stump (5); VII-23-57, litter (1) (N. A. Walker).

MENDOCINO Co.: Yorkville, 6 miles WSW., IV-21-56 (2) (N. A. Walker).

MONTEREY Co.: Carmel, XII-21-53 (1) (V. D. Roth). Pfeiffer-Big Sur State Park, 43 miles S., VIII-30-56 (4); III-20-57 (3) (N. A. Walker).

SAN MATEO Co.: San Mateo County Memorial Park, IV-18-54 (2) (R. O. Schuster, E. E. Gilbert); VIII-31-56 (1) (N. A. Walker).

SONOMA Co.: Mark West Springs, XII-31-53 (5) (V. D. Roth, G. A. Marsh, R. O. Schuster). Monte Rio, 0.9 mile W., IV-22-56 (5) (N. A. Walker).

Non-redwood distribution:

COLUSA Co.: Princeton, IX-4-53, unknown source (27) (H. L. Hansen).

The specific name is derived from that of my elder son.

The distribution data indicate that *Rhysotritia scotti* is rather widespread under the coast redwood. It may rarely be found in large numbers, but more usually appears to be present in so small numbers as to suggest that redwood litter and logs are marginal microhabitats. Although it did occur in some collections from redwood logs, it was absent from many similar collections and is assumed to inhabit small twigs in litter. Only rarely were both *Rhysotritia* species found within the same collection.

Rhysotritia paeneminima sp. n.

(Pls. and figs. 43, A-E; 44)

Diagnosis: small; exoskeleton appearing thin, shiny, smooth, but shagreen-like under high magnification; sensilli geniculate, simple, with blunt club-like sclerotized area enlarged distally with membranous, sharply pointed tip, usually broken resulting in coronal effect; aspal setae simple, short, fine, inconspicuous; notogastral setae similar to but perhaps twice length of aspals; anterior notogastral rim broad, with prominent collar, lapet; 4 rather fine genital, 1 similar aggenital, 3 rather long, fine adanal, 3 nearly vestigial anal setae; ovipositor setae *od:*4 lacking; 6 coronal setae.

Adult: off white to light tan; among the smallest species of the superfamily; exoskeleton appearing very thin, surface shiny, smooth under low magnification, with fine reticulations shagreen-like under high magnifications.

Female size range: notogaster length 380-284, height 244-201, width 248-187; aspis length 225-166, height 77-62, width 166-111; ten specimens measured.

Male size range: notogaster length 331-256, height 232-180, width 230-173; aspis length 177-146, height 78-49, width 147-111; ten specimens measured.

Sex ratio: 37% males among 68 specimens from four samples, influenced by a larger collection from the fall containing 14% males.

Aspis: 225 long, 77 high, 166 wide. In dorsal aspect with rather pointed anterior tip; in lateral aspect with slight hump in central third of length of dorsal surface. Rostral region low, nearly flat; ventral margin nearly straight, without notch. Very fine shagreen surface patterning barely evident. Anterior rim lacking, lateral rim thin, apparent from carina posteriad; posterior rim strong, fine, about 5 wide, median rib extending anteriad to level of posterior bothridial margins. Central rib present, not strongly marked; in lateral aspect stronger posterior margin about equidistant between verticals and laterals, weaker anterior margin between laterals, rostrals; not obviously attaining median line in dorsal aspect, does so in lateral aspect in well sclerotized specimens. Median carina lacking. With single strong lateral carina, not obvious dorsally save as being lateral aspal margin, in lateral view obvious, ending at dorsal bothridial margin. Rostral setae very fine, smooth, erect, about 23 long; insertions high, approximate, less than a setal length apart. Lateral setae very fine, smooth, erect, about 25 long; insertions high, approximate, separated by setal length. Vertical setae very fine, smooth, short, about 12 long, appear appressed because of shortness; insertions widely separated. Anterior pair of exobothridial setae very fine, about 7 long; posterior pair vestigial. Bothridia low on aspis, almost circular in outline, opening laterad, without emarginate border to atrium, with short, mesad directed, lightly sclerotized lobulations leading to eight to 12 slightly sclerotized elongate lobes. Scale posteriad from, very slightly ventrad of, barely separated from bothridium, relatively strong, smoothly curved, non-mammiform. Sensillus strong, smooth, very slender basally increasing evenly to club-like shape, with lightly sclerotized pointed tip commonly broken off leaving an irregular, crown-like structure on distal end; about 100 long; emerging laterad then bending smoothly, rather sharply anterodorsad.

Notogaster: 380 long, 244 high, 248 wide, sub-globose. Collar distinct, with two rather faint internal "margin" lines, one about 23, posterior one 50 from anterior margin, covering most of rather deep sensillar notch, leading to rather strong, prominent lapet. Surface apparently smooth at lower magnification, slightly roughened, shagreen-like, under magnification of 312 diameters. With 14 pairs of similar setae, very fine, slender, smooth, acuminate, erect, ranging in length from about 45-100; *c*:3 insertion high, above sensillar notch. Setae *f*:1 apparently vestigial. Lateral gland present, rather difficult to see because of slight sclerotization of small orifice. Fissures discrete, relatively large, elongate, obvious.

Ventral plates: 260 long, 46 wide (not flattened). Mesal triangle somewhat more simple in internal convolutions than in *Euphthiracarus;* small, discrete in appearance, without lateral fissures extending beyond triangle margins. With anterior reinforcing bar with slightly emarginate posterior margin forming triangle, base mesal, point distal. Genito-aggenital portion of plate short, four-elevenths of total plate length; with two rows of fine, smooth, slight setae. Genital row of four setae located on or near mesal margin; *g*:1 short, about 9 long, insertion barely anteriad to posterior margin of reinforcing rod, in triangle; *g*:2 slightly longer, insertion nearly one-third of distance from posterior margin of anterior triangle to mesal triangle; *g*:3 slightly longer, perhaps 18; *g*:4 slightly shorter than *g*:3, nearly at posterior margin of genital portion of

plate. Aggenital row comprising a single seta, similar to genitals but shorter, about 5 long; insertion about four-sevenths of plate width laterad from mesal margin, slightly behind posterior margin of reinforcing rod, almost as obvious in temporary mounts as genitals. Ano-adanal region with six setae separable into two groups of three setae each. Both groups of setae fine, smooth, simple, acuminate; *ad:*1 long, 32; *ad:*2 longest of ventral setae, 37; *ad:*3 shorter, 23, obvious; adanal setal insertions laterad of mesal margin. Anals short, nearly rudimentary, about 3 long, indistinct; *a:*1 frequently not obvious, insertion barely postero-mesad of lateral points of mesal triangle; insertions of *a:*2 about one-third of distance between *ad:*1-2 posteriad of *ad:*1; *a:*3 equal distance posteriad of *a:*2, anal insertions small, emerging at mesal plate margins. Adanal fissure similar to notogastral fissures, on line, equidistant, between *a:*1-*ad:*1.

Ovipositor: distal shaft with distinct, tiny, fine pattern of wavy striae. Dorsal lobes with distinct, pointed membranous tips extending beyond sclerotized portions, relatively poorly sclerotized save at setal insertions; *od:*1 rather stout basally, rapidly becoming slender, ending in very acuminate tip, recurved, relatively long, 48; *od:*2 slender spiniform, nearly straight, about 13 long, insertion proximad its setal length and paraxially laterad from *od:*1; *od:*3 similar but slightly stronger, 16 long, insertion slightly more proximad from *od:*1 than is *od:*2 and antiaxially laterad from *od:*1; *od:*4 lacking. Ventral lobe with bilobate distal portion extending proximad beyond bases of distal setae; *ov:*1 similar to, slightly stronger than *od:*1, 50 long, insertions forming caps on bilobate tip; *ov:*2 similar to *od:*2, insertion proximad its setal length, slightly mesad of *ov:*1. Three pairs of strong coronal setae present, subequal to *od:*2, about 10 long; insertions on lateral and dorsal surfaces of proximal membranous portion of ovipositor.

Male genitalia: setae rather finely spiniform, slender, sharp, nearly straight, similar in size, 10 to 13 long.

Gnathosoma: chelicerae 140 long, 66 high, with rather distinct hump on dorsal surface, both dorsal, to some extent, but particularly lateral surfaces with relatively large, short spicules; seta *cha* fine, frequently indistinct, straight, about 12 long; *chb* stronger, similar, slightly bent, about 21 long. Anterior pair aboral setae indistinct, posterior two pairs obvious. Third, middle, genal seta possibly vestigial. Menton setal insertions almost one-half length of menton posteriad from anterior point, separated by twice distance from seta to lateral margin, hence more approximate than in *Euphthiracarus.* Palpi three segmented, femur slightly longer than combined length of tibia and tarsus; disti-medial seta very fine, relatively long, 8; with widely discrete eupathidia; normal, long, solenidion. Palpal setal formula 2-1-8, tibia may have but single seta occasionally.

Legs: with single stout claw bearing two ventral, medial spurs, proximal one almost inconspicuous, distal one obvious. Famulus blunt to apparently slightly enlarged at distal portion, rather stout, not well sclerotized, apparently annulate, about 9 long.

Eggs: an average of 0.6 per specimen, with range of zero to one found in ten females examined.

Larva and nymphal stages unknown.

Type data: holotype female and allotype from; 0.2 mile from ESE. entrance of Samuel P. Taylor State Park, Marin County, California, March 14, 1957 (N. A. Walker), in well-decayed, moist coast redwood log; type number 2978

in the U. S. National Museum. Paratypes include 11 specimens with data as above and all 143 specimens listed from Marin County.

Distribution (see Pl. 44):

CONTRA COSTA CO.: Redwood Regional Park, V-18-53 (E. E. Gilbert, R. O. Schuster).

DEL NORTE CO.: Smith River, 3.2 miles S., III-22-56, well-decayed redwood, litter, soil (1) (N. A. Walker). Fort Dick, 2 miles N., XI-21-53 (V. D. Roth). Fort Dick, 0.8 mile S., III-22-56, decayed redwood log, stump (N. A. Walker). Crescent City, 5.9 miles S., III-22-56 (N. A. Walker). Crescent City, 9.2 miles S., Del Norte Coast Redwoods State Park, III-22-56 (N. A. Walker). Klamath, 1 mile S., IX-20-55, litter, (2); III-22-56, decayed redwood log (800); litter (1); IX-5-61, litter, decayed redwood log (N. A. Walker).

HUMBOLDT CO.: Klamath, 5.7 miles S., Prairie Creek Redwoods State Park, IX-5-61 (N. A. Walker). Klamath, 9.3 miles S., Prairie Creek Redwoods State Park, IX-5-61 (N. A. Walker). Klamath, 18 miles S., IX-19-53 (E. E. Gilbert, R. O. Schuster). Freshwater, 0.6 mile E., III-22-56, well-decayed redwood log (N. A. Walker). Carlotta, 4.1 miles E., IX-20-55, litter; litter, decayed redwood stumps; well-decayed redwood log (N. A. Walker). Pepperwood, 0.2 mile S., III-22-56, decayed redwood log (N. A. Walker). Pepperwood, 6.3 miles S., The Avenue of the Giants, Humboldt Redwoods State Park, III-23-56, redwood litter, humus, decayed wood (N. A. Walker). Dyerville, 1 mile S., Humboldt Redwoods State Park, IX-19-53 (E. E. Gilbert, R. O. Schuster). Dyerville Bridge, Eel River, 1.7 miles S., Humboldt Redwoods State Park, III-23-56, decayed redwood (N. A. Walker). Miranda, 2.5 miles N., Blair Grove, Humboldt Redwoods State Park, III-23-56 (N. A. Walker). Garberville, 3.9 miles S., III-23-56 (N. A. Walker).

MARIN CO.: Samuel P. Taylor State Park, N. entrance, X-24-53 (1) (V. D. Roth). Samuel P. Taylor State Park, 0.2 mile from ESE. entrance, XI-8-53, well-decayed redwood log, litter (15) (E. E. Gilbert, V. D. Roth, G. A. Marsh, R. O. Schuster); VII-5-56, well-decayed redwood log, same as previous collection (25); different well-decayed redwood log (2); moderately decayed redwood log (18); redwood tree hole litter, decayed wood (10); litter (8); litter, redwood log (16) (E. E. Gilbert, N. A. Walker); III-14-57, well-decayed, moist redwood log (type sample); moderately decayed, moist redwood log (11), decayed but drier redwood log (6); redwood litter (6); VII-11-57 (1); VII-16-57 (9); VII-17-57 (10); VII-23-57 (1), all mixed redwood log, litter collections (N. A. Walker). Mill Valley, IX-2-53 (2) (G. A. Marsh, R. O. Schuster). Muir Woods National Monument, I-10-54 (2) (N. A. Walker).

MENDOCINO CO.: Garberville, 11 miles S., III-23-56 (N. A. Walker). Fort Bragg, 13 miles E., IV-20-56 (N. A. Walker). Fort Bragg, 15 miles E., IV-20-56 (N. A. Walker). Fort Bragg, 27 miles E., IV-20-56 (N. A. Walker). Fort Bragg, 28 miles E., IV-20-56 (N. A. Walker). Russian Gulch State Park, 2.5 miles into, IV-21-56 (N. A. Walker). Mendocino, 6.6 miles E., IV-21-56 (N. A. Walker). Mendocino, 8 miles E., IV-21-56 (N. A. Walker). Navarro, 12.4 miles W., IV-21-56 (N. A. Walker). Navarro, 6.6 miles W., Paul M. Dimmick Memorial Grove State Park, IV-21-56 (N. A. Walker). Yorkville, 27 miles WSW. IV-21-56 (N. A. Walker).

MONTEREY CO.: Big Sur, 8 miles N., Bixby Creek Canyon, XII-12-53; V-20-56 (M. S. Wasbauer). Pfeiffer-Big Sur State Park, VIII-30-56 (N. A. Walker). Big Sur, 7 miles S., XII-22-53 (V. D. Roth). Pfeiffer-Big Sur State Park, 25.3 miles S., VIII-30-56 (N. A. Walker). Pfeiffer-Big Sur State Park, 43 miles S., VIII-30-56 (N. A. Walker).

SAN MATEO CO.: San Mateo County Memorial Park, IV-18-54 (R. O. Schuster, E. E. Gilbert).

SANTA CRUZ CO.: Big Basin State Park, III-20-57 (N. A. Walker). Mystery Spot near Santa Cruz, III-27-54 (J. R. Helfer). Santa Cruz, 1 mile N., XII-23-53 (V. D. Roth).

SONOMA CO.: Annapolis, 5.4 miles W., IV-22-56 (N. A. Walker). Annapolis, 3.9 miles SE., IV-22-56 (N. A. Walker). Plantation, 7 miles N.,

IV-22-56 (N. A. Walker). Monte Rio, 3.9 miles W., IV-22-56 (N. A. Walker). Monte Rio, 0.9 mile W., IV-22-56 (N. A. Walker). Monte Rio, 1 mile E., IV-22-56 (N. A. Walker).

TULARE CO.: under Sierra redwood; Kings Canyon National Park, General Grant Grove, V-25-56 (N. A. Walker). Sequoia National Park, Giant Forest, III-18-55 (M. S. Wasbauer, P. D. Hurd, Jr.). Sequoia National Park, Giant Forest Village, 1.5 miles SW., V-25-56 (N. A. Walker). Springville, 23.8 miles NE, V-24-56 (N. A. Walker). Springville, 22.4 miles NE, V-24-56 (N. A. Walker). Balch Park, West Campground, VI-13-56, primarily found in material from N. side of tree, 6400 feet above sea level (N. A. Walker). Balch Park, East Campground, VI-13-56, collection area with ferns, probably moist year around, 6400 feet elevation (N. A. Walker). Balch Park, 1 mile S., VI-13-56, N. side of base of "Methuselah" tree, about 6400 feet elevation (N. A. Walker). Camp Nelson, 1 mile E., Belknap Camp Ground, VI-13-56 (N. A. Walker).

The specific name is derived from the combination of the Latin *paene,* meaning almost, and *minima,* referring to *R. minima* (Berlese) as well as to the size of the species.

Rhysotritia paeneminima shows a wide distribution under redwoods and its range probably extends even more widely. *R. paeneminima* and *R. scotti* rarely occur in abundance within the same sample.

Dr. M. Sellnick identified and provided me with a collection of 89 specimens of *R. minima,* which was utilized in comparing the species. Morphologically, *R. paeneminima* is very close to *minima,* differing chiefly in the usual palpal setal formula, aggenital setation and in overall measurements. Occasional specimens were noted in both species in which the palpal setal formula varied from the usual numbers, perhaps more commonly in *minima,* resulting in a slight intergradation between the species with regard to this characteristic. On each aggenital plate region is found one tiny, fine, aggenital seta in *R. paeneminima* and two similar setae in *minima* (not depicted in Sellnick, 1923, or in Märkel, 1958). *R. paeneminima* is somewhat larger than are the *minima* specimens, as well as larger than the sizes given for *minima* in the original description (Berlese, 1904) and Sellnick's (1923) redescription.

It is assumed that the tip of the sensillus commonly breaks off in *minima,* as it does in *paeneminima;* only rarely were entire sensilli noted in *paeneminima* while none were noted in the *minima* specimens. The Tulare County samples included a number of specimens of *paeneminima* with sensilli somewhat longer and more slender than most of the specimens from the coastal region.

Less obvious morphological differences between the species include a very tiny second, proximal, hook on the claw of *paeneminima* with only the larger single hook apparent in *minima,* and the sensilli of *paeneminima* are not as strongly club-like as depicted for

minima by Märkel (1958), but not completely confirmed by the examined specimens. There were other minor variations noted between the specimens of *minima* and the drawing by Märkel (1958).

Other criteria used to decide the status of the present taxon included differences in sex composition of populations and habitat preferences. *R. paeneminima* is bisexual while *minima* is stated (Grandjean, 1941*a*) to be unisexual or parthenogenetic. Grandjean (1941*a*) reports 91 females and no males from Périgeux, France, habitat and date unspecified, while the 89 specimens, collected by Sellnick, from Donaustauf, near Regensburg [Bavaria], IX-12-58, from moss (*Leurobryum*), were also all females. In *paeneminima,* the sex ratio for samples apparently is correlated with the date of collection because spring samples show a preponderance of males while fall samples show the reverse, but with some males always present in samples of at least moderate size. Another difference noted between these species is that of habitat, *paeneminima* obviously occurring in decaying wood (for an outstanding example, note the collection data for Klamath, 1 mi. S.; 800 from wood, one specimen from litter including moss and humus) while *minima* is reported as occurring in humus (Evans, 1951; van der Hammen, 1952; Halasková and Kunst, 1961) and moss (Willmann, 1920, as *minuta* Willman; Evans, 1952; Sellnick collection).

The indicated habitat preference, of *paeneminima,* for decaying (redwood) wood is reinforced by: the repeated occurrences of decayed redwood logs as a major component of the collected materials for those samples in which the species was found; the common absence of this species, or marked reduction in numbers found, where decayed wood was not a major component of the collected material; and by the maintenance of the single available specimen on decayed redwood in culture for more than a month. It is possible that the humus habitat, referred to above, includes some decayed wood and that the species require access to moss for successful reproduction; a situation reported for three species of *Galumna* by Sengbusch (1954).

Because of the divergent habitats, sex differences and the slight morphological differences noted between *paeneminima,* the specimens of *minima,* and the drawing (by Märkel, 1958) representing *minima,* I consider that *paeneminima,* from decayed wood, and *minima,* from moss, are specifically distinct and would suggest that more detailed study of specimens from humus, in Europe, might result in a yet different species being defined.

Family Synichotritiidae fam. n.

Genus *Synichotritia* gen. n.

In comparing the patterns of distribution of these species in the areas of coincidence, no northern samples were obtained in which both species occur although, at 1 mile south of Klamath, a collection in September, 1955, yielded only *S. caroli* while collections, taken within 5 feet of the original site, in March, 1956, and September, 1961, yielded only *S. spinulosa.* Slightly farther south, in the center of abundance of *S. spinulosa* in Prairie Creek Redwoods State Park, the collections yielded only *S. spinulosa,* with the exception of one collection taken 8 miles south of Klamath, not collected by the author, which contained both *S. spinulosa* and a few *S. caroli.* Toward the southern end of the center of abundance of *S. spinulosa,* just south of the Prairie Creek redwoods, two samples with both species present were taken, *S. spinulosa* being more abundant than *S. caroli.* A gap occurs in the apparent distribution of *S. spinulosa* from Orick, 19 miles south of Klamath, thru Freshwater and Charlotta to 1.7 miles south of the Dyerville Bridge over the South Fork of the Eel River, where *S. spinulosa* again is found, but in very small numbers associated with larger numbers of *S. caroli.* One other collection slightly farther south shows the same pattern.

It may appear that the distribution patterns reported are a result of unrecognized bias, on my part, in favor of certain types of litter; this would seem to be contraindicated by the similar results shown in relatively numerous collections taken by others in this general region, as noted in the distribution of *S. caroli,* as well as collections from this region containing neither of these species. Additional collections would probably show these species to be more commonly coexistent in this area.

Synichotritia caroli is considered to be more primitive than *S. spinulosa* because of the following differences: *S. caroli* has six ano-adanal setae and five palpal segments, none of its ovipositor setae are markedly reduced in size, and it has the wider distribution under redwood; while *S. spinulosa* has seven ano-adanal setae and four palpal segments, two pairs of ovipositor setae are markedly reduced in size, and it has a more restricted distribution.

Key to the *Synichotritia* species from *Sequoia* litter

1. With six pairs of ano-adanal setae; aspal vertical setae not extending past aspal midline ..... *caroli*
— With seven pairs of ano-adanal setae; aspal vertical setae extending past aspal midline ..... *spinulosa*

Synichotritia caroli sp. n.

(Pls. and figs. 45, A-D; 46)

Diagnosis: moderate in size; notogastral surface with closely spaced fine depressions with minute punctations in bottom of depressions; vertical setae not extending past midline of aspis; scale with rather acute distal margin; six fine, smooth, antero-genital, four similar genito-aggenital, three larger adanal, three short, fine anal setae; ovipositor lobe setae *od:*4 and coronal setae lacking.

Adult: light to medium cream color with red-brown plate margins. Setae moderately long, rather slender, spiculate at least distally with fine but bluntly rounded tip. Notogaster with sculpturing of fine, irregular depressions with minute punctations at bottom, venter frequently covered with debris.

Female size range: notogaster length 859-450, height 589-298, width 568-333; aspis length 423-249, height 159-111, width 291-180; ten specimens measured.

Male size range: notogaster length 686-367, height 464-249, width 478-270; aspis length 367-194, height 139-55, width 249-132; ten specimens measured.

Sex ratio: 57% males among 209 specimens from three samples.

Aspis: length 366, height 143, width 249. Sculpturing of tiny tubercules obvious on rostral, less distinct on lateral, surfaces in dorsal view. Latero-anterior rim one-half as wide as posterior rim, much thinner around anterior end. Posterior rim rather wide, 23, for three-fourths width of aspis, then somewhat more narrow to posterior borders of bothridia. Median aspal rib relatively short, 62 long, pronounced because of heavier sclerotization, appears convoluted or rope-like. Lateral carina single, not obvious dorsally, laterally weak. Rostral setae setiform, about 125 long, spiculate basally only, each terminating in a very fine acuminate tip, in dorsal view curving slightly laterad then strongly mesad to angled tips, which cross mesally, not extending beyond aspal rim, in lateral view emerging at 30° angle then curving smoothly and gently toward rostrum with rather abruptly angled tip parallel to rostral surface. Lateral setae about 90 long, setiform, appressed to aspis, almost straight, directed anteriad, each terminating in an acuminate tip; insertions very slightly laterad of verticals, about two-thirds aspal width apart. Vertical setae setiform, about 100 long, extending almost vertically from insertions then curving mesally, with acuminate tip. With two pairs of exobothridial setae, both very fine, smooth, small, acuminate, obvious; anterior setae 39 long, directed antero-laterad; posterior setae 37 long, directed anteriad. Bothridia oblong, in dorsal view with several mesal lobulations, in lateral view with distinct antero-dorsal, and less distinct postero-ventral, lobulations apparent at surface. Scale about 20 long and wide, prominent, mammiform, situated posteriad and slightly dorsad to bothridia with mammilla slightly posteriad from median line. Sensillus setiform, origin centered in bothridium, about 117 long; leaving aspis directed laterad and at nearly right angle to aspal margin, very gently curving anteriad then posteriad to a straight portion, rising gently to a rather abrupt retrorse angle and slightly spiculate in this region, also curving slightly dorsad, to a fine, sharp point.

Notogaster: 680 long, 460 high, 443 wide. Sensillar notch rather prominent, anterior marginal rim rather narrow, not strongly delimited, may be overlooked in dorsal view of whole mount due to strong posterior aspal margin. With

14 pairs of setae, all approximately similar, about 115-120 in length, directed posteriad, none noticeably appressed. Setae *f*:1 lacking. Notogastral fissures small, frequently indistinct because of debris.

Ventral plates: 555 long, 106 wide, frequently covered with debris, papillate sculpturing found near anal region in irregular longitudinal rows. In whole mount lateral view, anterior margin thickened, bar-like; in ventral view each plate an elongate triangle with lateral margin appearing nearly straight to gently arched posteriorly, mesal margin straight; in flattened dissected view, lateral margin nearly straight, mesal margin gently arched in posterior half. With totals of ten setae on genital region, six setae on anal region. Anterior bar with six setae, smooth, setiform; one seta, 45 long, inserted in anterior vertical groove about one-fourth plate width distad from mesal margin; other five setae in ventral furrow, three fine setae projecting mesad, about 25 long, in longitudinal row near mesal margin, two longer, 45, setae inserted distad of mesal row of three, one about midway of and other near distal end of furrow. Other four setae of genital region stouter, 60 long, slightly barbed, recurved; on plate near overhanging posterior border of anterior bar in two rows, anterior row of three with mesal one inserted slightly laterad of longitudinal row of bar setae, second inserted just laterad of central seta on bar, third inserted slightly latero-posteriad of second; second row of one seta inserted postero-laterad of mesal seta of first row and postero-mesad of second seta of first row; all insertions separated by less than a setal length. Ano-adanal region setae erect, curving slightly posteriad, strong with sharp tips, differentiated into two rows of three each. Adanal setae moderately long, 100, slightly barbed, stouter, inserted more laterad; *ad*:1 inserted one-third of plate width from mesal margin; *ad*:2 inserted about laterad from *a*:3, one-third of plate width from mesal margin; *ad*:3 inserted in straight line with *ad*:1,2. Anal setae shorter, 70, smooth, inserted on lateral margin of mesal rim of plate, closely grouped; *a*:1 inserted slightly more than one-half length of plate posteriad from anterior margin; *a*:2 inserted posteriad to *a*:1 one half setal length; *a*:3 inserted one setal length posteriad to *a*:1, nearly mesad of *ad*:3. Adanal fissure laterad from *ad*:1, nearly on lateral margin of plate, often covered by debris.

Ovipositor: distal shaft lacking definite pattern, with pattern of slightly wavy striations on lobes. Dorsal lobes slender, elongate, with lightly sclerotized areas around setal insertions, slightly heavier sclerotization on apposed faces; in lateral view ventral lobe slightly thinner than dorsal lobes. Dorsal lobes with three spiniform setae each, separated by about the diameter of an insertion, nearly in straight line; *od*:1 most robust, stout at base tapering smoothly to sharp point, very slightly curved, about 24 long, insertion toward lateral margin of sclerotized setal area; *od*:2 somewhat less stout, slightly more curved than *od*:1, 15 long, inserted slightly meso-proximad from *od*:1; *od*:3 small, practically straight, about 10 long, inserted almost directly proximad from *od*:1. Ventral lobe setae similar to dorsals, in two paraxial lines on sclerotized area; *ov*:1 slightly sinuously curved, about 28 long, insertion about midway of sclerotized area toward lateral margins; *ov*:2 nearly straight, smallest of ovipositor setae, about 8 long, inserted less than its length directly proximad from *ov*:1. Occasionally a specimen with only one *ov*:1 but two *ov*:2.

Male genitalia: setae similar, sharply pointed, spiniform, between 10-20 long.

Gnathosoma: chelicerae 220 long, 100 high, with very few, extremely small spiculae, perhaps 2 long, on dorso-lateral surfaces; setae similar in length, 34, *cha* more strongly spiculate, slightly more acute at tip than *chb*. Lateral lips with distal pair of setae slightly bifid at tips. Dorso-lateral genal lobes rather small. Palpi five segmented; setae spiculate to barbed, disti-medial setae slender, slight, 17 long, spiculate; paraxial eupathidia sharing common insertion, fused basally. Palpal formula, 0-2-0-2-8.

Legs: lateral claws rather weak, slender, median claw moderately stout, many specimens with notch on inner surface of median claw I. Famulus slender, rather blunt, slightly rugose, nearly straight, 17 long.

Eggs: an average of 6.1 per specimen, with range of zero to 11 found in ten females examined; about 250 long, 156 in diameter with one apex more broadly rounded than other; no clearly demarked, sclerotized or sculptured deutova seen in samples taken in nearly every month of the year.

Larva and nymphal stages unknown.

Type data: holotype female and allotype from; 2.5 miles north of Miranda, or 3.8 miles south of Myers Flat, Blair Grove, Humboldt Redwoods State Park, Humboldt County, California, March 23, 1956 (N. A. Walker), in ordinary coast redwood litter, above usual flood line of South Fork, Eel River; type number 2979 in the U. S. National Museum. Paratypes include 31 females and 67 males, same data as above.

Distribution (see Pl. 46):

Alameda Co.: Oakland, Mountain Boulevard, on north and south banks of Palo Seco Creek, IV-11-55; N. and S., V-26-55; N. and S., XII-12-55; N. and S., I-13-56; N. and S., II-12-56; N. and S., III-12-56; S., IV-15-56; N. and S., V-18-56; N., VI-11-56; S., VII-13-56 (N. A. Walker).

Contra Costa Co.: Redwood Regional Park, V-18-53 (E. E. Gilbert, R. O. Schuster).

Del Norte Co.: Smith River, 3.2 miles S., III-22-56, litter, decayed redwood, humus (N. A. Walker). Fort Dick, 2 miles N., XI-21-53 (V. D. Roth). Fort Dick, 0.8 mile S., III-22-56, litter, decayed redwood (N. A. Walker). Fort Dick, 1 mile S., IX-20-55 (N. A. Walker). Crescent City, 5.9 miles S., III-22-56 (N. A. Walker). Crescent City, 9.2 miles S., Del Norte Coast Redwoods State Park, III-22-56 (N. A. Walker). Klamath, 1 mile S., IX-20-55 (N. A. Walker).

Humboldt Co.: Klamath, 8 miles S., Prairie Creek Redwoods State Park, VI-26-53 (J. D. Lattin). Klamath, 16 miles S., IX-5-61, rather dry decayed redwood, litter (N. A. Walker). Klamath, 18 miles S., IX-19-53 (E. E. Gilbert, R. O. Schuster). Freshwater, VII-13-53 (G. A. Marsh, R. O. Schuster). Freshwater, 0.6 mile E., III-22-56, well-decayed redwood log, litter, humus (N. A. Walker). Charlotta, 4.1 miles E., IX-20-55; III-22-56 (N. A. Walker). Pepperwood, 2.7 miles N., III-23-56 (N. A. Walker). Pepperwood, 3.5 miles S., Humboldt Redwoods State Park, IX-5-61, dry redwood litter (N. A. Walker). Pepperwood 6.3 miles S., The Avenue of the Giants, Humboldt Redwoods State Park, III-23-56, decayed redwood, litter, humus (N. A. Walker). Dyerville, 1 mile S., Humboldt Redwoods State Park, IX-19-53 (E. E. Gilbert, R. O. Schuster). Dyerville Bridge, Eel River, 1.7 miles S., Humboldt Redwoods State Park, III-23-56, well-decayed redwood, litter, humus, moss (N. A. Walker). Weott, 3.7 miles S., S. R. Boardman Grove, Humboldt Redwoods State Park, III-23-56 (N. A. Walker). Miranda, 2.5 miles N., Blair Grove, Humboldt Redwoods State Park, III-23-56 (type sample) (N. A. Walker). Franklin Lane Grove, Humboldt Redwoods State Park, X-10-53 (J. W. MacSwain). Garberville, 3.9 miles S., III-23-56 (N. A. Walker). Hartsook Grove, Richardson Grove State Park, IX-19-53 (E. E. Gilbert, R. O. Schuster).

MARIN Co.: Samuel P. Taylor State Park, N. entrance, X-24-53 (V. D. Roth). Samuel P. Taylor State Park, 0.2 mile from ESE. entrance, VII-5-56, redwood tree hole; decayed log; redwood litter (E. E. Gilbert, N. A. Walker); III-14-57; VII-11-57 (N. A. Walker). Mill Valley, IX-2-53 (G. A. Marsh, R. O. Schuster). Muir Woods National Monument, II-11-53 (R. Wagner).

MENDOCINO Co.: Garberville, 11 miles S., III-23-56 (N. A. Walker). Piercy, 6.4 miles S., III-23-56 (N. A. Walker). Piercy, 14.7 miles S., III-23-56 (N. A. Walker). Fort Bragg, 6.6 miles NE, IV-21-56 (N. A. Walker). Fort Bragg, 13 miles E., IV-20-56 (N. A. Walker). Fort Bragg, 15 miles E., IV-20-56 (N. A. Walker). Fort Bragg, 16 miles E., IV-20-56 (N. A. Walker). Fort Bragg, 27 miles E., IV-20-56, well-decayed redwood bark (N. A. Walker). Fort Bragg, 28 miles E., IV-20-56, decayed redwood, litter (N. A. Walker). Russian Gulch State Park, 1.9 miles into, IV-21-56 (N. A. Walker). Russian Gulch State Park, 2.5 miles into, IV-21-56 (N. A. Walker). Mendocino, 4.7 miles E., IV-21-56 (N. A. Walker). Mendocino, 5.5 miles E., IV-21-56 (N. A. Walker). Mendocino, 6.6 miles E., IV-21-56 (N. A. Walker). Mendocino, 7.1 miles E., IV-21-56 (N. A. Walker). Mendocino, 8 miles E., IV-21-56 (N. A. Walker). Navarro, 12.4 miles W., IV-21-56, (N. A. Walker). Navarro, 6.6 miles W., Paul M. Dimmick Memorial Grove State Park, IV-21-56 (N. A. Walker).

MONTEREY Co.: Big Sur, 7 miles S., XII-22-53 (1) (V. D. Roth). Pfeiffer-Big Sur State Park, 43 miles S., VIII-30-56 (1) (N. A. Walker).

NAPA Co.: Oakville, III-14-54 (J. R. Helfer).

SAN MATEO Co.: San Mateo County Memorial Park, IV-18-54 (E. E. Gilbert, R. O. Schuster).

SANTA CLARA Co.: Saratoga, 4 miles W., VIII-4-57, (B. J. Adelson).

SANTA CRUZ Co.: Big Basin State Park, "100 acre woods area," III-20-57 (2) (N. A. Walker). Santa Cruz, 1 mile N., XII-23-53 (1) (V. D. Roth).

SONOMA Co.: Annapolis, 5.4 miles W., IV-22-56, litter, humus, 1 foot deep (N. A. Walker). Annapolis, 3.9 miles SE., IV-22-56 (N. A. Walker). Plantation, 7 miles N., IV-22-56, well-decayed redwood, litter, humus (N. A. Walker). Plantation, IV-5-56 (D. J. Burdick). Fort Ross State Historical Monument, 0.2 mile S., IV-22-56, litter, humus, 6 inches deep (N. A. Walker). Monte Rio, 3.9 miles W., IV-22-56, well-decayed redwood, litter, humus (N. A. Walker). Monte Rio, 0.9 mile W., IV-22-56 (N. A. Walker). Monte Rio, 1 mile E., IV-22-56 (N. A. Walker). Armstrong Redwoods State Park, III-14-54 (J. R. Helfer). Guerneville, 1.2 miles N., IV-22-56 (N. A. Walker). Guerneville, 2.7 miles E., IV-22-56 (N. A. Walker). Mark West Springs, XII-31-53 (V. D. Roth, G. A. Marsh, R. O. Schuster); III-14-54 (J. R. Helfer).

The specific name is derived from the Latin *Carolus* for Charles, my younger son.

Evaluation of the collection data, both of the samples in which *Synichotritia caroli* was found and of samples solely of wood in which it was not found, suggests that this species is not an inhabitant of redwood logs, stumps or large limbs, but rather a common member of the litter community, possibly extending into humus. The distribution data indicate that the range reported includes the southern, or southwestern, portion of the range since the last three collections to the south included only a single specimen each. When the numbers collected in the north are considered, it is apparent that the species extends northward and eastward beyond the range shown.

Synichotritia spinulosa sp. n.

(Pls. and figs. 47, A-D; 48, A-C; 49)

Diagnosis: moderate in size; surface spinulose; vertical setae extending past midline of aspis; scale with rounded distal margin; six fine, smooth antero-genital, five rather short, finely ciliate genito-aggenital setae; four stout, smooth, nearly blunt adanal setae similar to notogastrals; three anal setae slightly smaller than adanals; ovipositor lobe setae *od:*3, *ov:*2 nearly vestigial, *od:*4 and coronal setae lacking.

Adult: yellowish tan, moderate in size, often partially covered with debris. Setae rather slender, blunt but strong. Sculpturing composed of tiny, sharp, short, perhaps 5 long, spinulate protuberances distributed randomly, rather close together.

Female size range: notogaster length 686-402, height 423-277, width 471-284; aspis length 340-215, height 146-90, width 229-173; ten specimens measured.

Male size range: notogaster length 499-353, height 360-263, width 388-284; aspis length 291-222, height 111-76, width 215-146; ten specimens measured.

Sex ratio: 31% males among 293 specimens from two samples.

Aspis: 320 long, 115 high, 250 wide. In lateral aspect shallow, smoothly arcuate above, with slight anterior rim; giving impression of being rather small in comparison to notogaster. Sculpturing spinules more common anteriorly on rostrum, less common at middle, practically absent on posterior third; moderately covered with debris held in place by spinules. Posterior rim about 20 wide, narrower laterally, leading into single median rib, extending forward to level of posterior bothridial margins. Lateral carina single, rather unpronounced, not apparent in dorsal view; but lateral aspect sinuously curved then almost straight posteriad to anterior border of bothridia, may extend above bothridia connecting with antero-mesal margin of scale. Rostral setae smooth, slender, setiform, curving medio-dorsad, 100 long, combined length greater than distance between bases; insertions more approximate than other aspal setae. Lateral setae smooth, setiform, curving slightly mesad while pointing anteriad, 100 long, tips just surpassing rostral insertions. Vertical setae smooth, slender, setiform, curving mesad, longer, 115, combined length greater than distance between insertions. With two pairs of very fine exobothridial setae; anterior pair short, perhaps 15 long; posterior pair particularly indistinct, shorter, perhaps 10 long. Bothridia with about five inner lobes directed mesad; opening with rather large internal atrium. Scale dorso-posteriad to bothridia, width and length equal to bothridial diameter, mammiform in outline, posterior margin slightly more acute than anterior, prominent in dorsal and lateral views. Sensilli slender, smooth, simple, setiform, perhaps 150 long, curving dorsad strongly and slightly anteriad, with tips curving postero- or antero-mesad.

Notogaster: 645 long, 415 high, 445 wide. Anterior rim not markedly wide; collar, sensillar notch, lapet present, not particularly pronounced. Sculptured evenly, not densely. With 15 pairs of setae, all slender, strong, smooth, ending almost bluntly, erect, bent somewhat posteriad, majority equal in length, about 100, shortest perhaps 80; setal rows *h, ps* inserted more dorsad than usual. Setae *f:*1 lacking. Fissures present, frequently difficult to distinguish because of spicules.

Ventral plates: 500 long, 90 wide, almost always covered with rather thick layer of debris, especially antero-lateral region, hiding setae unless removed; sculpturing spicules in uneven, parallel, longitudinal rows. With totals of 11 setae on genital region, 7 setae on anal region. Anterior bar with six setae, all smooth, almost spiniform with acuminate tip, short, 10-15 long; one seta in anterior vertical furrow, insertion about one-fourth of plate width distad from mesal margin; other five setae in ventral furrow, three inserted in triangle near mesal margin, fourth insertion about midway along and fifth near distal point of ventral furrow. Anterior portion of plate with five setae inserted near anterior bar, all slightly, distinctly barbed, about 30 long, covered with debris; anteriad two insertions one-fourth and one-half width of plate distad to mesal margin, less than setal length apart, just posteriad to posterior margin of reinforcing bar; third setal insertion less than setal length postero-mesad to mesal one of anterior two; fourth setal insertion slightly more than setal length directly posteriad of mesal one of anteriad two; fifth setal insertion less than one-half setal length postero-mesad of fourth. Ano-adanal portion of plate bearing seven setae, all strong, smooth, setiform, with acuminate tips, erect, curving posteriad. Four adanal setae somewhat longer, stouter, inserted more laterad, than three anals; *ad:*1 shortest, about 70, insertion almost one-half length of plate posteriad from anterior margin, one-fourth of plate width from mesal margin; *ad:*2-4 longer, about 115; *ad:*3 insertion its setal length posteriad from *ad:*2, slightly antero-distad to *a:*3, possibly slightly posteriad from *a:*3 in some specimens; *ad:*4 insertion posteriad from *a:*3; adanal setae nearly in straight line in lateral view. Three anal setae similar to, somewhat smaller than adanals; *a:*1 longest, 70, moderately straight, insertion posteriad one-third of distance between *ad:*2-3, or two-thirds plate length posteriad from anterior margin; *a:*2,3 shorter, 65; insertions of *a:*1,2,3 about equidistant from one another. Adanal fissure slightly posteriad of *ad:*1, near lateral margin of plate.

Ovipositor: distal shaft lacking obvious reticulation pattern, with vague regular longitudinal membranous folds. Dorsal lobes slender, elongate, with lightly sclerotized areas surrounding setal insertions, slightly heavier sclerotization on apposed faces, membranous tissue surrounding sclerotized tip area pointed, projecting distad. Dorsal lobes with three setae each; *od:*1 spiniform, sharply pointed, short, about 20, insertion slightly proximad from distal margin; *od:*2 spiniform with pointed tip, shorter, about 12, insertion directly proximad of *od:*1, two-thirds length of sclerotized area proximad from distal margin; *od:*3 small, fine, indistinct, about 5 long, insertion slightly proximo-laterad from *od:*2. Ventral lobe with proximal portion of sclerotized region narrower than distal, spatulate; *ov:*1 almost spiniform, slightly curved, tapering to sharp apex, about 20 long, insertion about midway in length of distal expanded portion of sclerotized area; *ov:*2 almost vestigial, perhaps 3 long, insertion directly proximad from *ov:*1, near level of incurving region between proximal and distal portions of sclerotized area.

Male genitalia: small, setae similar, sharply pointed, spiniform, about 8-10 long.

Gnathosoma: chelicerae 200 long, 90 high, with almost no surface irregularities or spicules obvious; setae smooth, setiform, *cha* straight, about 33 long, *chb* curving slightly ventrad, longer, 36. Lateral lips with distal pair of setae strongly bifurcate near tip. Palpi four segmented, triangular trochanter in-

distinct because distal margin coincides with infracapitulum margin, femorogenual fusion complete; setae slightly barbed, disti-medial setae fine, slight, 17 long, spiculate; normally only three stout, separate, obvious eupathidia on tip of tarsi, drawn specimen showing rudiment of fourth but uncommonly visible. Apparent palpal formula, 0-2-2-8.

Legs: lateral claws rather weak, flattened, broadened toward tip, with sharp tip; median claw strong, stout. Famulus slender, bending slightly, 15 long.

Eggs: an average of 3.1 per specimen, with range of zero to nine found in 15 females examined; about 240 long, 120 in diameter, similar to *Synichotritia caroli;* no clearly demarked, sclerotized or sculptured deutova seen.

Larva and nymphal stages unknown.

Type data: holotype female and allotype from; 6.4 miles south of Klamath, on east side of U. S. 101, 0.3 mile south of north county line, within but near north edge of Prairie Creek Redwoods State Park, Humboldt County, California, March 22, 1956 (N. A. Walker), under coast redwood in deep litter, humus, soil, with decayed branches and wood; type number 2980 in the U. S. National Museum. Paratypes include 140 females and 44 males with data as above.

Distribution (see Pl. 49):

Del Norte Co.: Klamath, 3.7 miles N., IX-5-61, moist, decayed redwood stump, log, litter (1) (N. A. Walker). Klamath, 1 mile S., III-22-56, damp, 2-3 inch thick redwood litter (4 females); IX-5-61, decayed redwood log, litter (9) (N. A. Walker).

Humboldt Co.: Klamath, 5.7 miles S., Prairie Creek Redwoods State Park, IX-5-61, decayed redwood, litter (33) (N. A. Walker). Klamath, 6.4 miles S., Prairie Creek Redwoods State Park, IX-20-55 (11 females, 19 males); III-22-56, (type sample) (N. A. Walker). Klamath, 8 miles S., Prairie Creek Redwoods State Park, VI-26-53 (18 females, 13 males) (J. D. Lattin). Klamath, 9.3 miles S., Prairie Creek Redwoods State Park, IX-5-61, decayed redwood, litter (19) (N. A. Walker). Klamath, 16 miles S., IX-5-61, decayed redwood, litter (21) (N. A. Walker). Klamath, 18 miles S., IX-19-53 (82 females, 77 males) (E. E. Gilbert, R. O. Schuster). Dyerville Bridge, Eel River, 1.7 miles S., Humboldt Redwoods State Park, III-23-56, decayed redwood, litter, humus, moss (1) (N. A. Walker). Weott, 3.7 miles S., S. R. Boardman Grove, Humboldt Redwoods State Park, III-23-56, deep litter, humus (1) (N. A. Walker). Miranda, 2.5 miles N., Blair Grove, Humboldt Redwoods State Park, III-23-56 (3) (N. A. Walker).

The specific name is derived from the Latin *spinula* (f., dim.) + *osus* meaning small spines + abundance, with reference to the spinose integumental sculpturing.

Analysis of the collection data indicates that this species is a true litter inhabitant. It seems probable that the distribution reported represents the major portion of the range of this species, certainly from north to south under coast redwoods, although it may occur under other types of trees to the east. While gross collections were not directly comparable, it is obvious that *Synichotritia spinulosa* is most abundant in and near Prairie Creek Redwoods State Park, presumably its most favorable habitat, perhaps a slightly less humid area than immediately north or south of its distribution range.

Life History Observations of *Plesiotritia megale*

Of earlier workers, only Rhode (1955) appears to have actually reared euphthiracaroid mites. The mite he treated in detail was a *Pseudotritia* species, near *ardua* (Koch), but he includes notes on *Eupthiracarus flavum* [sic] (Ewing) and an *Oribotritia* species. The general comments by Michael (1884, 1888) were based on some phthiracaroid nymphs he reared and larvae he watched hatch.

The mites, *Plesiotritia megale,* used in the life history studies were obtained from a second-growth stand of *Sequoia sempervirens,* with an understory of scattered shrubs, grasses and herbs, and with well-decayed logs and branches included in the collections of litter. The site was 0.2 mile from the ESE. entrance of Samuel P. Taylor State Park, Marin County, California. Collections were taken during November and December, 1957.

Methods

Living samples were handled much like preserved samples, except that the alcohol was replaced by water in the receiving bottles and the mites were removed and sorted at 24 hour intervals. The culture containers (Pl. 5) were rigid plastic tubing placed in rigid plastic sandwich boxes, approximately 11 x 12 x 3 cm, with a substrate about 0.7 cm thick prepared from a 9:1 dry weight mixture of plaster of Paris and animal charcoal (Rohde, 1956). The lower end of each tube had two or four half-circles of 0.5 cm diameter removed. Water passed into the tube through the continuous substrate. Corks were cut to fit barely into the tubes.

The cultures were maintained at the constant temperature of 25° C (± 1°) for the first two months and at 20° C (± 1°) for the remaining four months and ten days of the study. By watering the substrate every four to five days, the cultures were maintained at a high level of humidity, above 95% relative humidity according to Huber (1958). Normally, there were water droplets condensed on the top of the plastic box and occasionally on the inside of the tubes or corks. The cultures were exposed to light only while being examined, a period of four hours or less a day.

Food particles of well-decayed redwood or compact frass of wood-boring insects were placed on the substrate within the tubes. The particles offered varied in size, from 25 mm^3 to 1 mm^3, depending on the number and size of instar present. That the mites

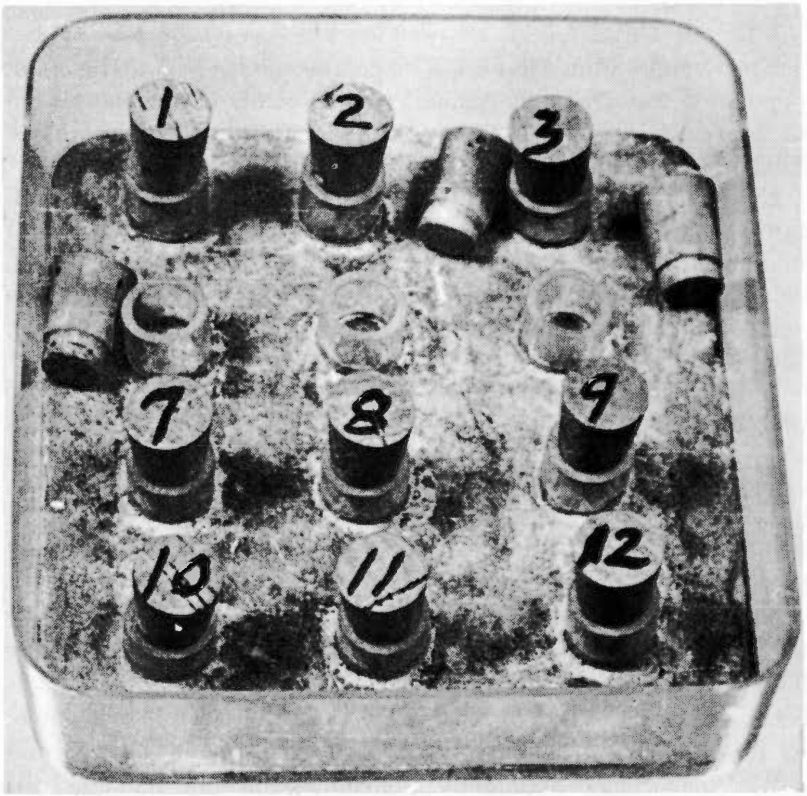

PLATE 5. Rearing chamber used in life history studies.

had fed was established by noting the presence of food and fecal boli within the immature instars or the teneral adults. All active instars of these mites tunnel into their food if the particle is large enough. Small food particles appear to dry out more easily than do larger ones and feeding ceases. Continuous observation of an individual was impractical because of the tunneling.

Cultures were routinely examined once a day, although some observations were made more frequently. By removing the box lid and cork, the mites could be studied with a dissecting microscope, without unduly disturbing their activities. Eggs were removed daily, from cultures of adults, and placed in a tube until they hatched. As they hatched, the larvae were placed in another tube with food. Specimens were handled in a similar fashion as they entered other instars. Characteristics of the various instars are given in the species description.

Results

Ninety-eight adult *Plesiotritia megale* were observed. This adult population was gradually reduced by apparently normal causes until 14 remained after 192 days, when the study was concluded. Each culture was initiated with 30 to 40 specimens.

Eggs were laid within 10 days following initiation of the cultures, with commonly 2 to 7 eggs laid daily by the 30 to 40 mites in each tube. The greatest number of eggs laid, in a 24-hour period, was 22 by 71 mites. A total of 192 eggs were laid and their development followed. Of these, 28 were nonviable or did not hatch; 164 yielded larvae.

Oviposition was not observed, but, from various observations, the process must require less than one-half hour for completion. There was no indication of any preparation of the oviposition site. Because the food particles offered the adults were small, there was little successful tunneling and oviposition in tunnels, and eggs were found on the substrate or loosely inserted into cracks and crevices of the food.

Newly laid eggs were usually pinkish in color, shiny, rather clear to transluscent, and varied in shape from an ellipsoid, slightly flattened on one side, to elongate (Pls. 11, 12). The elongate eggs became ellipsoidal before hatching; if not, the egg did not hatch. As the pre-larva developed, the egg became opaquely white and dull. Some eggs, apparently nonviable, did not undergo this change but remained pink for extended periods, 30 days or more. In some other eggs, the pre-larva developed and was seen, indistinctly, to move within the eggshell; but these did not hatch. The reason for this is not apparent, because other eggs laid the same day and kept under identical conditions did hatch.

The incubation period (Table 3) was considered to include the day the egg was laid to, but not including, the day of hatching. The mean incubation period was 11.75 days at 25° C and 12 days at 20° C, while the mode was 11 days at both temperatures.

TABLE 3. *Plesiotritia megale* eggs. Incubation periods, as influenced by two constant temperatures while at a uniform relative humidity (95 to 100%)

Incubation period in days		8	9	10	11	12	13	14	15	17	19	22	23
Number of Eggs	25° C..	1	7	23	47	22	10	11	3	2	2	1	3
	20° C..	0	1	4	10	7	4	1	1	1	1	0	0

One observation of eclosion was made but was not followed to completion, because the process stopped after two hours of observation. Little progress was noted during repeated periods of observation, during the succeeding 48 hours, but the probable pattern was evident. An exserted leg drew attention to a small opening slightly subapical to the larger apex of the egg. Events leading to this stage were not observed. Movements were apparent through the eggshell, but there was no distortion in the shape of the shell by the moving larva (pre-larva?). All movements ceased occasionally, without periodicity and for varying lengths of time. The chelicerae chewed at the margin of the hole and gradually widened it, while one or a pair of legs also pushed against the margin or against a partially severed portion of the shell. Completion of eclosion was not noted, because it required over 48 hours in this specimen, and occurred between observations. All other eggs hatched in less than the 24-hour period between routine observations, and some hatched between observations made at 4-hour intervals. These observations indicate that the process is substantially similar to that described for *Pseudotritia* sp. by Rohde (1955:35).

Of 20 eggshells examined, all the emergence holes were found to be on the rounded portion of the eggshell just to the side of the flattened, fenestrated area where some smaller fenestrations were noted. Each of four larvae removed the entire side of the eggshell, while 16 hatched through subapical holes. Other observations indicated that an occasional larva will chew a hole so large as to remove the apical portion of the eggshell along with the subapical portion. Fecal pellets commonly were seen in the otherwise empty eggshells.

Upon hatching, the larvae were milky-white in color, with obviously sclerotized cheliceral tips and claws. This instar was not obviously wrinkled at any time. The only obvious body suture was a protero-hysterosomal furrow. The newly hatched larva was about equal in width and height. As the larva fed, the hysterosoma began to increase markedly in size until it approached twice the proterosomal width and height. Late in this period of development, the genital region protruded somewhat, and the anal region protruded markedly, as is usual in nymphs.

The larvae were very active immediately upon hatching, climbing on the sides of the tubes or the corks in addition to the substrate. When food was placed in the tube prior to the eggs hatching, no larvae were seen wandering, apparently because they chewed

their way into the food upon contacting it. After the larvae had fed enough to produce the hysterosomal engorgement, they were somewhat less active. Unlike the behavior of *Pseudotritia* sp. (Rohde, 1955), these larvae did not feed appreciably on adult fecal pellets nor was any contact with these pellets necessary for growth and development. Some, but not all, larvae became more active in their movements, left their food tunnels and ceased feeding, sometimes for several consecutive days. Interruption of feeding occurred at different times and frequencies, without any apparent correlation or coincidence. During these periods, the food boli would often disappear, but eventually the larvae resumed feeding.

Following the feeding stage, the larva entered a pre-molt quiescent period during which food and fecal boli gradually disappeared, response to external stimuli diminished, and the body began to lose its opaque white appearance. Midway through this period the larva became distinctly bloated, nearly clear in color and almost transparent; only the tips of the chelicerae were colored, and there was no response to stimuli nor were any body movements noticeable. These conditions occurred prior to each molt of each instar and continued until ecdysis was concluded.

While many larvae underwent this period within food, five larvae underwent the dormant period outside the food particle. The duration of the period varied for each larva, lasting for 11, 14, 15, 16, and 17 days, at 20° C and at a relative humidity of 95 to 100%. Of a total of 164 larvae, only 22 were known to have completed the stadium successfully. Other larvae may have molted, but died and decayed within their food tunnels; these were considered as not having molted. No larvae survived the pre-molt dormant stage when exposed to a constant temperature of 25° C, while the majority survived and continued their development when exposed to a constant temperature of 20° C. For this reason, all details of the subsequent stadia in this life history were based upon a constant temperature of 20° C and a relative humidity of 95 to 100%.

For the five larvae that molted outside the food, definite data relative to the length of this stadium are reported in Table 4; 17 molted within food, and for these data could only be extrapolated when they became exposed by natural movements or dissection of the food material.

Ecdysis requires less than twelve hours. The thin, crumpled, cast skin remains loosely attached to the posterior and anterior portions of the succeeding stage for a relatively short time, until it is scrubbed off in the feeding tunnels.

TABLE 4. *Plesiotritia megale.* Duration of larval stadia at 20° C and relative humidity of 95 to 100%

Duration of Stadium in Days		<55	55	57	<61	63	64	<70	74	<82	<90
Number of Larvae	Definite data[a]	.....	1	1	.....	1	1	.....	1	.....	.....
	Extrapolated data[b]	1	....	....	2	....	....	7	....	4	3

[a] Larvae actually observed during conclusion of stadium.

[b] Observed as recently molted protonymphs leaving feeding tunnels or by dissection of food.

In any nymphal instar, the newly emergent nymph, within twelve hours of ecdysis and while the cast skin was still attached, appeared opaque white and granulosely wrinkled on the hysterosoma, at least. It moved very slowly and most of the movements were of the chelicerae. As it began to become more active and commenced feeding, food and fecal boli became obvious and the wrinkles were lost, so that the integument again appeared smooth and shiny. By the time the nymph had fed two to three weeks, it was fat and the genital and anal regions protruded markedly. Changes in activity and appearance, as described for the larva, occurred during nymphal quiescent periods.

Within three to four days after molting, the protonymphs burrowed into the foot particle. Of the known 22 protonymphs, at least 8 completed this stadium successfully. Of these eight, only two molted into and out of the protonymphal stage on the substrate. These specimens were inactive, in the pre-molt period, for 15 and 16 days and had a total length of stadium of 42 and 45 days. The history of the other six specimens was obtained by their being dissected from the food tunnels, or by their appearing naturally as freshly molted deutonymphs. They were protonymphs for approximately 45 to 55 days (Table 5).

None of the eight individuals, known to have developed to the deutonymphal stage, molted on the substrate; data was extrapolated from observations based upon specimens dissected from their food tunnels shortly after having molted. On this basis, the deutonymphal stadium is greater than 106 days and less than 150 days (Table 5). What little was seen of the activities of this instar, was similar to that described previously.

The data for the tritonymphal stadium were based upon one reared specimen that successfully molted from the deutonymphal stadium and two specimens obtained, as deutonymphs, during the

dissection of food material for the cultures. The quiescent pre-molt stage, for one specimen, was completed in ten days. The stadium apparently required 100 to 145 days (Table 5). The pattern of behavior, so far as known, followed the description given previously.

Teneral adults retained the cast tritonymphal skin for a short time and appeared pale, pinkish-white and rather transluscent. They began feeding within a week after molting, and food boli could be seen through the integument for a period of approximately two weeks, after which the integument became too opaque. About one month, under culture conditions, was required for the adult to reach its normal, dark reddish-brown coloration.

The development of *Plesiotritia megale* from egg to adult requires about a year. Precise data for all stadia were impracticable, because of the feeding habits of the mite, but the approximate results are shown in Table 5.

The normal length of life of the adult is uncertain. Some specimens were retained in culture for eight and one-half to nine months. Adults of this species have been collected in all seasons of the year. Available evidence indicates that the adults have a potential life span of approximately one year (Table 5).

TABLE 5. Length of stadia in life history of *Plesiotritia megale*, at 20° C and relative humidity of 95 to 100%

Stadium	Time in Days		
	Least	Mean	Maximum
Egg	9	12.0	19
Larva	<55	62.6[a]	<90 (179[b])
Protonymph	42	43.5[a]	<55
Deutonymph	>106		<150
Tritonymph	>100		<145
Adult			365±

[a] Data from specimens molting outside food.
[b] Aberrant specimen.

One female, reared from a tritonymph found in food material, was segregated and maintained, for six months, without ovipositing. Dissection of the dried specimen indicated that eggs were in process of development at the time of death although positive identification of the bodies, considered to be eggs, was not practicable.

Courting activities similar to those reported for Galumnidae by Grandjean (1956*b*) were not noted. Neither was any behavior pattern noted similar to the pattern associated with the production of spermatophores by the males of Belbidae (Pauly, 1952). It is possible that spermatophores were present, were intermingled with and confused with fungal fruiting bodies. Taberly (1957) has pointed out the similarity in appearance between the spermatophores and sporangia (+ sporangiophores).

Rohde (1955:31) noted that bacteria, appearing to be of the genus *Clostridium*, were present within certain euphthiracaroid mites; and suggested that they, perhaps, served as symbionts to convert cellulose into a form usable by the mites. Dr. E. A. Steinhaus examined smears of some crushed mites, *Oribotritia sellnicki*, which were chemically disinfected externally before being crushed. He reported (personal communication) that no forms were observed that resembled any previously reported symbiotic forms and that there were no *Clostridium* spores present. He further commented that *Clostridium* had not previously been noted as being a symbiont and that it was doubtful, in his opinion, if it could be. He suggested that the report by Rohde might possibly be a result of contamination, because *Clostridium* spores are airborne and practically omnipresent.

The only presumed parasite noted was a nematode, family Allantonematidae, determined by Dr. M. W. Allen (personal communication). The known life cycle of this nematode family includes a parasitic phase in insect larvae and a free-living phase in plants attacked by the insect host (Hyman, 1951:301, 303-304). Nematodes were very rarely seen in the cultures and are not definitely known to have emerged from the mites. Only once was one seen to be apparently emerging from a living mite, through the membranous area around the coxa. Rarely, preserved mite specimens were noted with a nematode attached, apparently emerging at the time of preservation.

While a pselaphid beetle has been reported (Park, 1947) as a predator of ptychoid mites, no feeding resulted from offering *Pselaptrichus* sp. (? *pennatus* Schuster and Marsh) various genera and species of euphthiracaroid mites. During his study of these beetles, Schuster has seen no indication that Californian pselaphids feed on Acarina (personal communication). There was no evidence of inter- or intra-specific predatism by any stage of euphthiracaroid mites.

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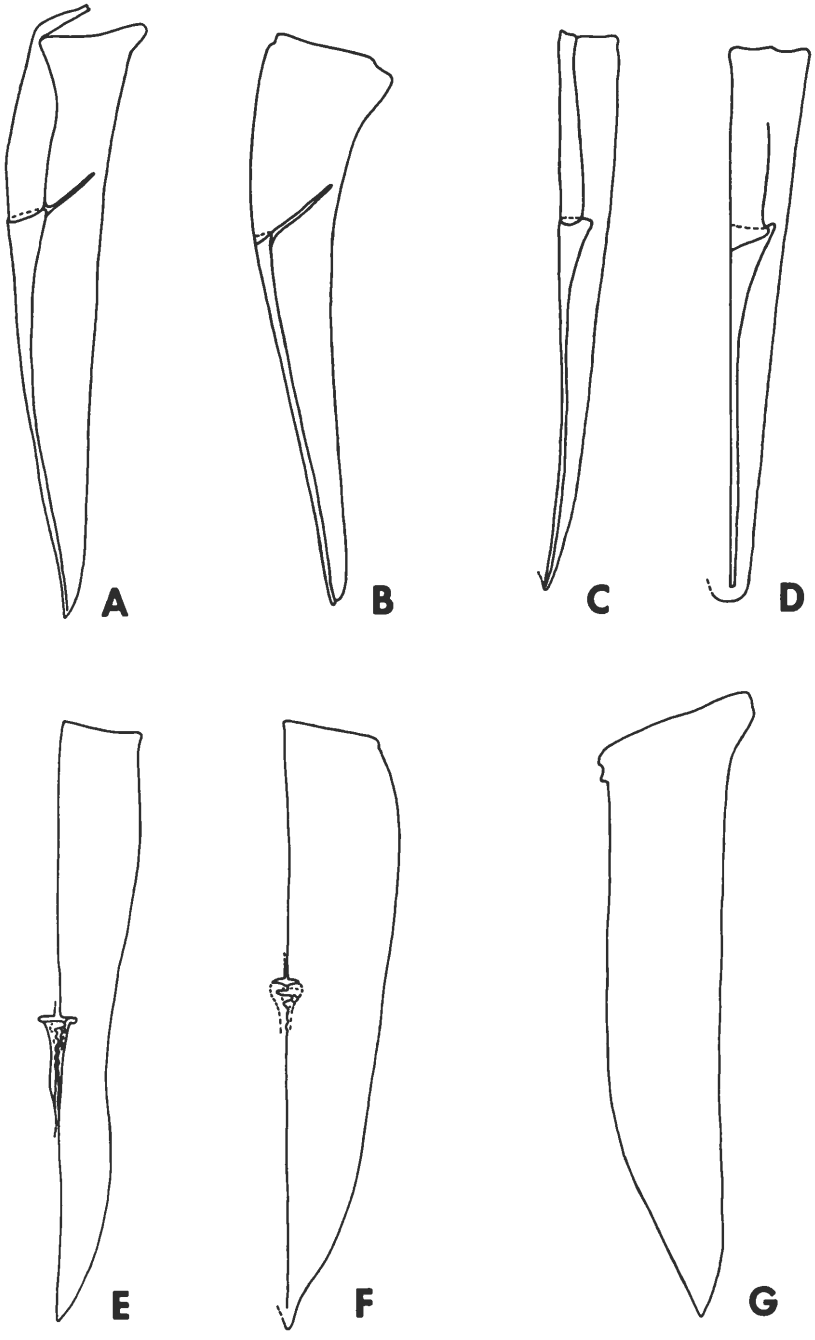

PLATE 6. Semidiagrammatic drawings of the left ventral plates, without the plicature plates, of the euphthiracaroid genera. A. *Plesiotritia*. B. *Austrotritia*, after Sellnick (1959). C. *Oribotritia*. D. *Indotritia*, after Sellnick (1924). E. *Euphthiracarus*. F. *Rhysotritia*. G. *Synichotritia*.

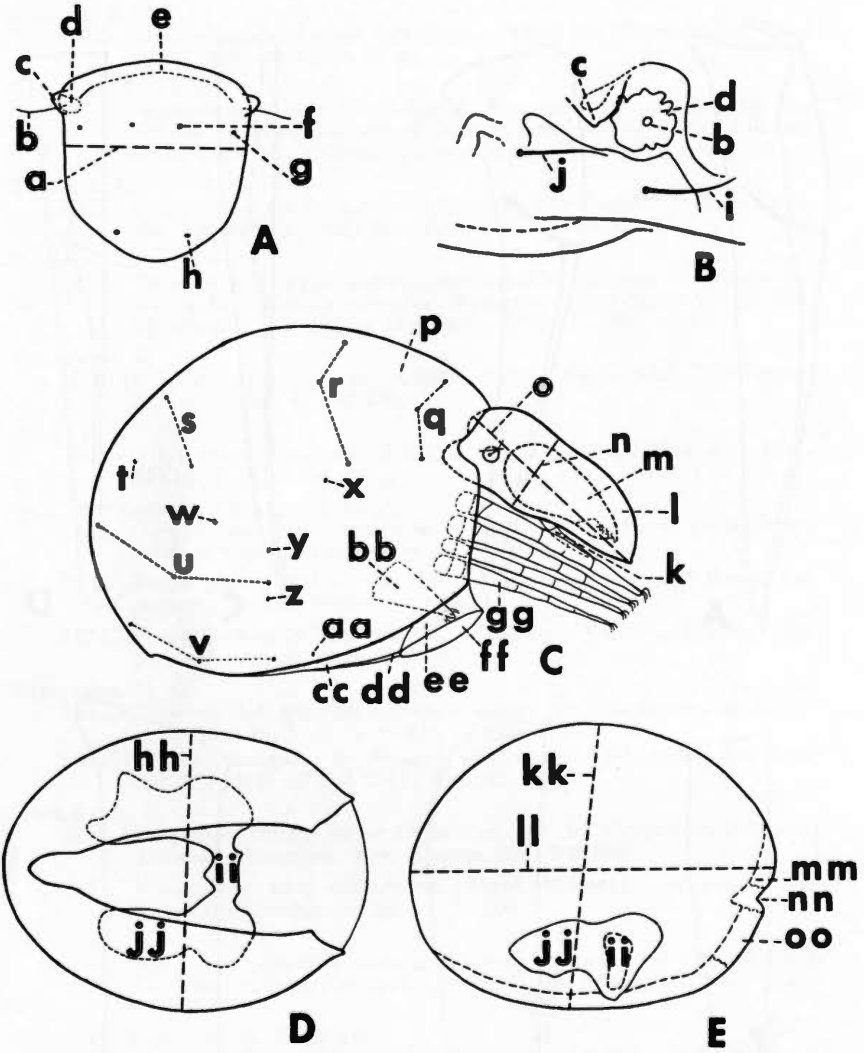

PLATE 7. Semidiagrammatic drawings of characteristics and standard dimensions in euphthiracaroid mites. A. Dorsal view of aspis. B. Lateral view of portion of aspis near trichobothridium, of *Synichotritia caroli*. C. Lateral view of entire mite. D. Ventral view of notogaster, without ventral plates. E. Lateral view of notogaster, rolled slightly anteriad.

a. Standard measurement of aspal width. b. Sensillus. c. Scale. d. Bothridium. e. Posterior aspal rim. f. Vertical setal insertion. g. Lateral setal insertion. h. Rostral setal insertion. i. Anterior exobothridial seta. j. Posterior exobothridial seta. k. Right maxillary palpus or palp. l. Aspis. m. Chelicera. n. Standard measurement for aspal height. o. Standard measurement for aspal length. p. Notogaster. q. Setal row *c*. r. Setal row *d*. s. Setal row *e*. t. Setal row *f*, vestigial. u. Setal row *h*. v. Setal row *ps*. w. Lateral gland. x. Fissure *ia*. y. Fissure *im*. z. Fissure *ih*. aa. Fissure *ips*. bb. Ovipositor. cc. Adanal plate. dd. Anal plate. ee. Aggenital plate. ff. Genital plate. gg. Leg IV. hh. Standard measurement for notogastral width. ii. Vesicula seminalis. jj. Testis. kk. Standard measurement for notogastral height. ll. Standard measurement for notogastral length, greatest length. mm. Collar. nn. Sensillar notch. oo. Lapet.

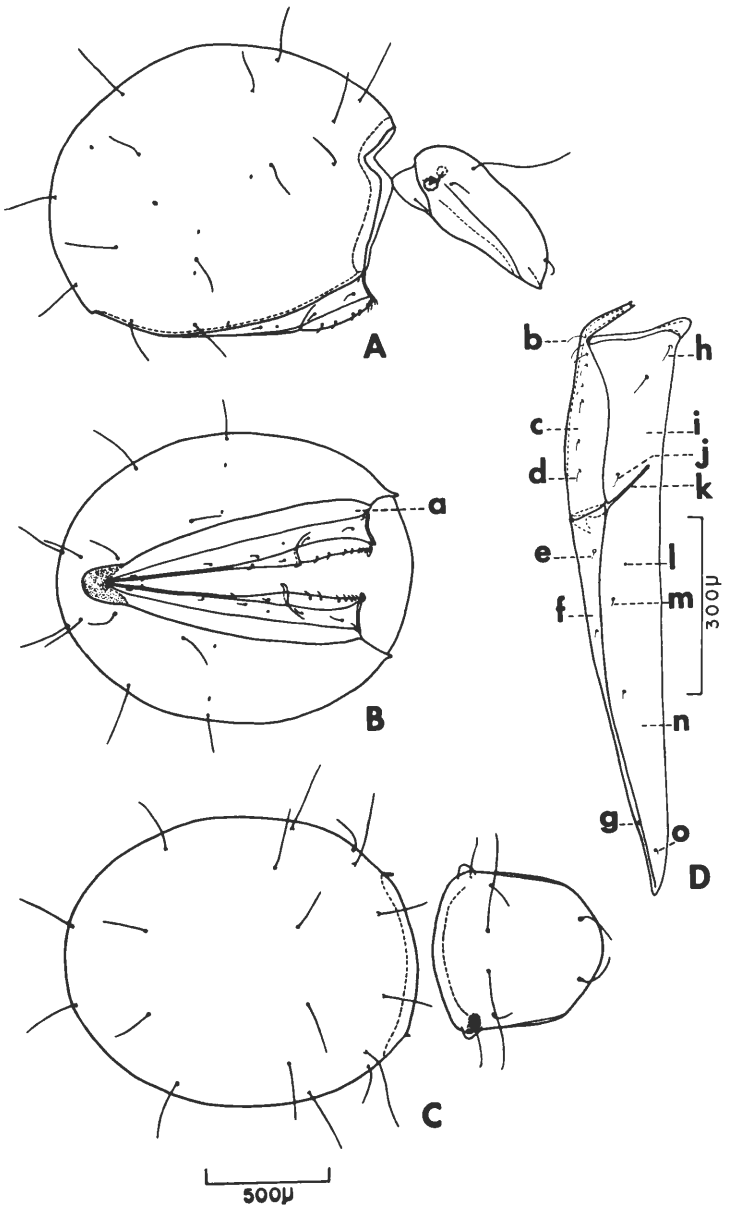

PLATE 8. *Plesiotritia megale* sp. n. A. Lateral view of notogaster and aspis. B. Ventral view of notogaster. C. Dorsal view of notogaster and aspis. D. Enlarged view of left ventral plates.

a. Plicature plate. b. Seta *g*:1. c. Genital plate. d. Seta *g*:8. e. Seta *a*:1. f. Anal plate. g. Seta *a*:3. h. Seta *ag*:1. i. Aggenital plate. j. Seta *ag*:3. k. Incision partially separating aggenital and adanal plates. l. Fissure *iad*. m. Seta *ad*:1. n. Adanal plate. o. Seta *ad*:3.

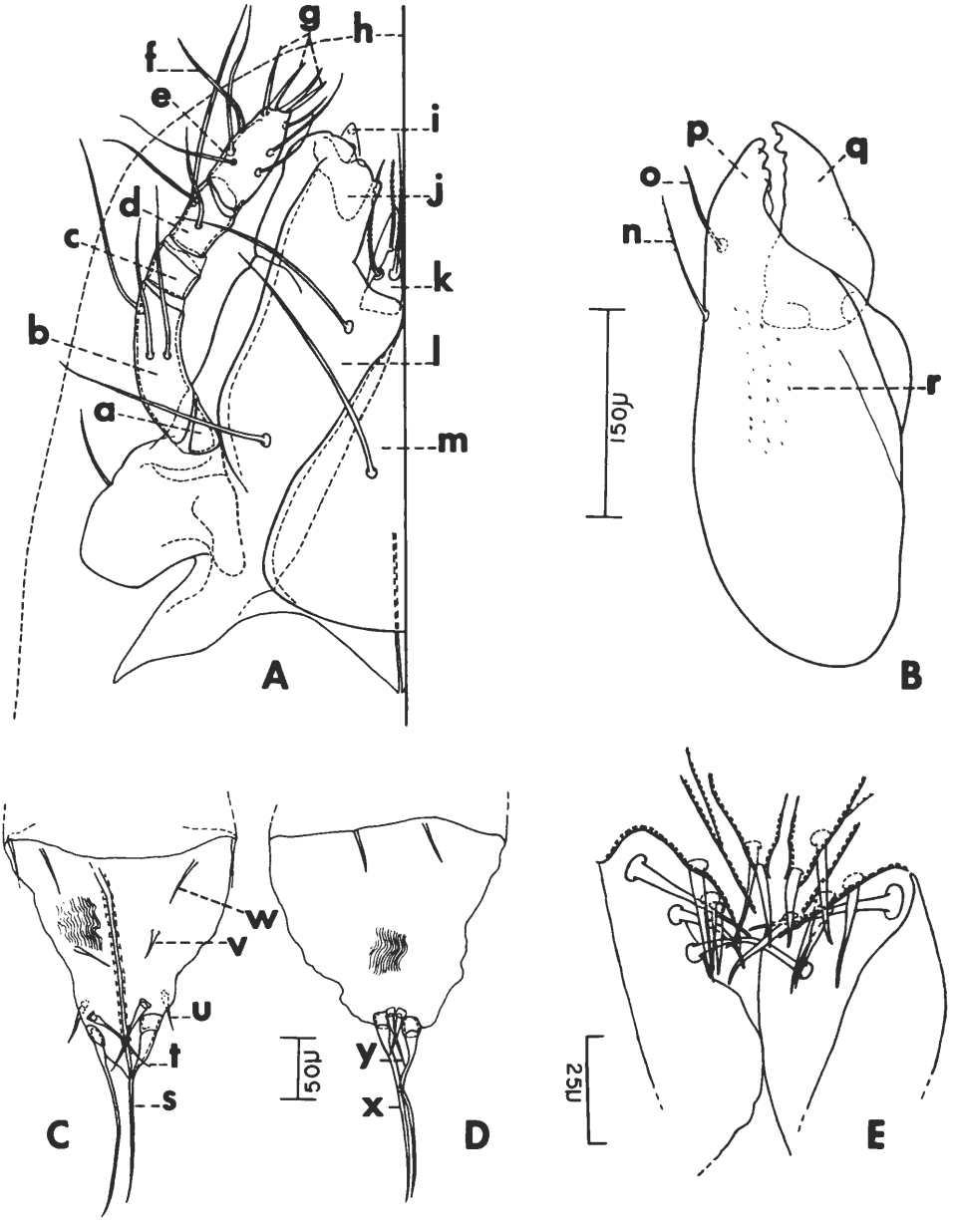

PLATE 9. *Plesiotritia megale* sp. n., details. A. Ventral view of infracapitulum. B. Chelicera, in paraxial view. C. Dorsal lobes of ovipositor. D. Ventral lobe of ovipositor. E. Distal portion of male genitalia.

a. Trochanter. b. Femur. c. Genu. d. Tibia. e. Tarsus, a. through e. all segments of palp. f. Tarsal solenidion. g. Four tarsal eupathidia. h. Outline of ventral aspal margin. i. Tip of chelicera, otherwise hidden by rutellum. j. Rutellum. k. Lateral lip. l. Gena. m. Menton. n. Seta *cha.* o. Seta *chb.* p. Fixed digit of chelicera. q. Movable digit. r. Spicules. s. Seta *od:*1. t. Seta *od:*2. u. Seta *od:*3. v. Seta *od:*4. w. Coronal seta. x. Seta *ov:*1. y. Seta *ov:*2.

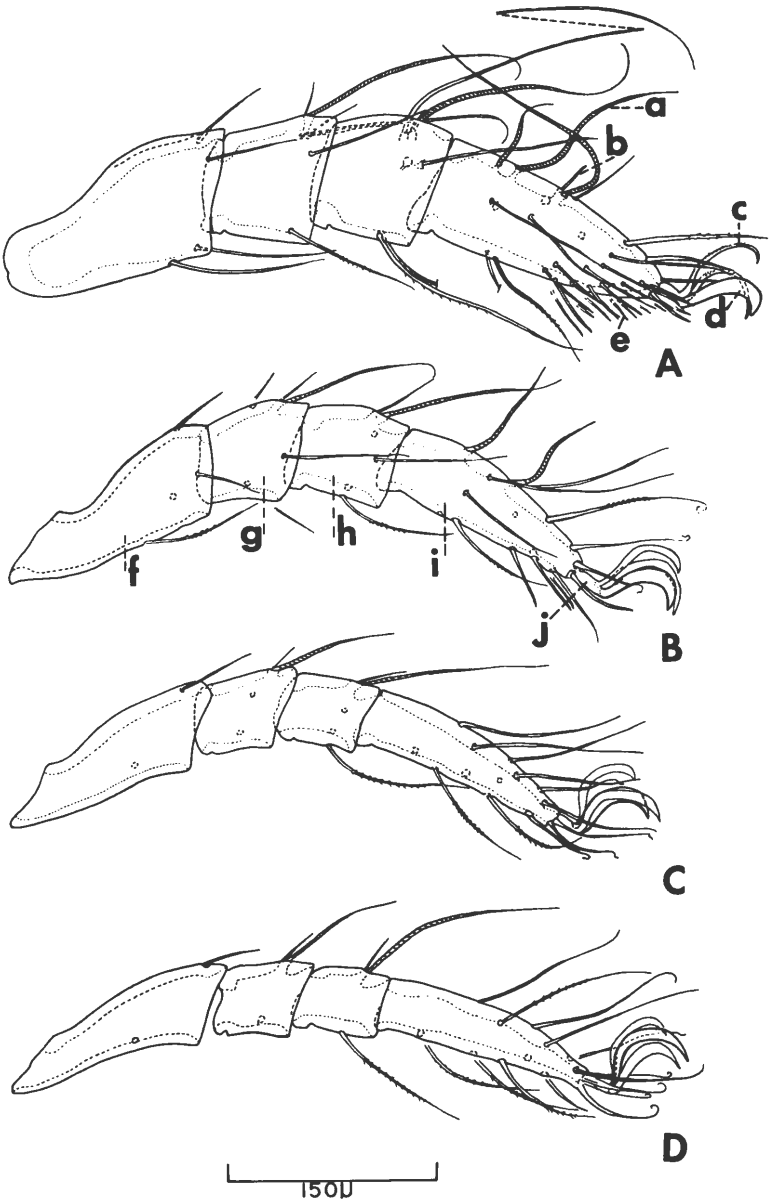

PLATE 10. *Pleisiotritia megale* sp. n., distal segments of legs. A. I. B. II. C. III. D. IV. Note that the numbers of solenidia on each segment result in the solenidial formula.

a. Solenidion. b. Famulus. c. Lateral claw. d. Median claw. e. Eupathidion. f. Femur. g. Genu. h. Tibia. i. Tarsus. j. Apotele.

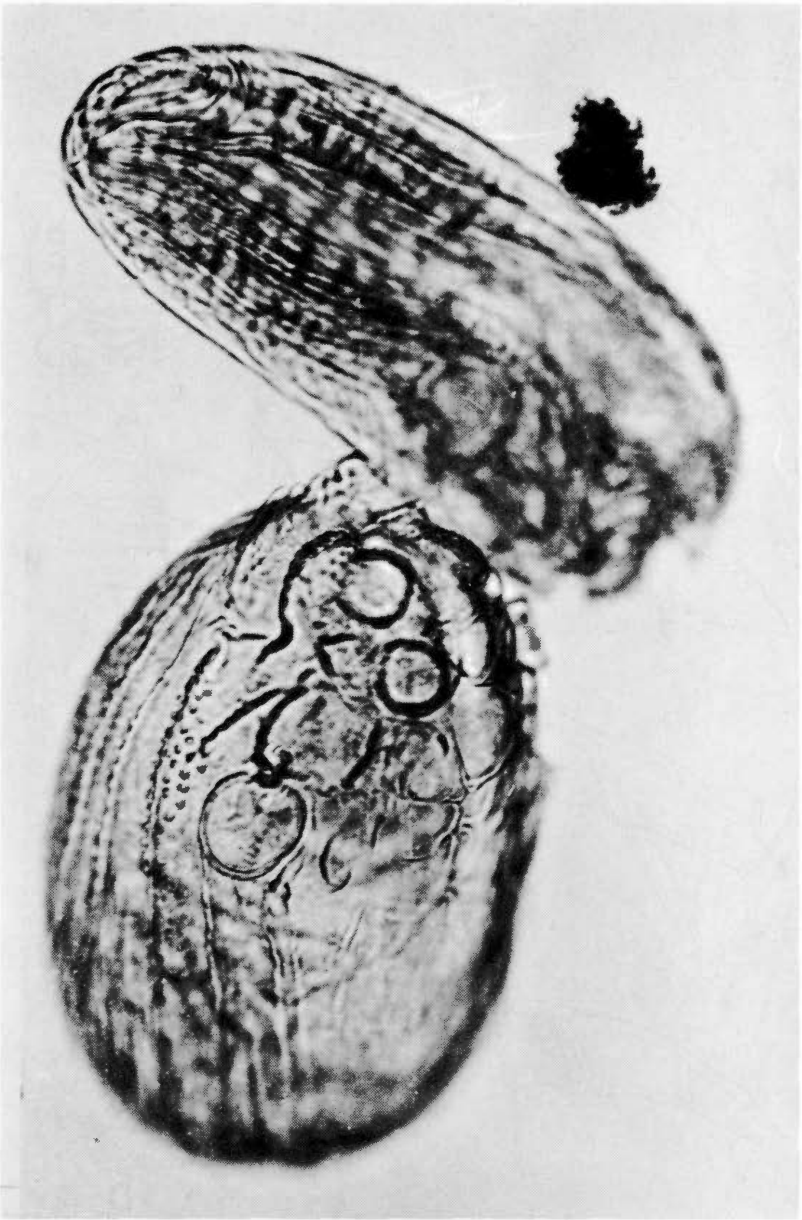

PLATE 11. *Plesiotritia megale* sp. n., deutova, the upper, narrow and elongate egg resembles those which were non-viable, while the lower, rotund egg resembles those from which larvae hatched.

PLATE 12. *Plesiotritia megale* sp. n., deutova, the opposite side of the eggs shown in Plate 12.

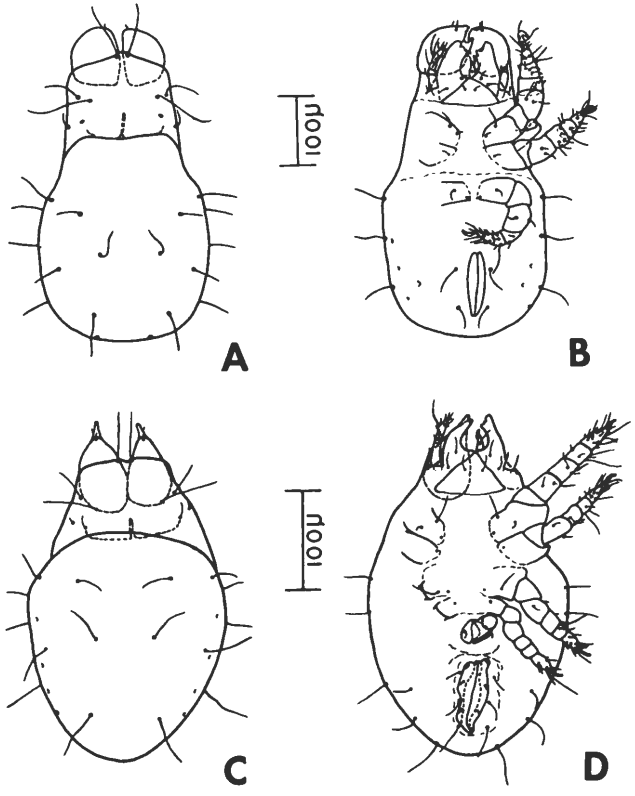

PLATE 13. *Plesiotritia megale* sp. n., immature stages. A. Dorsal aspect of larva. B. Ventral aspect of larva with right legs and lateral lip and left palp omitted. C. Dorsal aspect of protonymph. D. Ventral aspect of protonymph with right legs and lateral lip and left palp and chelicera omitted.

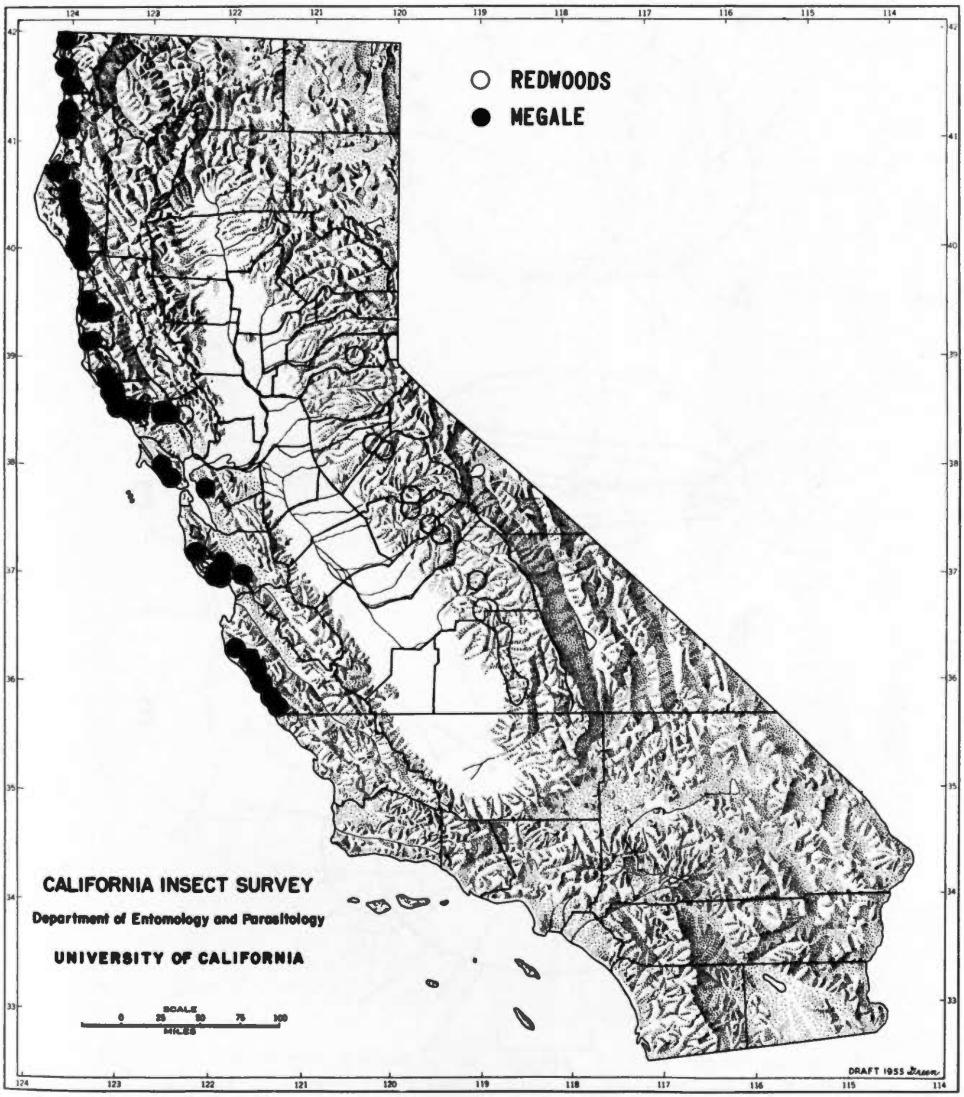

PLATE 14. Distribution of *Plesiotritia megale* sp. n.

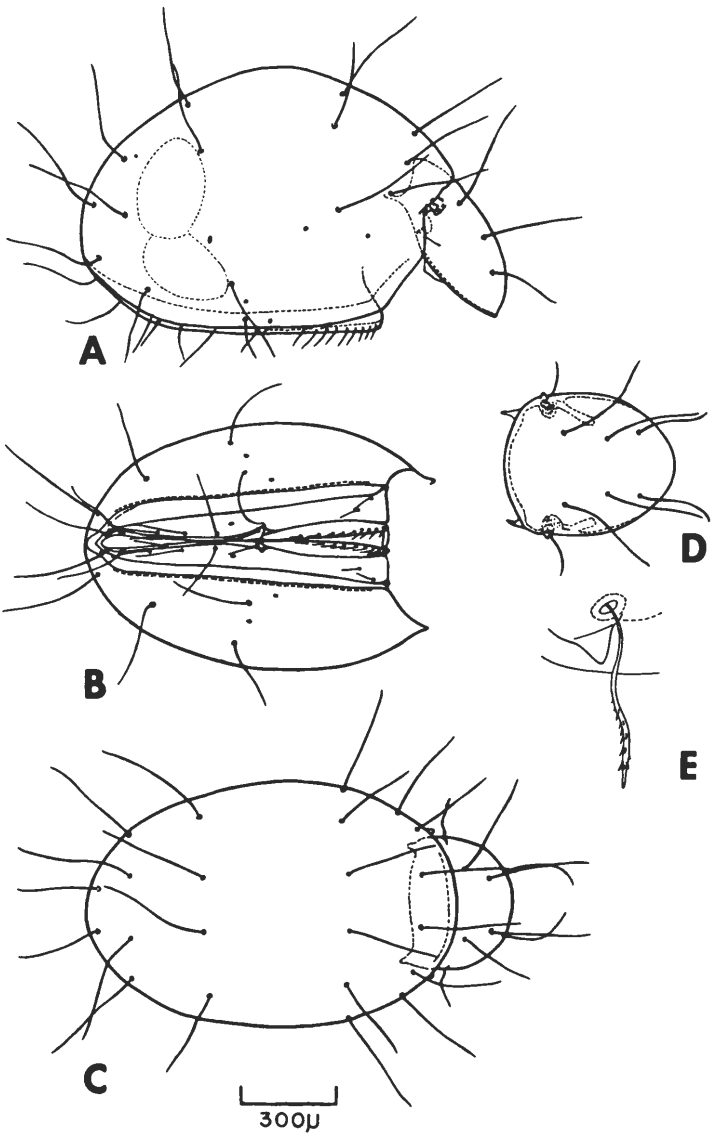

PLATE 15. *Oribotritia gibbera* sp. n. A. Lateral view of aspis and notogaster with two eggs indicated in normal position. B. Ventral view of notogaster. C. Dorsal view of notogaster and partially depressed aspis. D. Dorsal view of entire aspis. E. Enlarged view of scale and sensillus, magnification scale four times that of A-D.

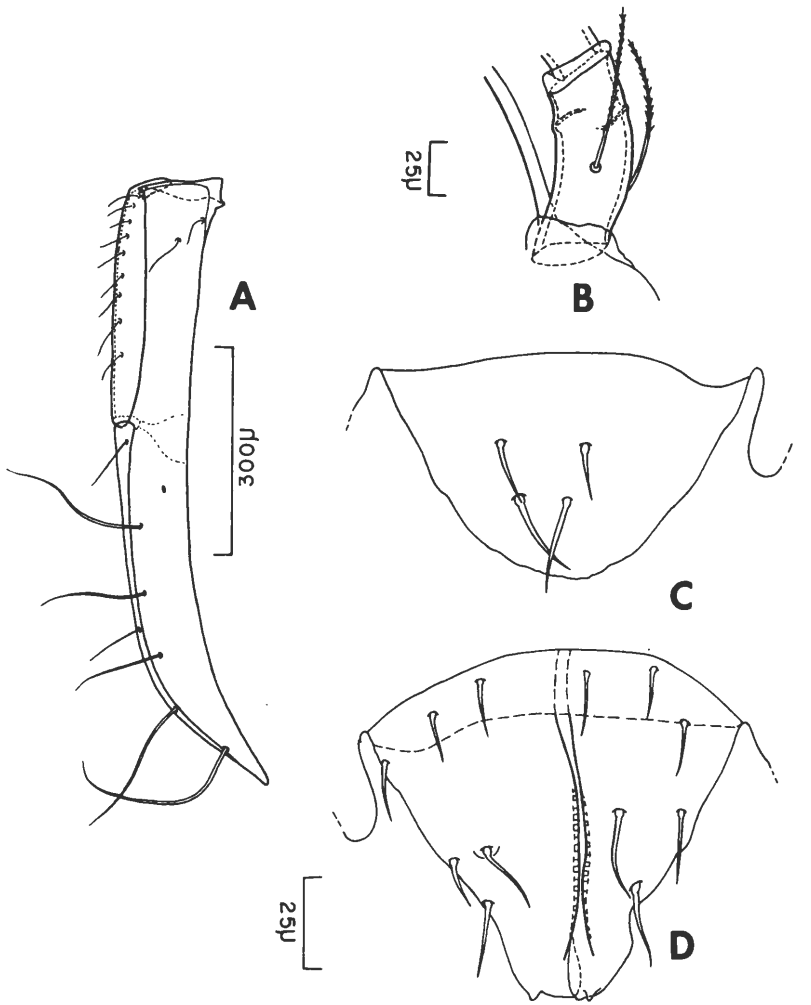

PLATE 16. *Oribotritia gibbera* sp. n., details. A. Left ventral plates. B. Palpal trochantero-femoro-genu segment, showing indistinct traces of fusion of genual portion. C. Ventral ovipositor lobe. D. Dorsal ovipositor lobes, ventral and dorsal lobes showing lack of sclerotized area around setal insertions.

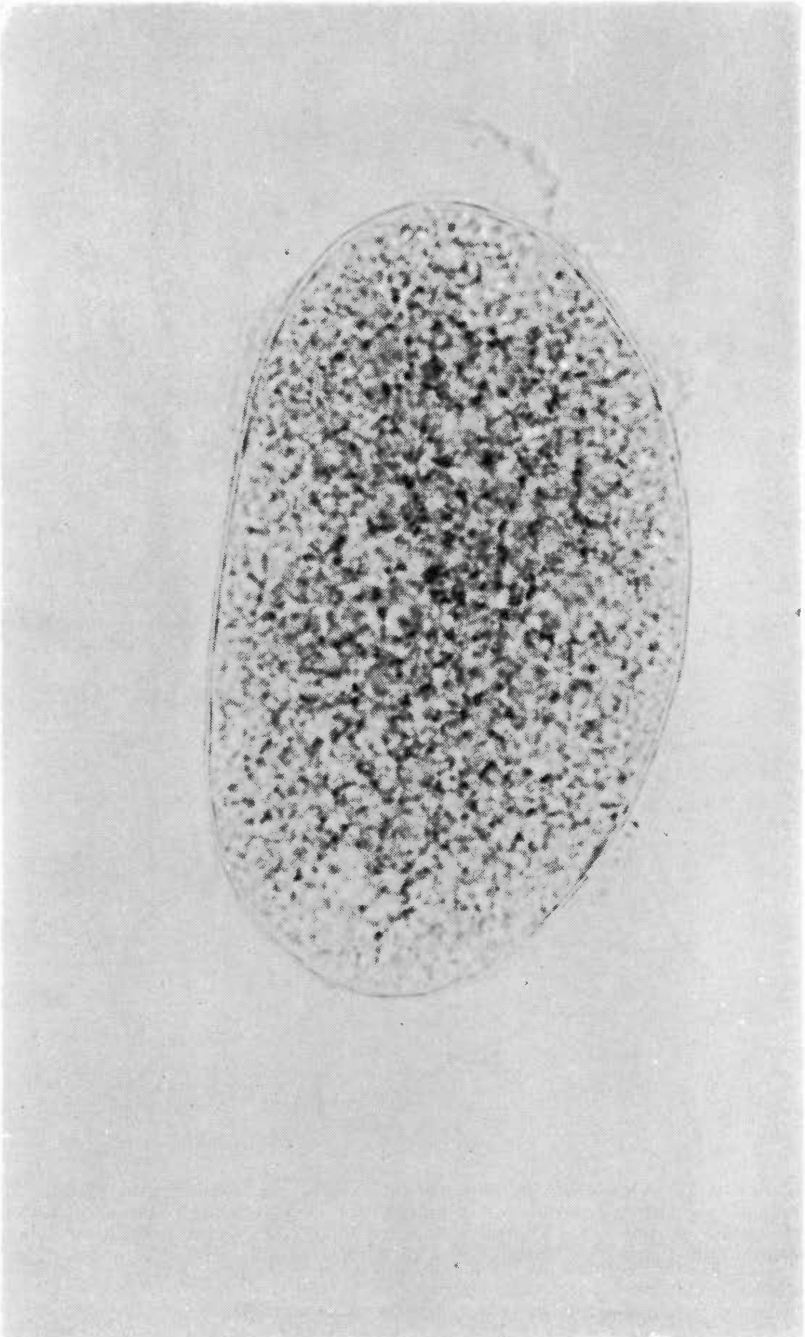

PLATE 17. *Oribotritia gibbera* sp. n., primovum showing thin shell and granulate yolk.

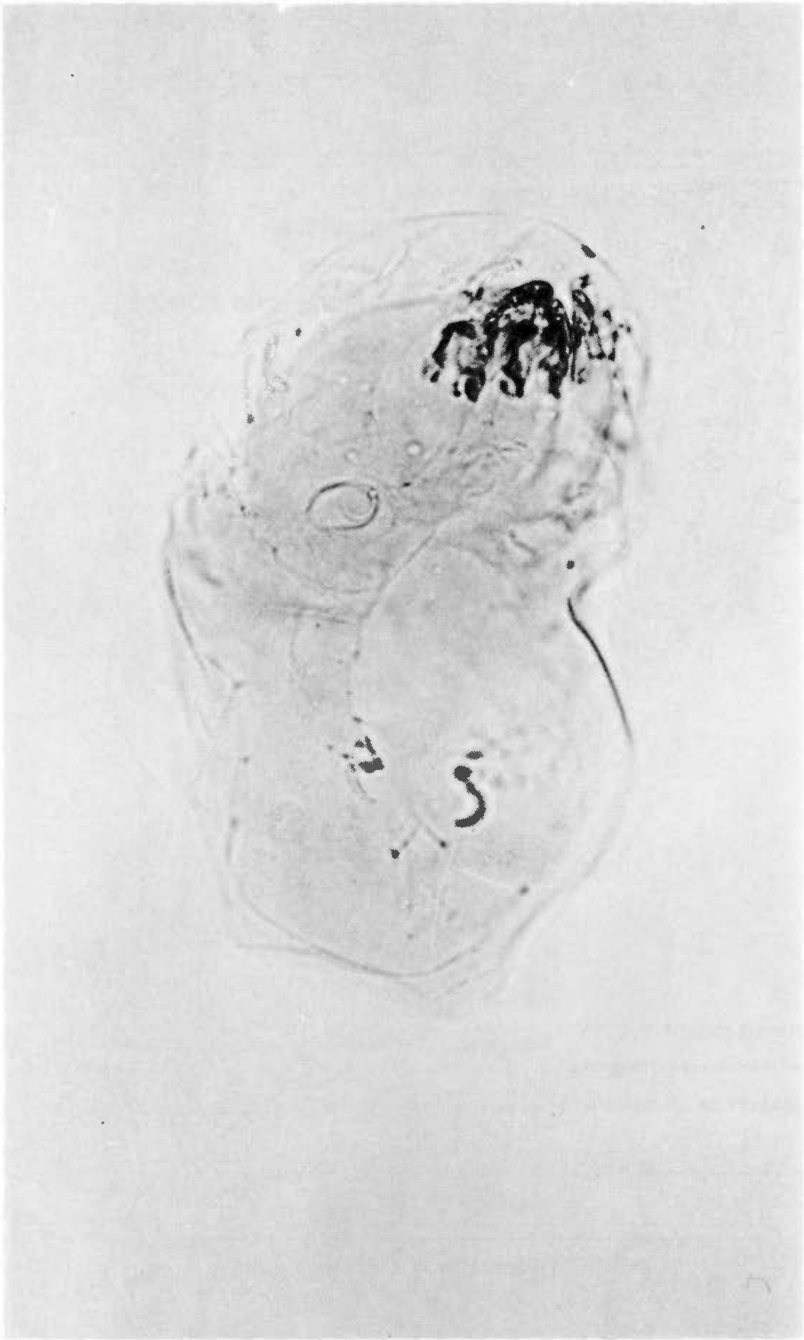

PLATE 18. *Oribotritia gibbera* sp. n., deutovum with pre-larva visible within thin, non-sculptured, non-sclerotized shell.

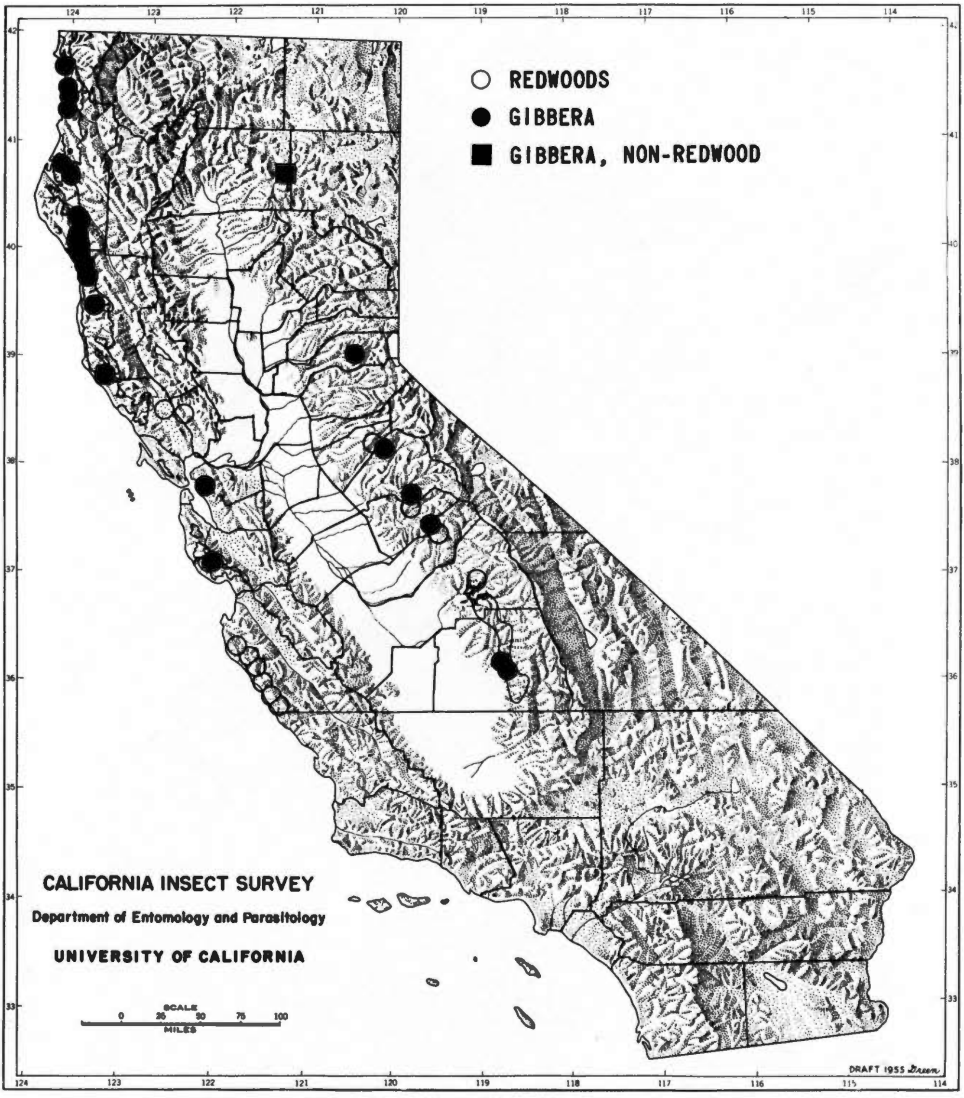

PLATE 19. Distribution of *Oribotritia gibbera* sp. n.

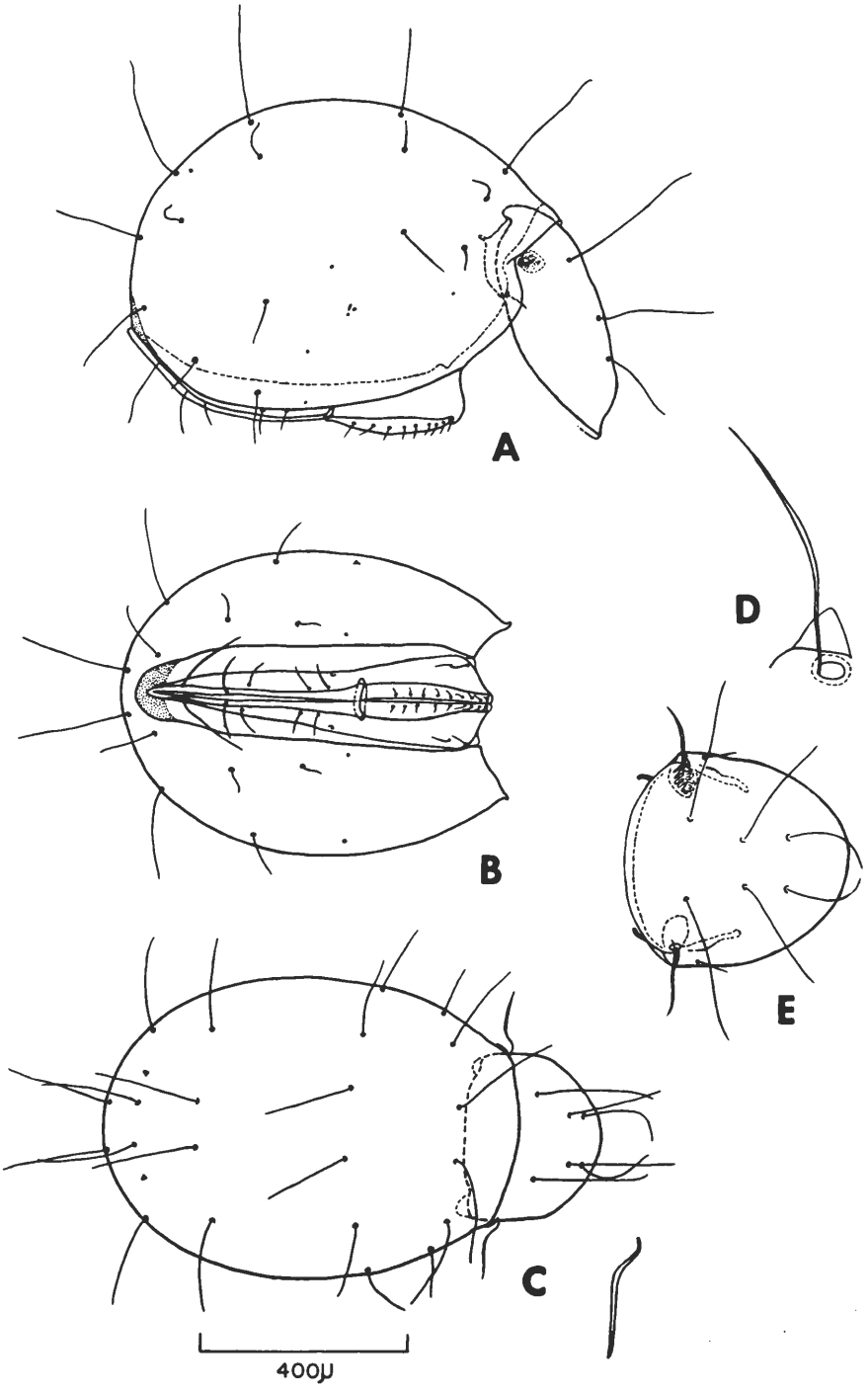

PLATE 20. *Oribotritia sellnicki* sp. n. A. Lateral view of notogaster and aspis. B. Ventral view of notogaster. C. Dorsal view of notogaster and partially closed aspis with separate sensillus enlarged to scale twice that of A-C, E. D. Separate sensillus enlarged to scale four times that of A-C, E. E. Dorsal view of full aspis, slightly flattened.

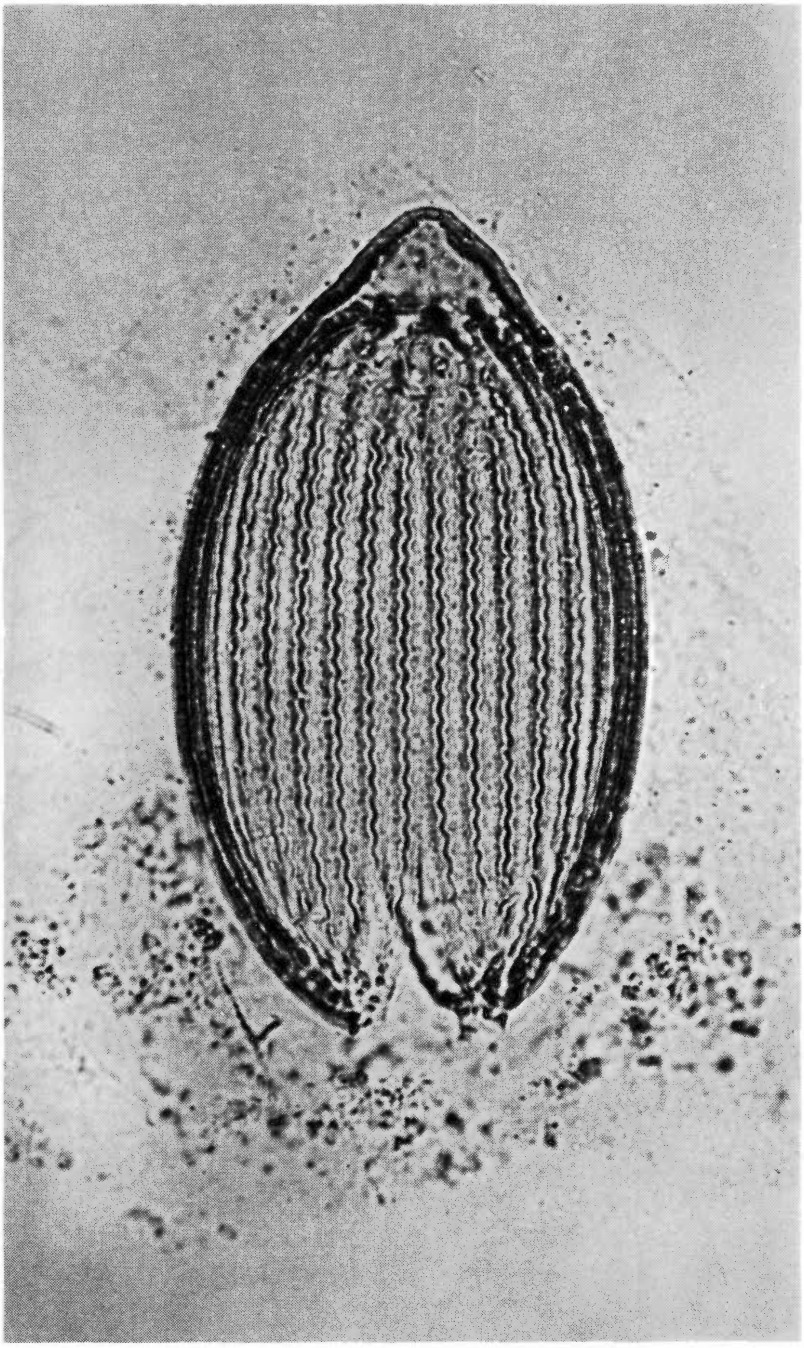

PLATE 21. *Oribotritia sellnicki* sp. n., deutovum.

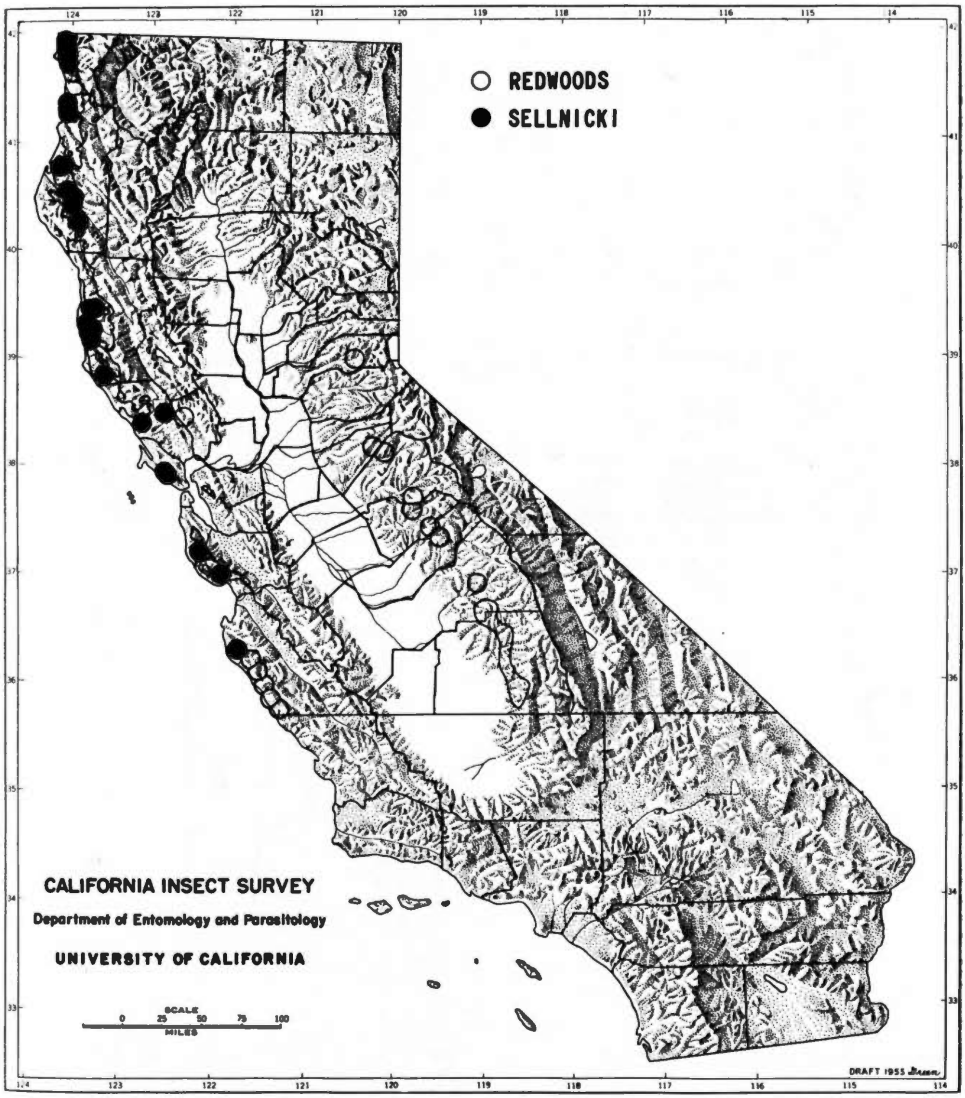

PLATE 22. Distribution of *Oribotritia sellnicki* sp. n.

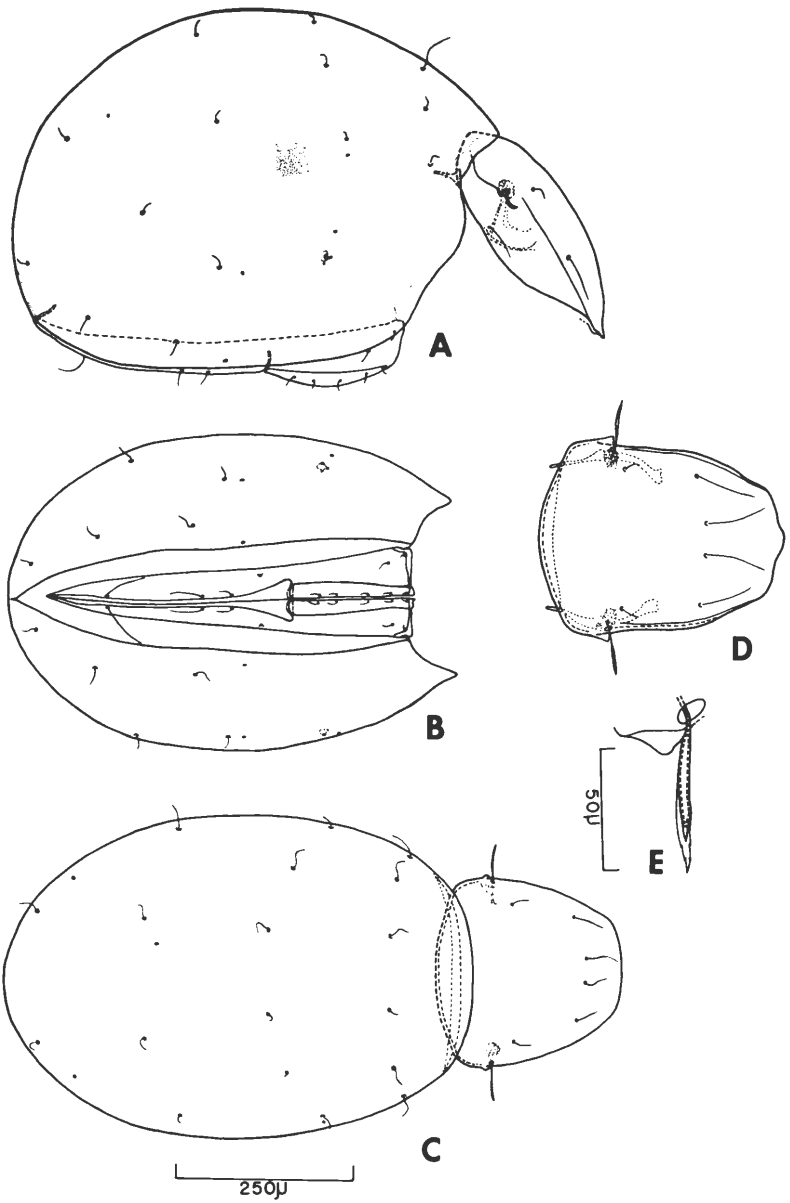

PLATE 23. *Oribotritia brachythrix* sp. n. A. Lateral view of notogaster and aspis. B. Ventral view of notogaster. C. Dorsal view of notogaster and slightly depressed aspis. D. Dorsal view of entire aspis. E. Enlarged detail of sensillus and scale.

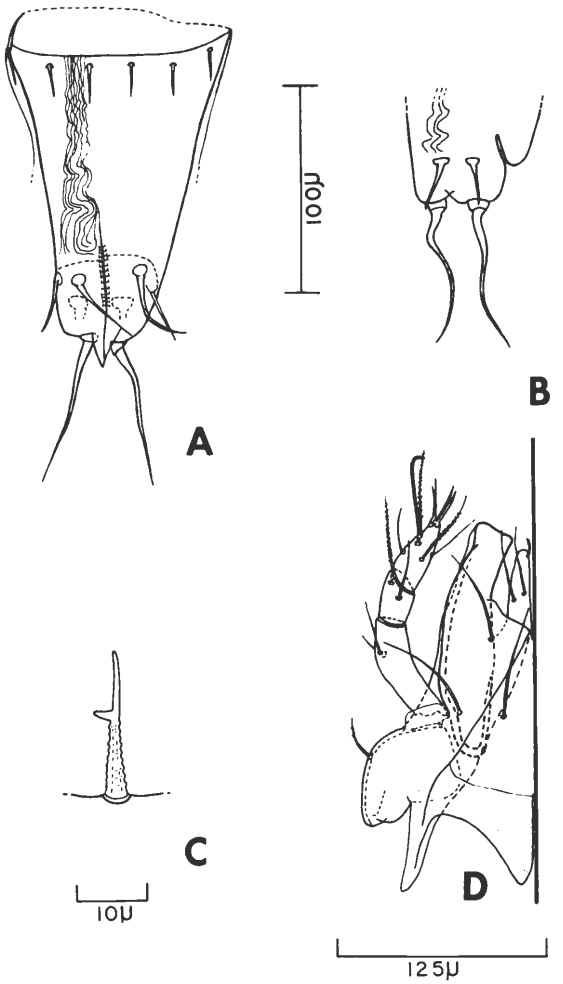

PLATE 24. *Oribotritia brachythrix* sp. n., details. A. Ovipositor dorsal lobes, with base of *ov*:1 dotted. B. Ventral lobe of ovipositor. C. Famulus, leg I. D. Ventral view of right half of infracapitulum.

PLATE 25. *Oribotritia brachythrix* sp. n., deutova.

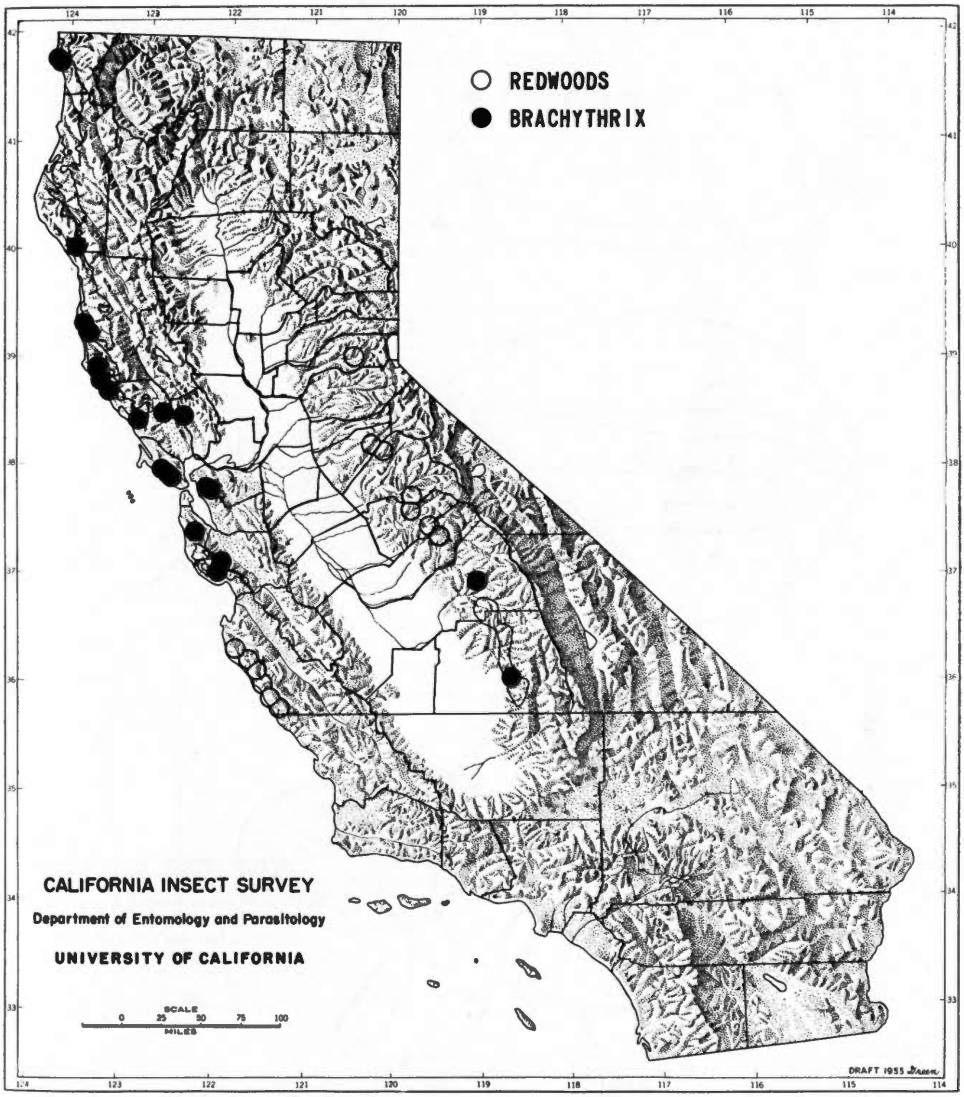

PLATE 26. Distribution of *Oribotritia brachythrix* sp. n.

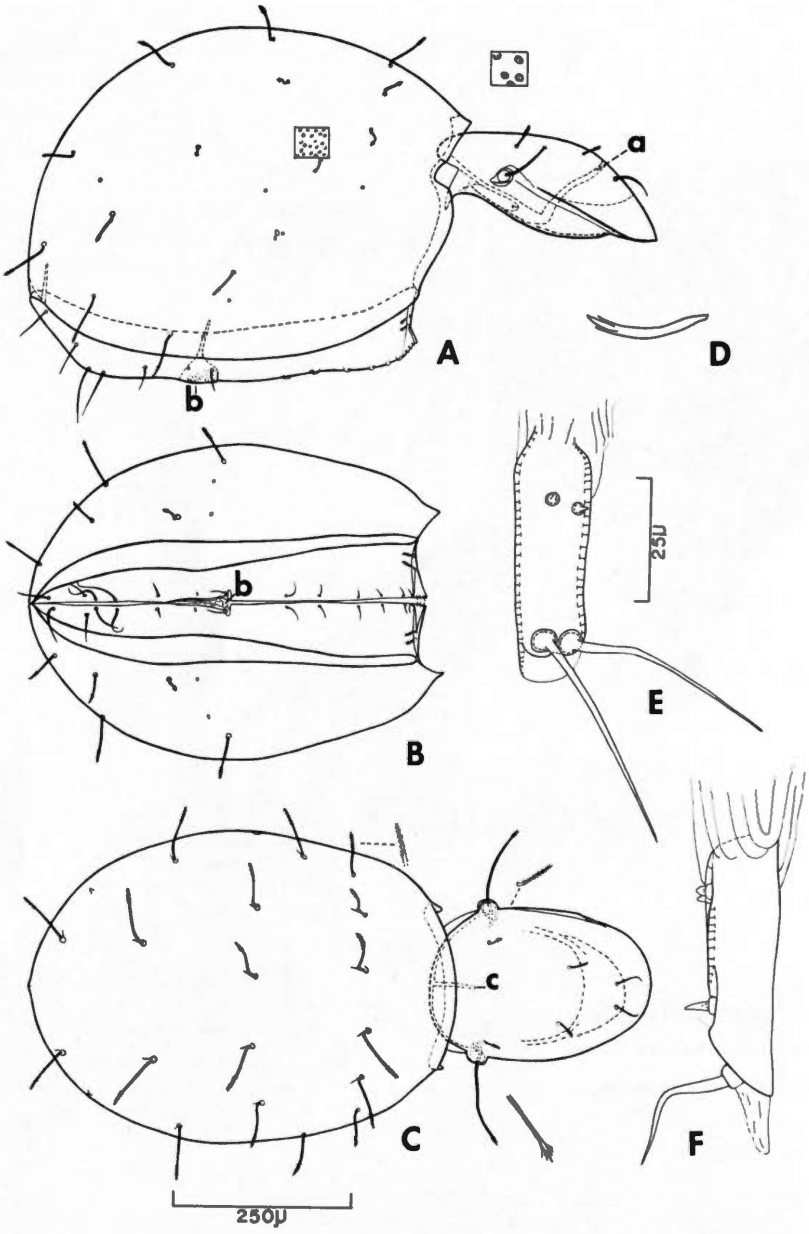

PLATE 27. *Euphthiracarus longirostralis* sp. n. A. Lateral view of notogaster and aspis, with view of surface reticulation enlarged twice magnification of reticulations shown on notogaster. B. Ventral view of notogaster. C. Dorsal view of notogaster and aspis with all enlarged setae at twice scale of A-C. D. Postero-mesad seta of coxa IV, magnification scale twice that of A-C. E. Ventral view of ventral ovipositor lobe tip, showing rudimentary *ov*:2 setae. F. Lateral view of dorsal ovipositor lobe tip, showing rudimentary *od*:3, 4 setae, magnification scale as for E.

a. Central rib of aspis. b. Interlocking triangle. c. Median rib of aspis.

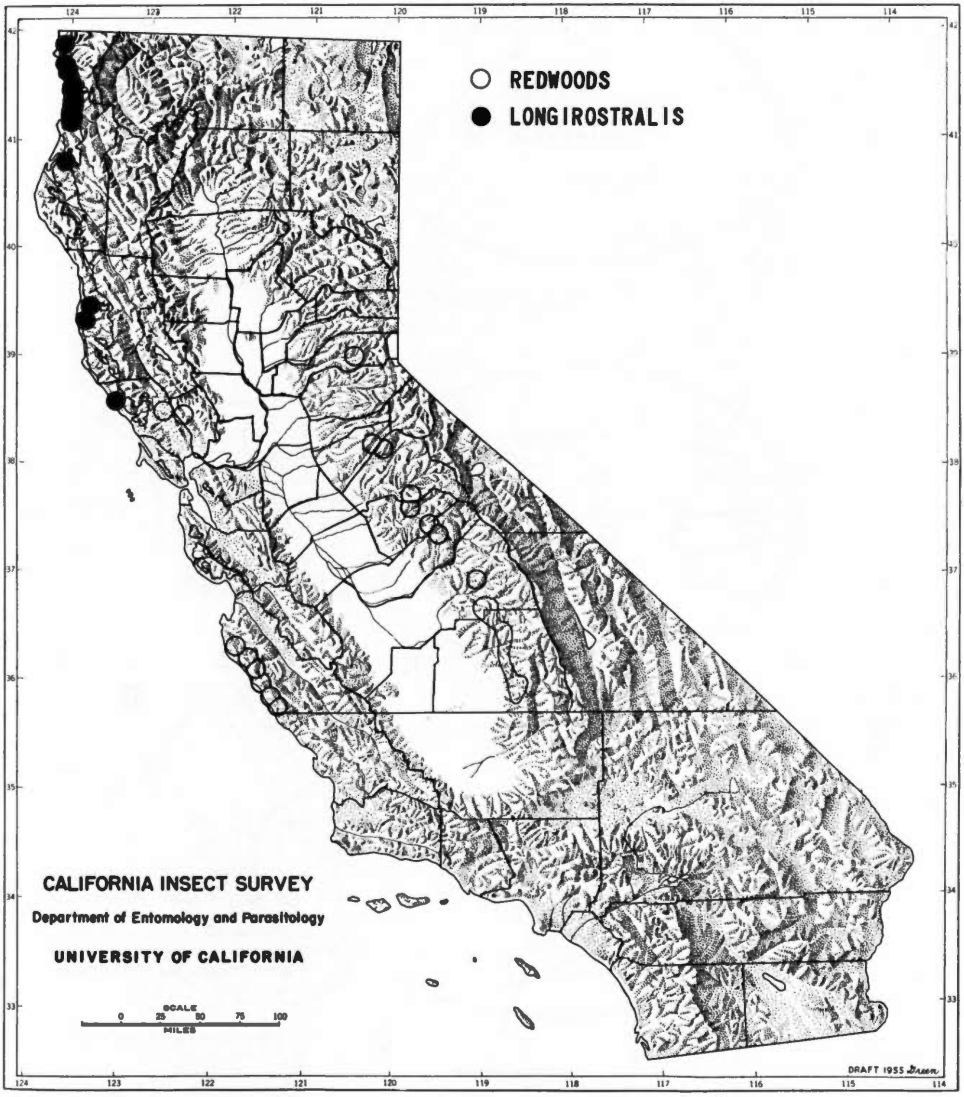

PLATE 28. Distribution of *Euphthiracarus longirostralis* sp. n.

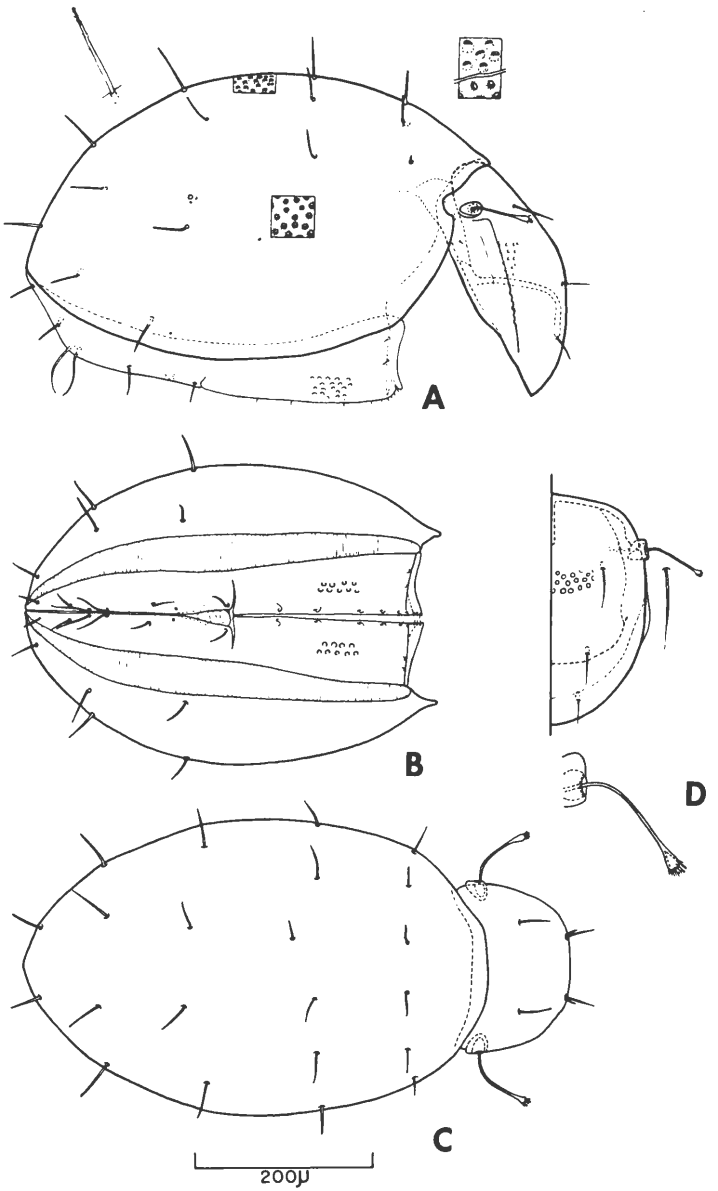

PLATE 29. *Euphthiracarus polytretos* sp. n. A. Lateral view of notogaster and aspis, showing type of deep pits on exoskeleton, enlarged sections twice scale of A. B. Ventral view of notogaster, plicature plates slightly, internally, striate. C. Dorsal view of notogaster and partially closed aspis. D. Left half of dorsal, horizontal, view of aspis, enlarged sensillus and vertical seta twice magnification scale of A-D. All drawn from male specimen.

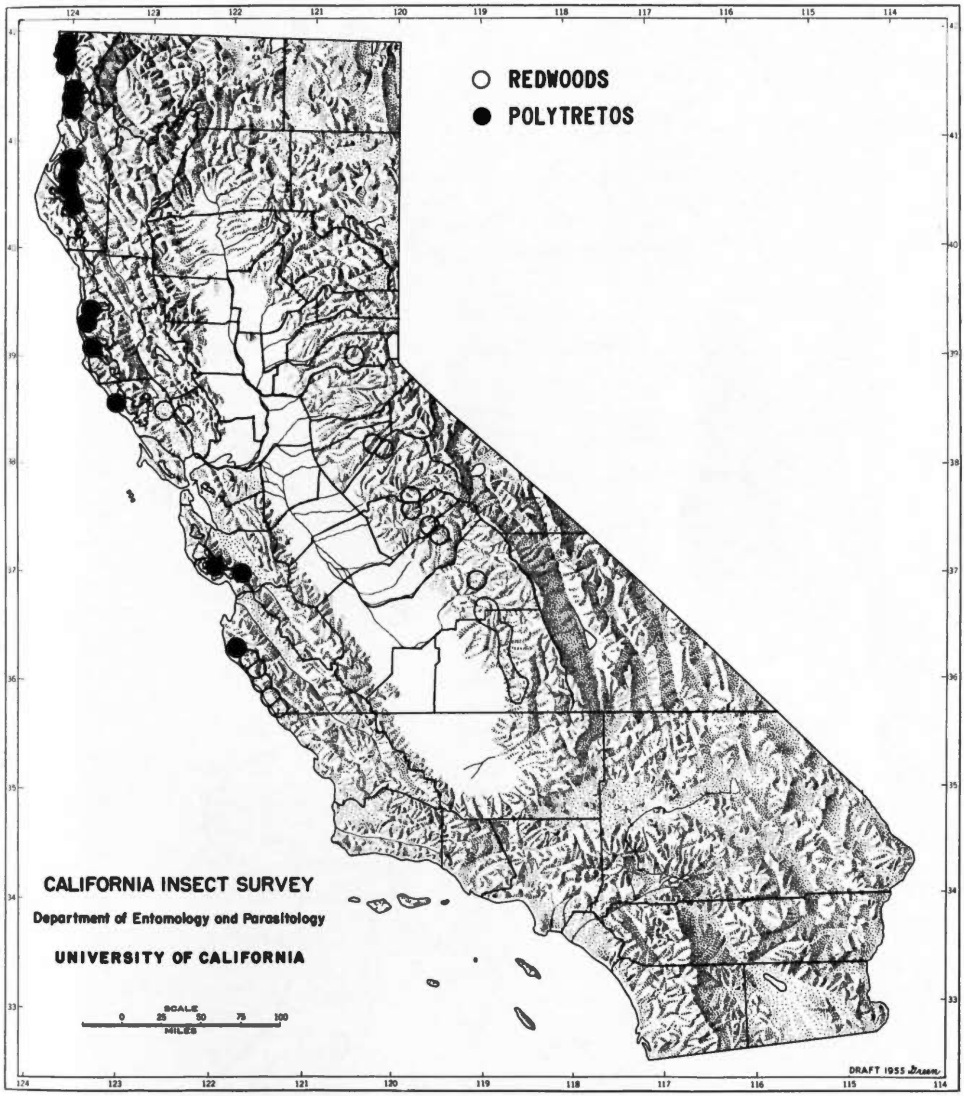

PLATE 30. Distribution of *Euphthiracarus polytretos* sp. n.

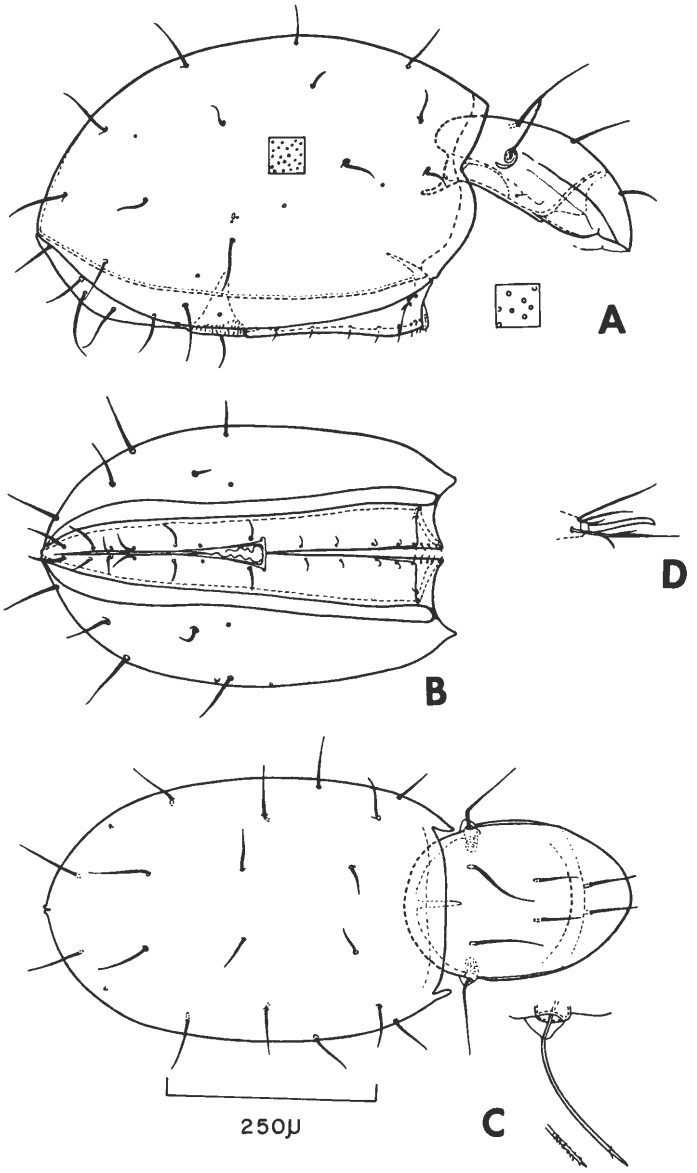

PLATE 31. *Euphthiracarus alazon* sp. n. A. Lateral view of notogaster and aspis, with enlargment of surface depressions at twice scale of A-C. B. Ventral view of notogaster. C. Dorsal view of notogaster and aspis, with sensillus and sensillar tip enlarged to twice scale of A-C. D. Tip of leg I showing single median claw, magnification scale twice that of A-C.

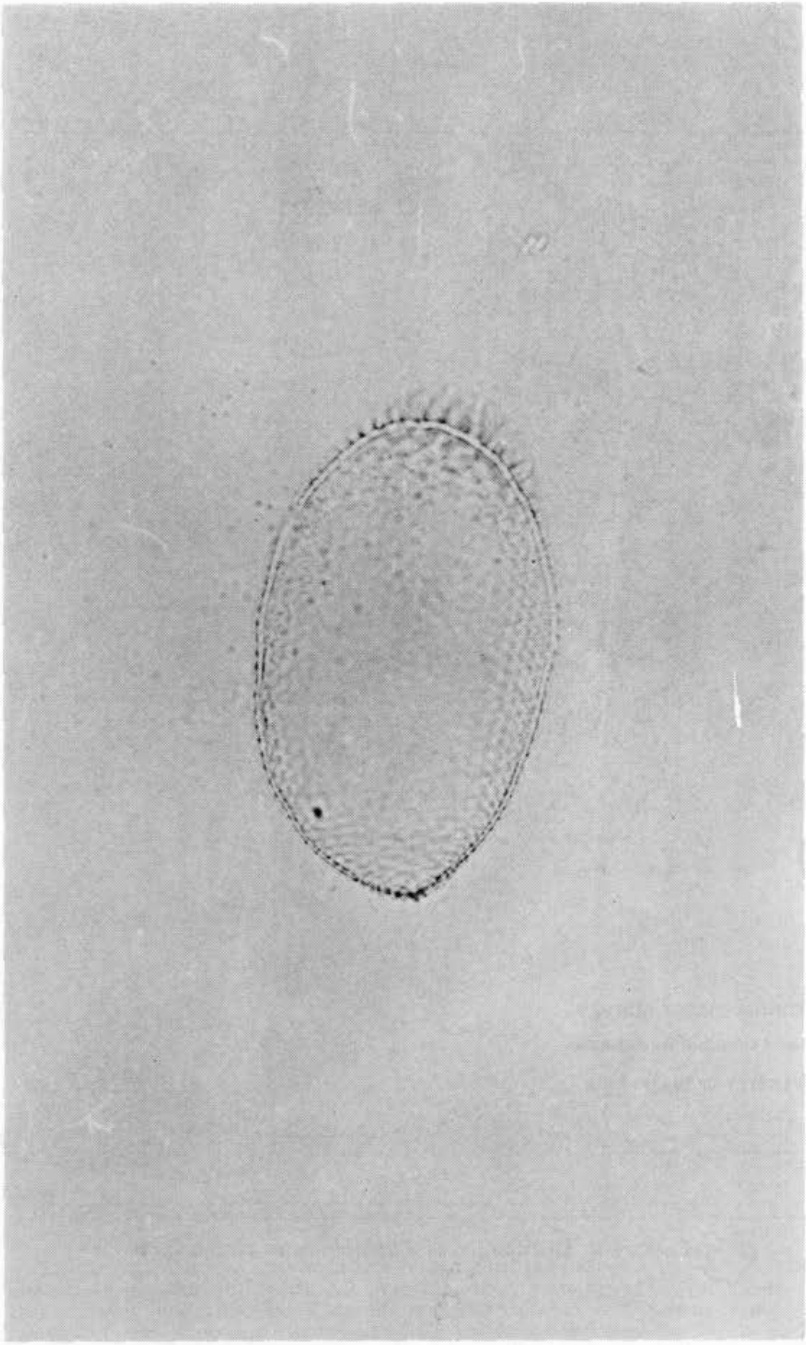

PLATE 32. *Euphthiracarus alazon* sp. n., deutovum.

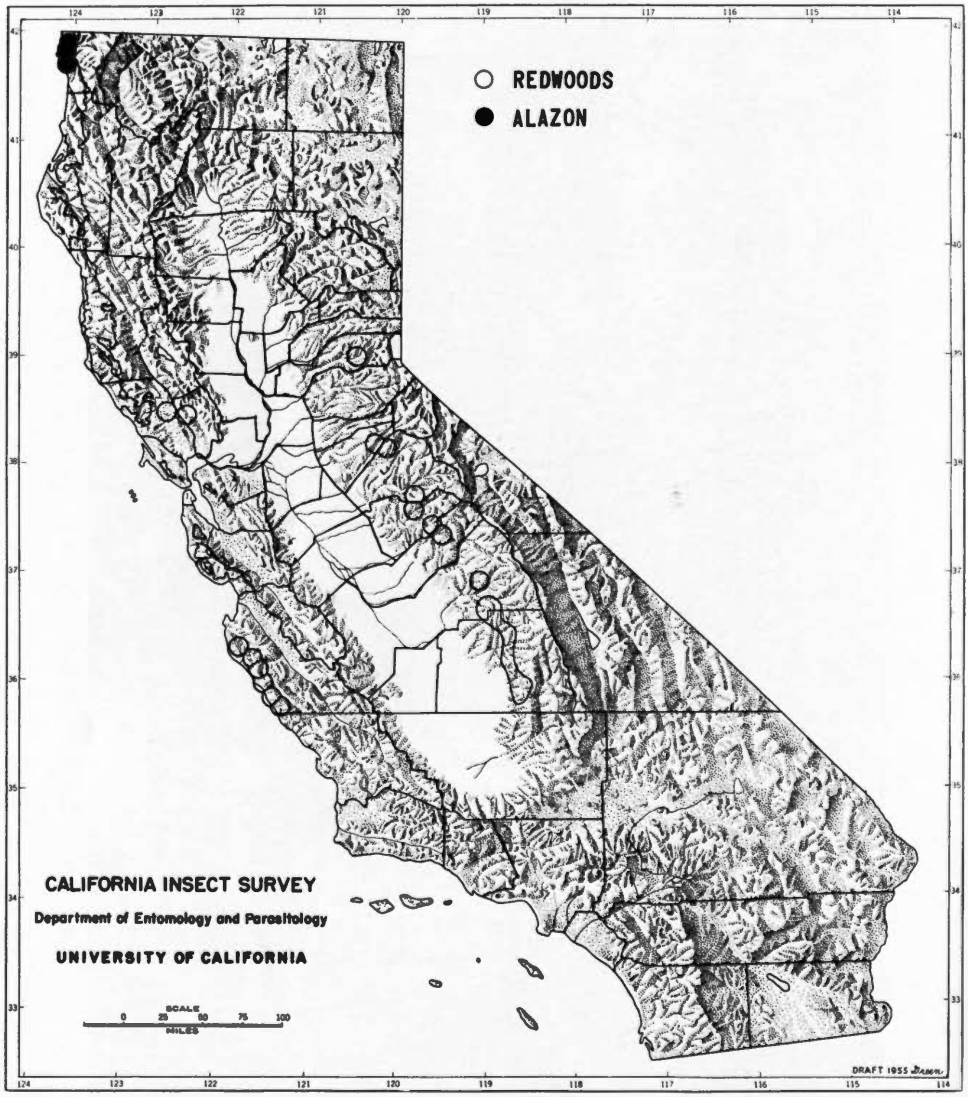

PLATE 33. Distribution of *Euphthiracarus alazon* sp. n.

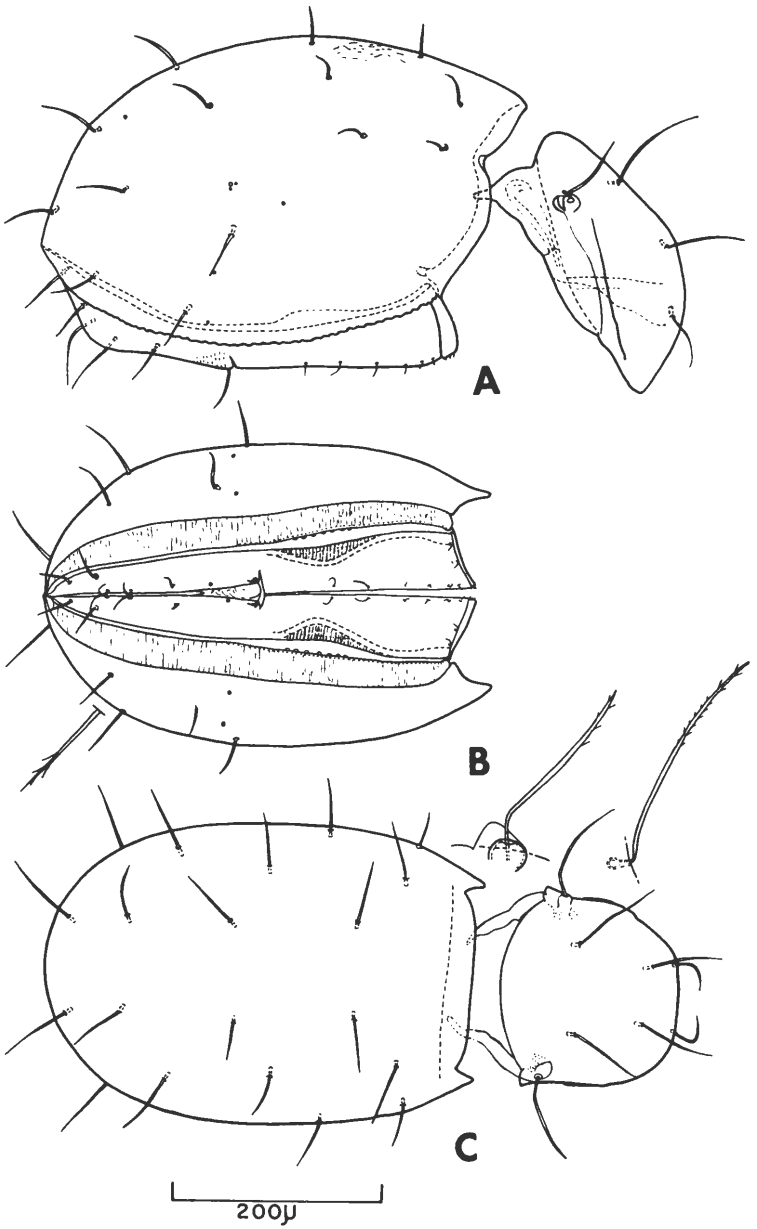

PLATE 34. *Euphthiracarus tanythrix tanythrix* sp. et ssp. n. A. Lateral view of notogaster and aspis. B. Ventral view of notogaster with enlarged seta showing fine cilia found on all notogastral setae. C. Dorsal view of notogaster and somewhat depressed aspis, with enlarged sensillus, scale and, to right, vertical seta, showing fine cilia on sensillus and on aspal setae. All enlarged views at twice scale of A-C.

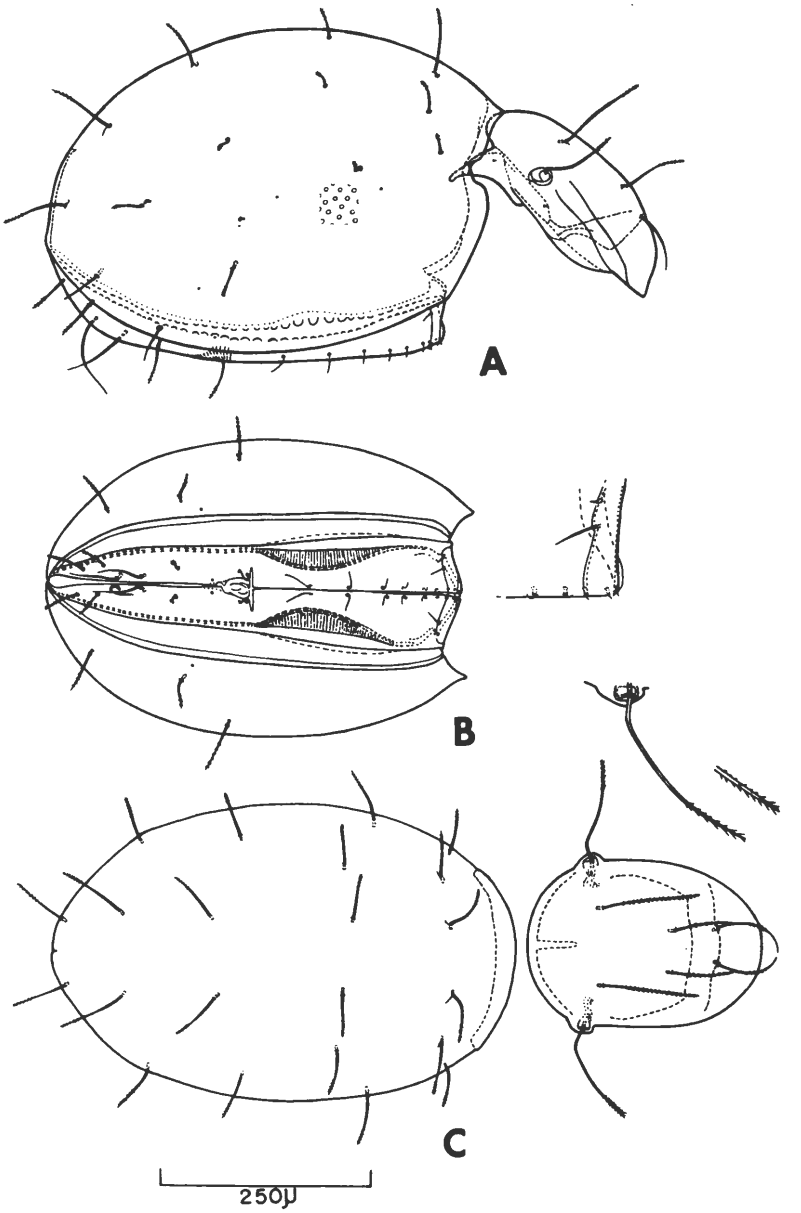

PLATE 35. *Euphthiracarus tanythrix sierriensis* ssp. n. A. Lateral view of notogaster and aspis. B. Ventral view of notogaster, with lateral pockets indicated and enlargement of antero-mesal corner of genital plate area. C. Dorsal view of notogaster and aspis, with enlargement of sensillus and its tip. All enlarged sections with scale twice that of A-C.

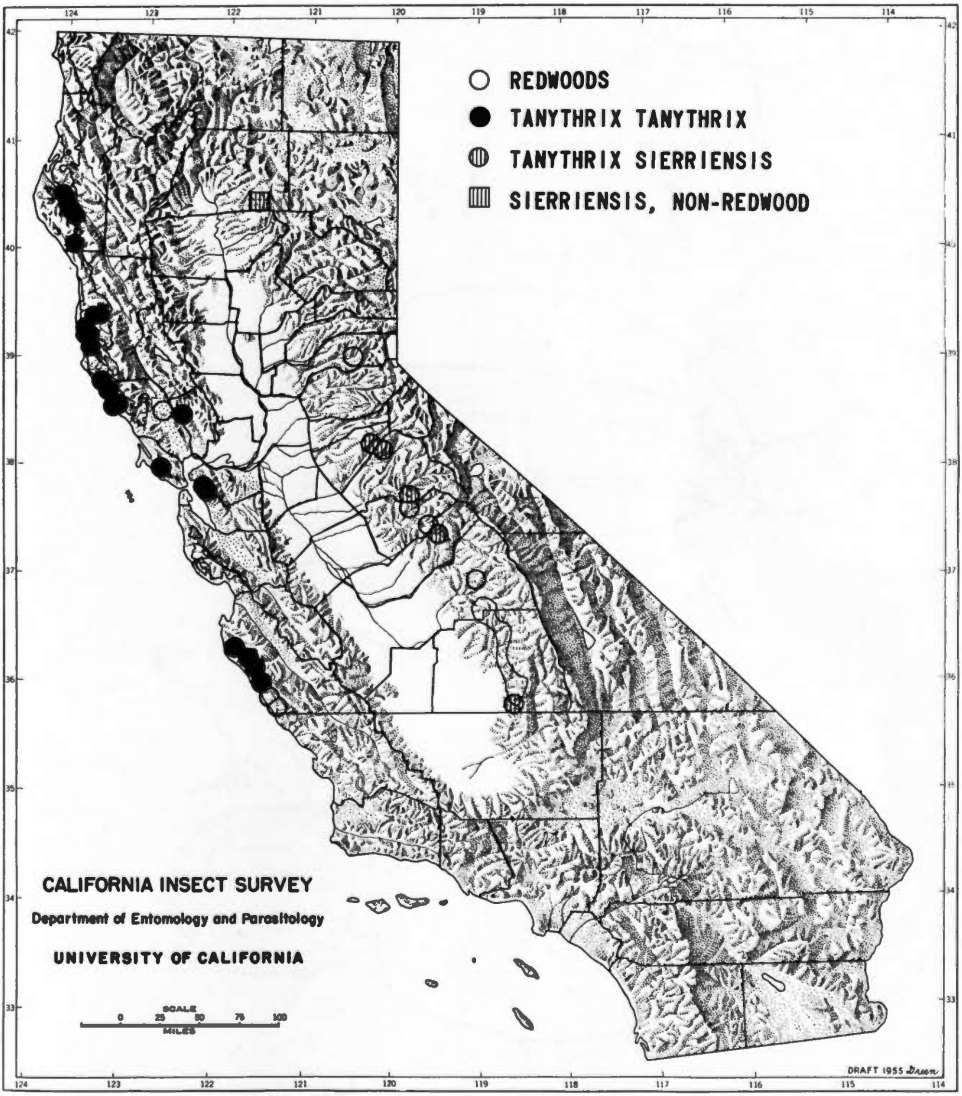

PLATE 36. Distribution of *Euphthiracarus t. tanythrix* and *E. t. sierriensis* sp. et sspp. n.

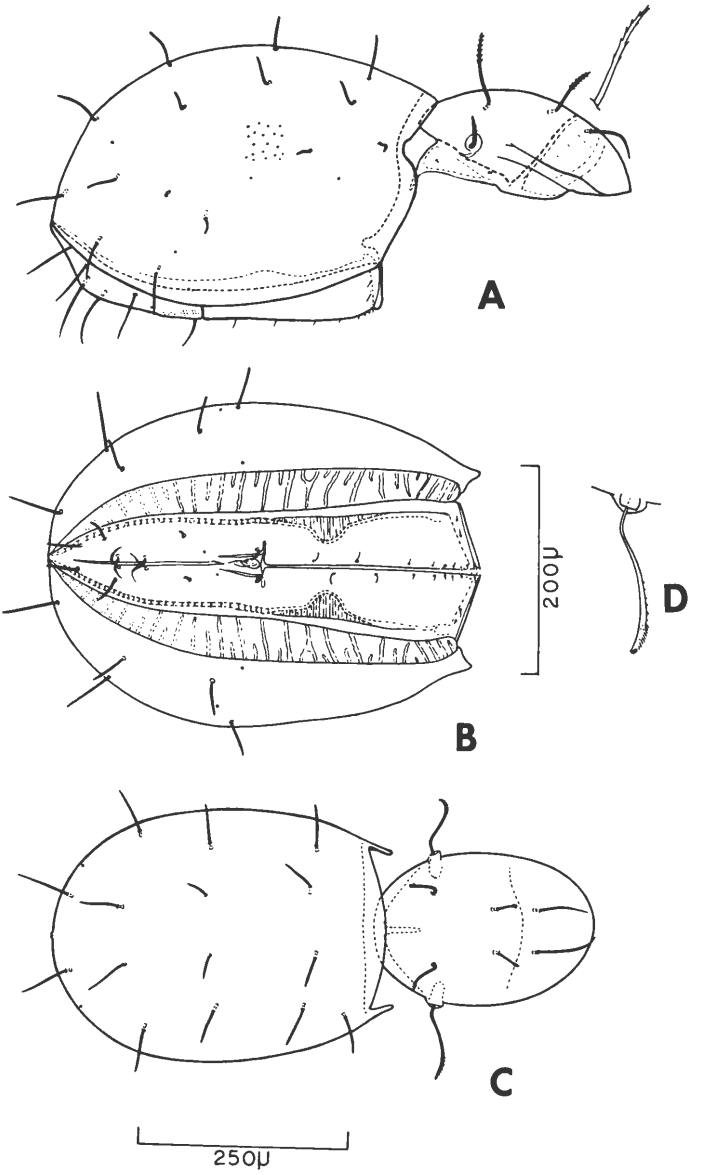

PLATE 39. *Euphthiracarus monyx* sp. n. A. Lateral view of notogaster and aspis, scale as C, with enlargement of lateral seta. B. Ventral view of notogaster. C. Dorsal view of notogaster and aspis. D. Enlargement of right sensillus and scale. All enlargements to twice scale of C.

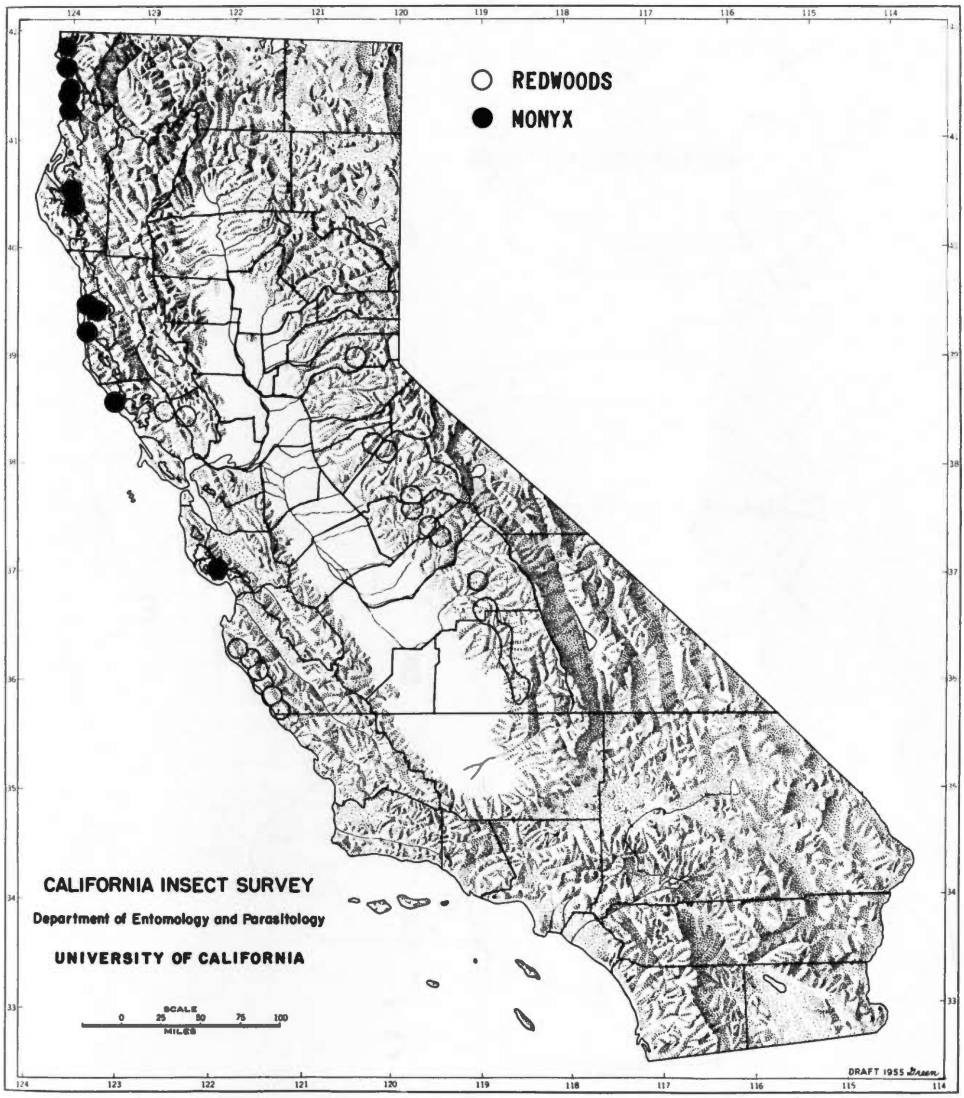

PLATE 40. Distribution of *Euphthiracarus monyx* sp. n.

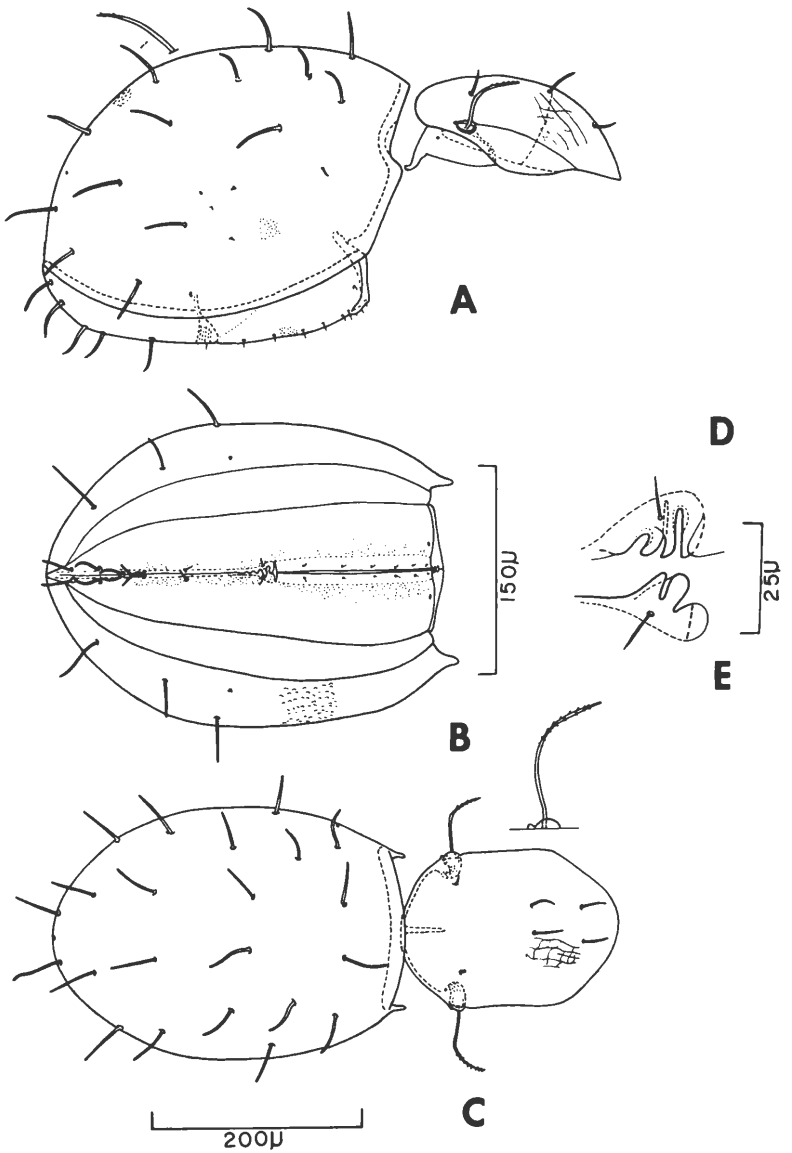

PLATE 41. *Rhysotritia scotti* sp. n. A. Lateral view of notogaster and aspis, scale as C. B. Ventral view of notogaster. C. Dorsal view of notogaster and aspis with sensillus enlarged to scale twice that of C. D. Flat view of right half of interlocking triangle. E. About three-quarter, lateral, view of left half of interlocking triangle.

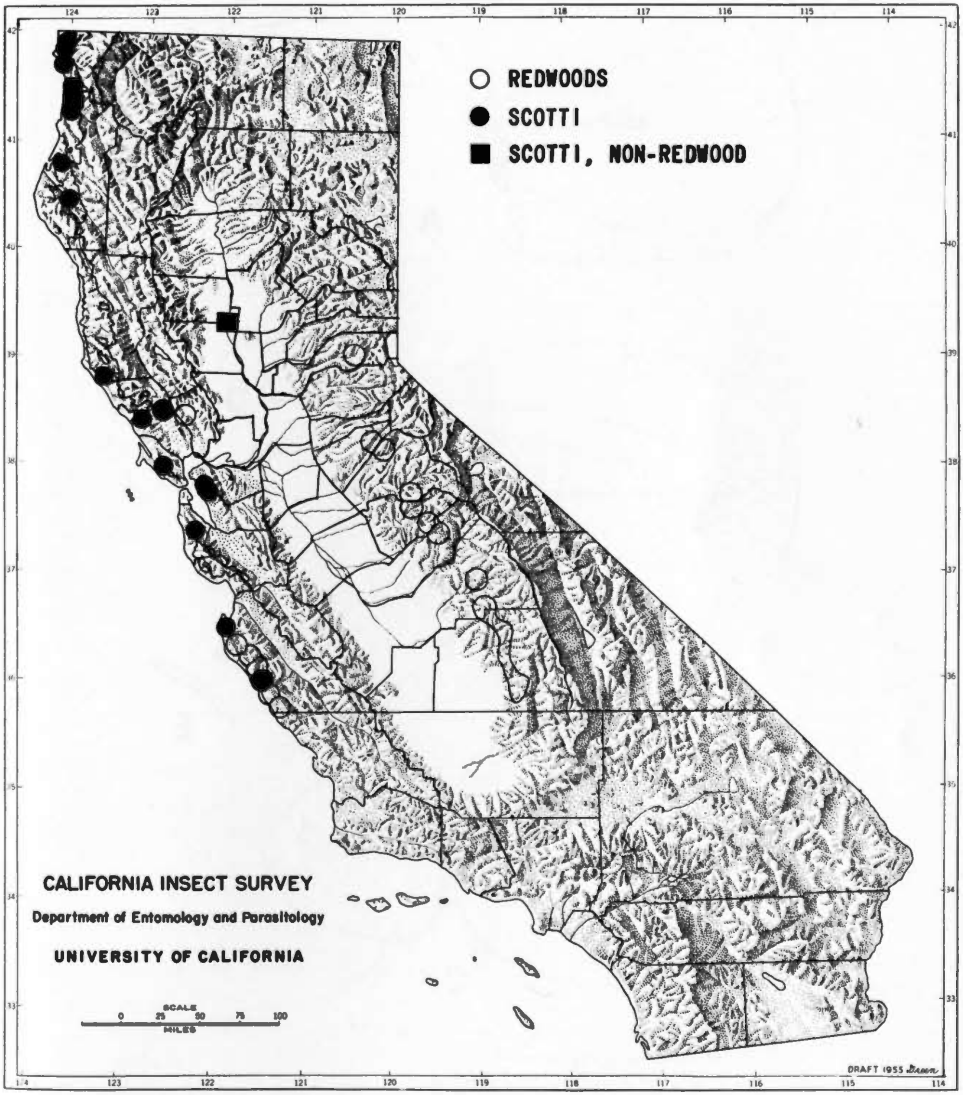

PLATE 42. Distribution of *Rhysotritia scotti* sp. n.

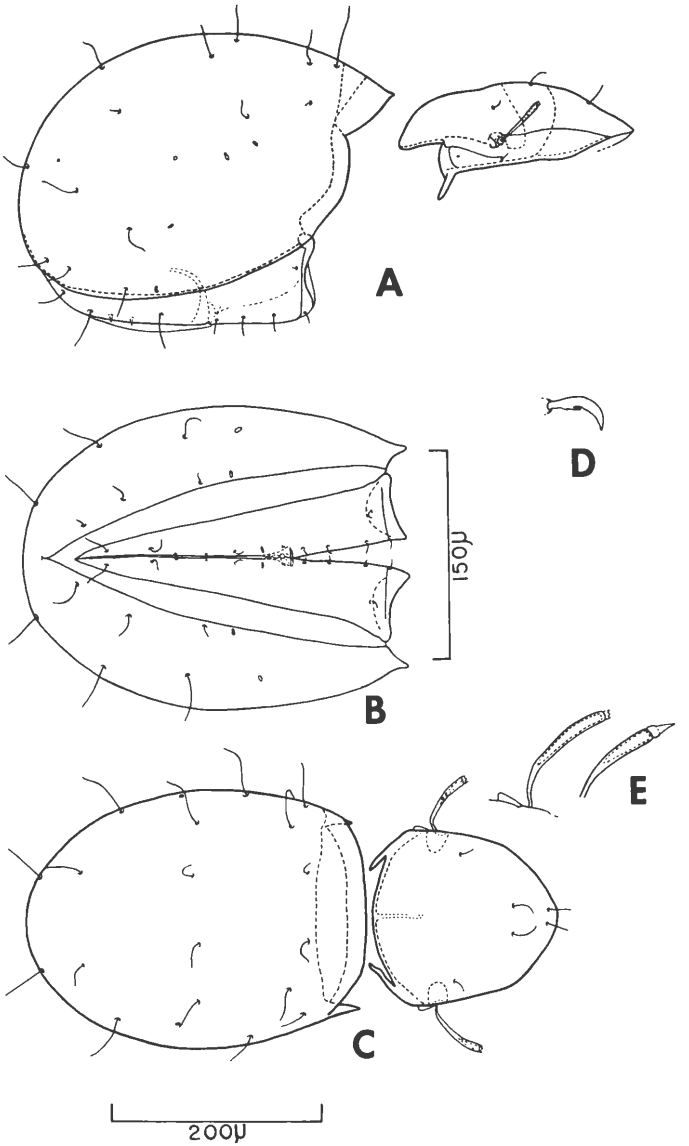

PLATE 43. *Rhysotritia paeneminima* sp. n. A. Lateral view of notogaster and aspis, magnification scale as C. B. Ventral view of notogaster. C. Dorsal view of notogaster and aspis. D. Lateral aspect of typical single claw. E. Enlarged sensilli, on left with usual damaged tip, on right with uncommon entire tip. Figures D and E enlarged to scale twice that of A and C.

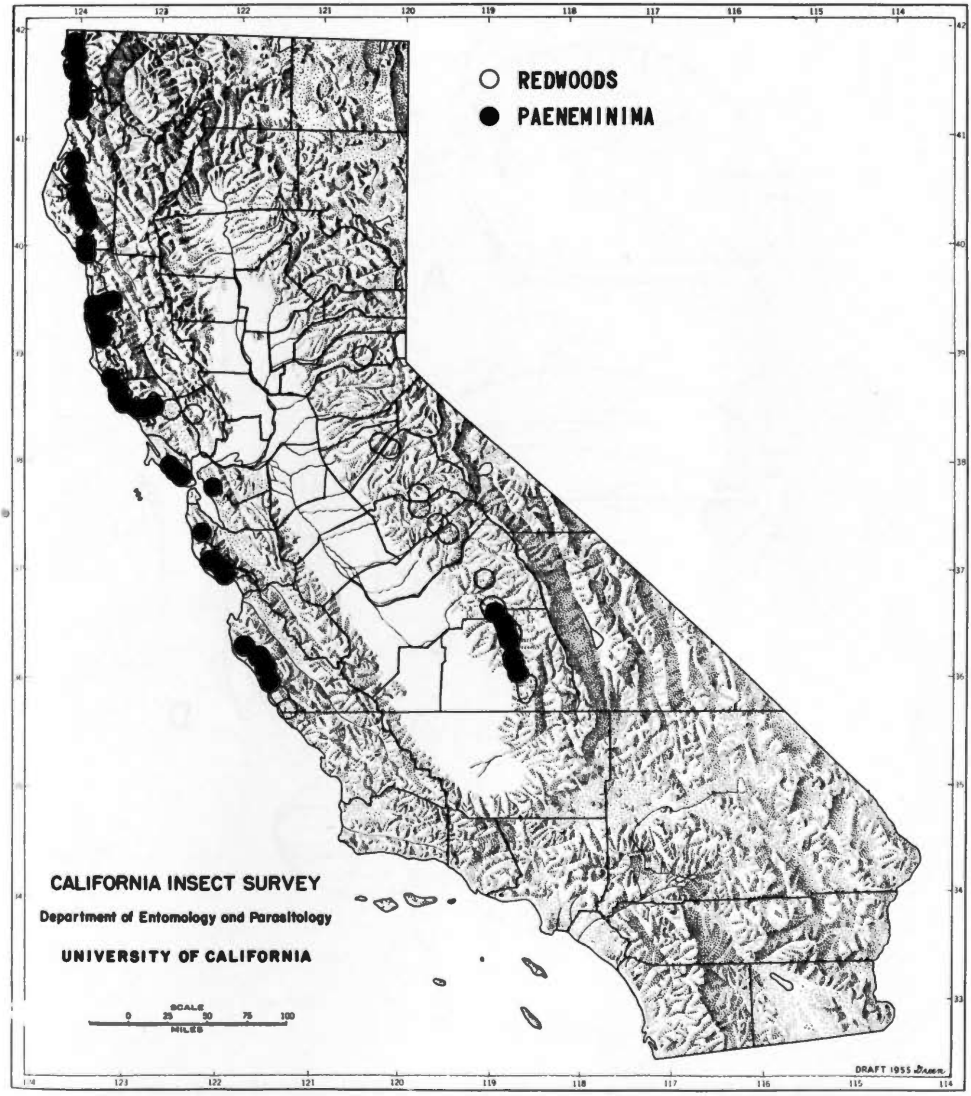

PLATE 44. Distribution of *Rhysotritia paeneminima* sp. n.

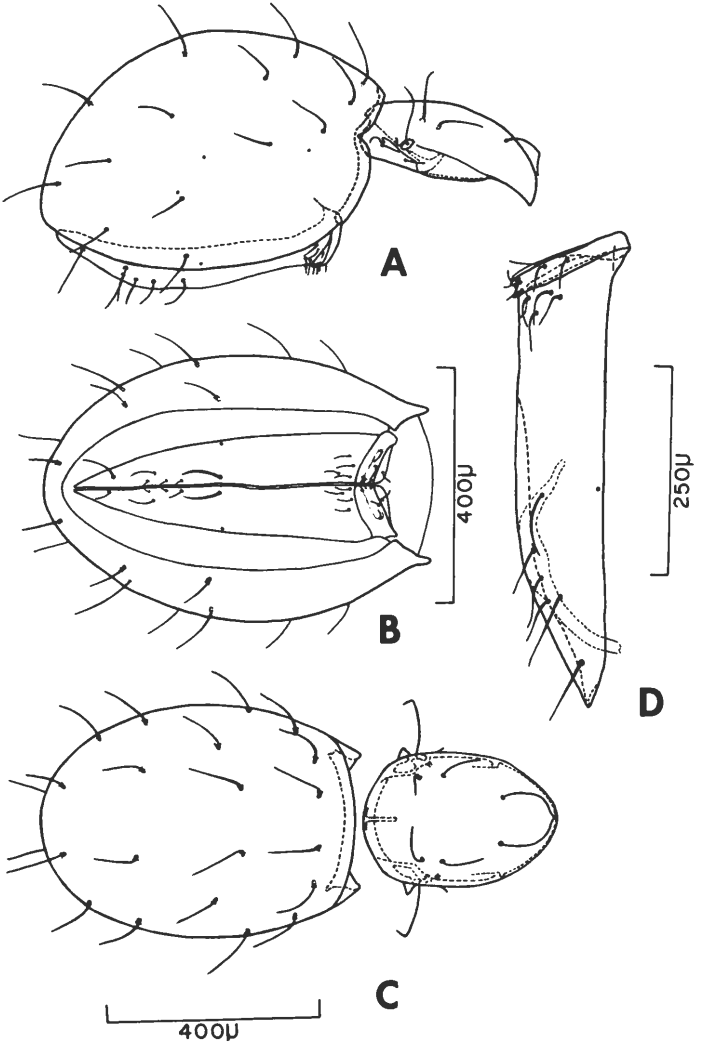

PLATE 45. *Synichotritia caroli* sp. n. A. Lateral view of notogaster and aspis, scale as C. B. Ventral view of notogaster. C. Dorsal view of notogaster and aspis. D. Ventral view of left ventral plate.

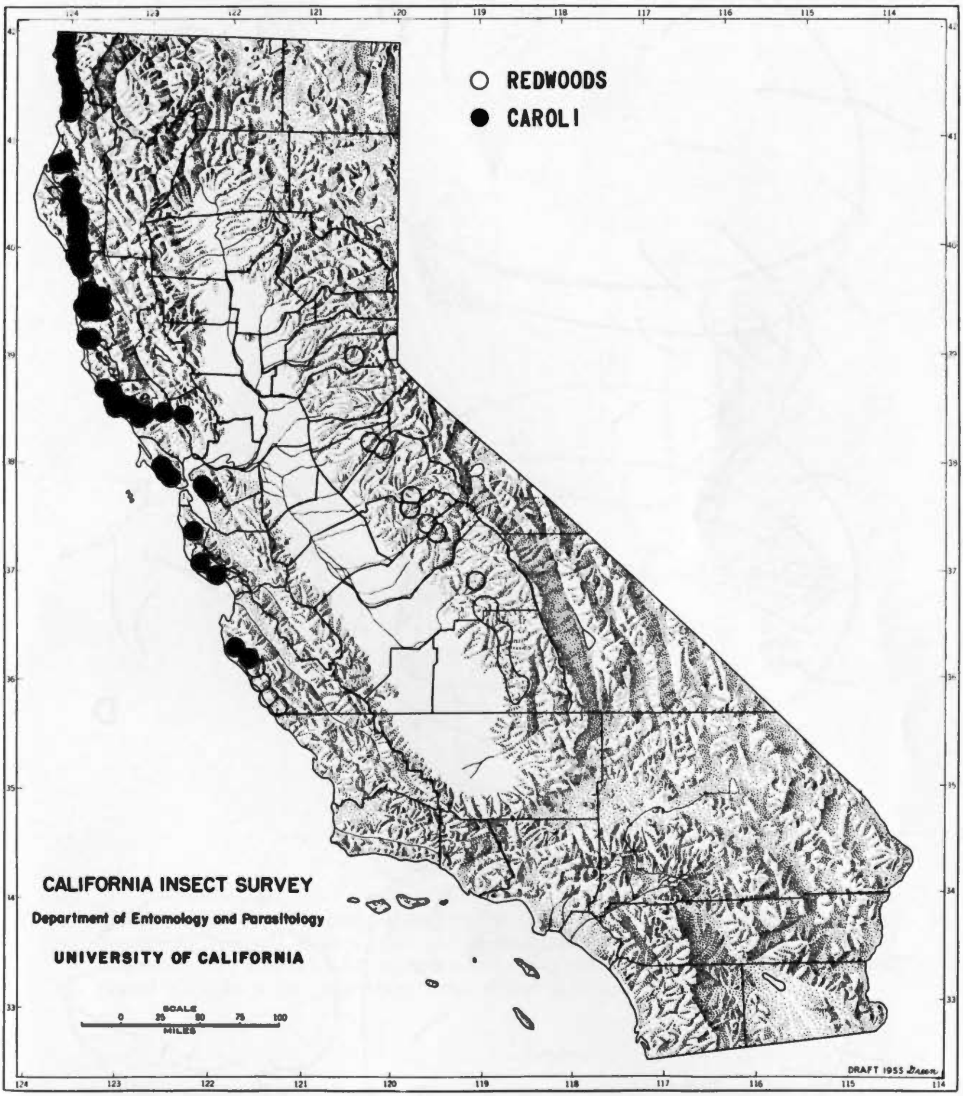

PLATE 46. Distribution of *Synichotritia caroli* sp. n.

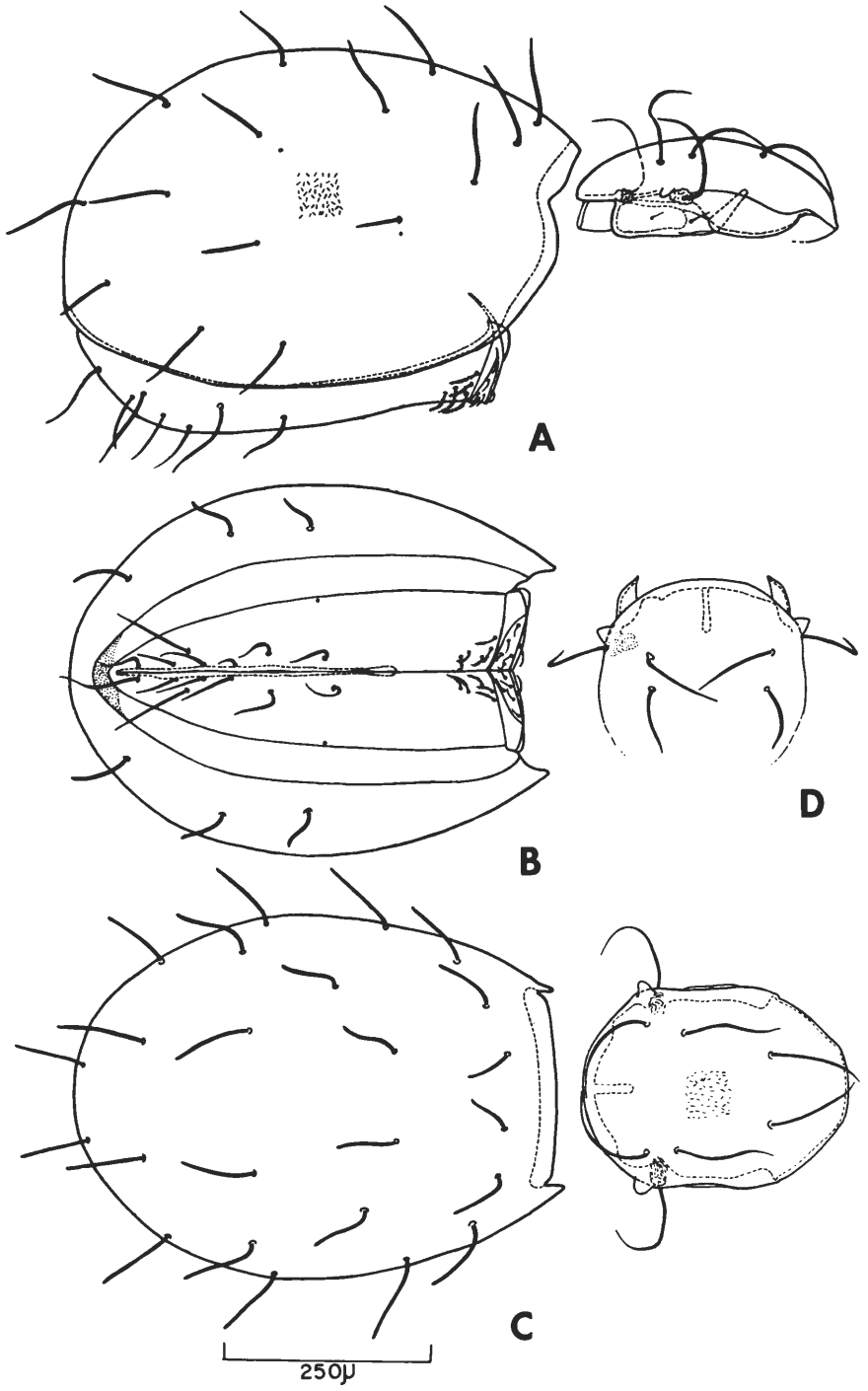

PLATE 47. *Synichotritia spinulosa* sp. n. A. Lateral view of notogaster and, slightly angled, aspis. B. Ventral view of notogaster. C. Dorsal view of notogaster and fully opened aspis. D. Dorsal view of partially depressed aspis.

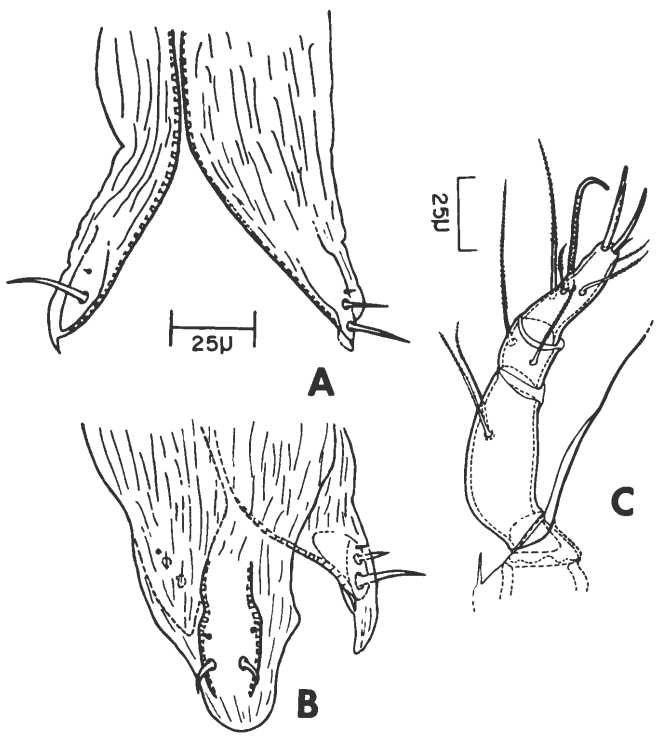

PLATE 48. *Synichotritia spinulosa* sp. n., details. A. Lateral view of ovipositor tip, ventral lobe to left and dorsal lobe to right. B. Ventral view of ovipositor tip, ventral lobe completely hiding one and partially hiding second dorsal lobe, to right. C. Right palp, showing four segmented condition.

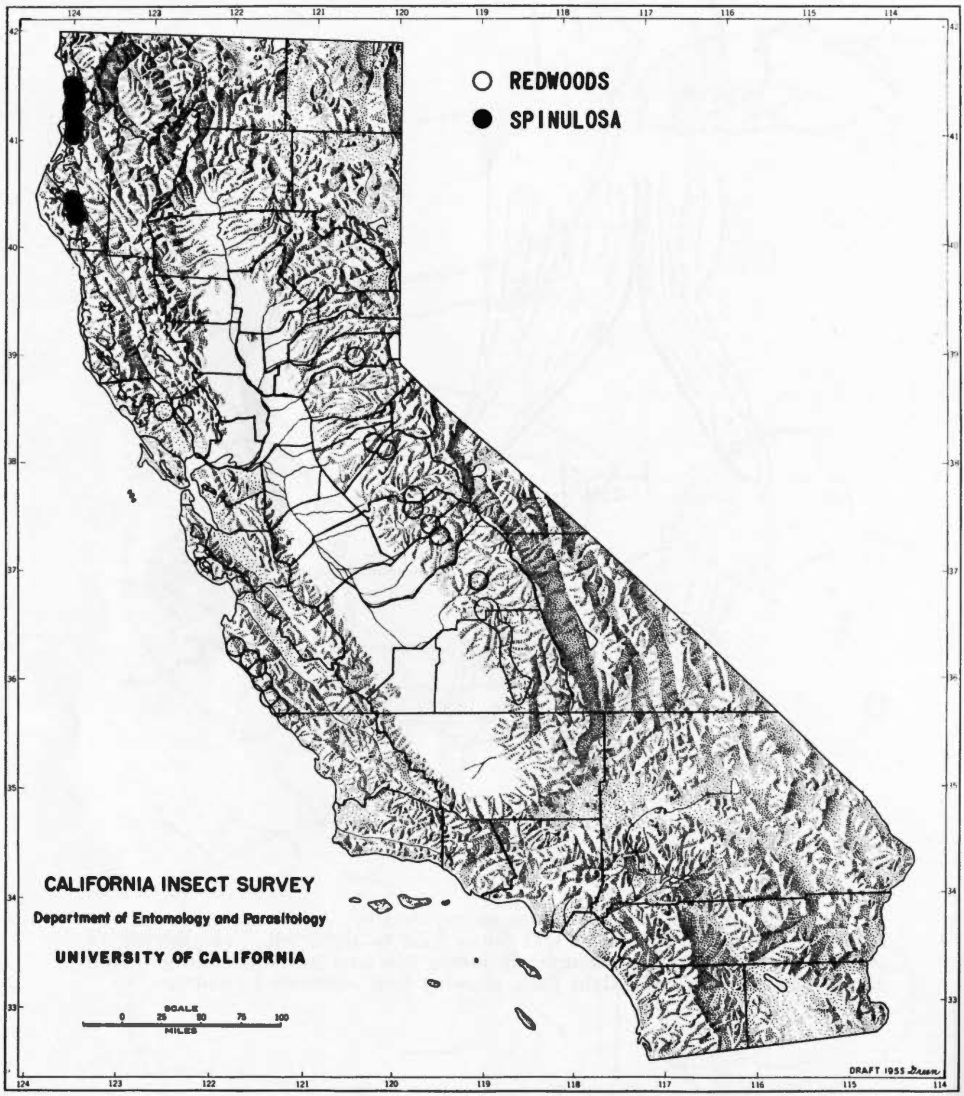

PLATE 49. Distribution of *Synichotritia spinulosa* sp. n.

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