

*IAIS CALIFORNICA* AND *SPHAEROMA QUOYANUM*,  
TWO SYMBIOTIC ISOPODS INTRODUCED TO CALIFORNIA  
(ISOPODA, JANIRIDAE AND SPHAEROMATIDAE)

BY

GEORGE ROTRAMEL

Department of Entomology and Parasitology, University of California, Berkeley, California 94720,  
U.S.A.

INTRODUCTION

*Iais californica* (Richardson, 1904) and *Sphaeroma quoyanum* H. Milne Edwards, 1840, are two isopods commonly found in estuaries of northern California. *Sphaeroma quoyanum* excavates burrows in a variety of substrates, in which it lives and reproduces, obtaining nearly all of its food by filter-feeding. *Iais californica* lives as a commensal with *Sphaeroma quoyanum*, scavenging food from the filter-brushes of its host and from the walls of the burrows (Rotramel, unpubl.). Both animals have been considered native elements of the estuarine fauna of California since they were described as *Janiropsis californica* and *Sphaeroma pentodon* from Sausalito, California by Richardson in 1904.

Revisionary work on the groups to which *I. californica* and *S. quoyanum* belong has shown that both species occur in the Australian region as well as in California. Baker (1926) synonymized *S. pentodon* from California with *S. quoyanum* from Australia and Tasmania. Menzies & Barnard (1951) recognized the existence of *I. californica* in New Zealand. I have seen specimens of both *S. quoyanum* and *I. californica* from New Zealand and can confirm their specific identity with specimens from California.

To date, the peculiar distributions of *Iais californica* and *Sphaeroma quoyanum* have been recorded but not discussed. One explanation of the occurrence of these species in California and the Australian Region is the introduction of both species into California. There is no direct evidence of the introduction of either *Sphaeroma* or *Iais* to California, but several independent lines of inference suggest that this is the case.

EVIDENCE FOR THE INTRODUCTION OF IAIS AND SPHAEROMA

The evidence for the introduction of *Iais* and *Sphaeroma* to California waters comes from three sources as follows:

1. The world distribution of both species and their near relatives.

2. A comparison of the distribution of both species and that of the presumed native genus *Gnorimosphaeroma* in western North America.
3. The discussions of isopods in the early zoological literature of northern California.

#### DISTRIBUTION OF LAIS

The world distribution of *Iais* has been summarized by Hurley (1965). One species, *I. pubescens*, is known from a variety of sphaeromatid hosts and has a wide distribution in the southern hemisphere. The other species, *I. californica*, is known from a variety of sphaeromatid hosts in New Zealand, where it is widespread, but it is apparently restricted to species of *Sphaeroma* in Singapore and California.

The distribution of the genus *Iais* thus suggests that the group is primarily restricted to waters of the southern hemisphere, with the California collections being the only records from north of the Tropic of Cancer.

#### DISTRIBUTION OF SPHAEROMA

The genus *Sphaeroma* is cosmopolitan and contains several wood-borers of economic importance. Four species, *S. annandalei*, *S. terebrans*, *S. walkeri*, and *S. quoyanum*, are morphologically very similar and have been frequently re-described as new species. They are common in tropical and subtropical harbors around the world, a circumstance which suggests that they may have been transported by man. Of this group of species, only *S. quoyanum* is known with certainty to be associated with *Iais*.

#### COMPARISONS WITH GNORIMOSPHAEROMA IN CALIFORNIA

In California *Sphaeroma* is often accompanied in its burrows by isopods of the related genus *Gnorimosphaeroma*. The range of *Sphaeroma* and its commensal *Iais* in California is much smaller than that of *Gnorimosphaeroma*. *Sphaeroma* and *Iais* are restricted to estuaries in San Francisco Bay, Bolinas Lagoon, Tomales Bay and Bodega Bay. *Gnorimosphaeroma*, while generally restricted to estuarine habitats, has at least 4 species in California (Menzies, 1954; Hoestlandt, 1969). The status of one of these species, *G. rayi* Hoestlandt, 1969, is uncertain. *Gnorimosphaeroma rayi* is apparently restricted to localities in Tomales Bay in North America, but according to Hoestlandt (1969), it occurs also in Japan. Therefore it may be alien to North America.

A second species of *Gnorimosphaeroma*, *G. oregonensis*, is sympatric with *Sphaeroma* and *Iais* in the San Francisco Bay region, but ranges up the Pacific Coast to Alaska (Menzies, 1954). Another species, *G. lutea*, occurs in Lake Merced on the San Francisco Peninsula. This lake was formed as a bay in the middle or upper Pliocene at approximately the same time as was San Francisco Bay. It was subsequently cut off from the ocean and transformed into a freshwater lake (Bowen, 1951).

The distribution of the genus *Gnorimosphaeroma* in California suggests that a variety of habitats have been available for colonization by estuarine isopods over

geologic time. This colonization has led to the formation of at least three species, one of which has a freshwater race in Lake Merced. Had *Sphaeroma* and *Iais* been present in California over a similar period, they might have been expected to have speciated or to have colonized Lake Merced. Since this has not occurred, it seems likely that *Sphaeroma* and *Iais* have been in California for a shorter time than has *Gnorimosphaeroma*.

#### ISOPODS IN EARLY CALIFORNIA ZOOLOGICAL LITERATURE

A search of the zoological literature of California prior to the description by Richardson (1904) of *I. californica* and *S. quoyanum* as *Janiropsis californica* and *Sphaeroma pentodon* has revealed no references to either species as they are currently understood. During the late 1800's, Lockington (1876, et seq.) described a number of the common isopods of northern California. In 1873, Arnold and Hewston discussed the presence of *Limnoria* as a newly arrived wood-borer in San Francisco Bay (Anonymous, 1875). Arnold and Hewston did not mention *Sphaeroma*, although adult *Sphaeroma* are very much larger than *Limnoria* and their burrows are correspondingly more obvious. It seems that the discoverers of *Limnoria* in San Francisco Bay either did not encounter *Sphaeroma* or else considered it a commonplace not worthy of mention. If *Sphaeroma* had been common at this time it is difficult to explain why it was not described by Lockington.

#### DISCUSSION

The available evidence, while incomplete, suggests that *I. californica* and *S. quoyanum* are not native members of the estuarine fauna of northern California. They appear to be alien species which are now naturalized in the San Francisco Bay region after having been introduced sometime in the period ca. 1870-1903. The exact origin of the populations introduced to California cannot be ascertained at present, but it seems reasonable to suggest that they came from the area of New Zealand and/or the south coast of Australia.

More than half a century has passed between the description of *Iais* and *Sphaeroma* from California and their identification as aliens. Thus future new species of estuarine invertebrates from California waters should be described only after a careful check of the world literature on their near relatives.

The potential for introduction of new species to California has been greatly increased by the activities of western man. Many new species have been added by shipping and the oyster industry (Barrett, 1963; Hanna, 1966; Hedgpeth, in Ricketts & Calvin, 1962). Miller (1969) reported the introduction of many invertebrates with kelp used as packing for lobsters imported from the eastern coast of the United States to San Francisco restaurants. This packing is dumped into San Francisco Bay after the lobsters are removed. Since there are now no governmental restrictions on the importation of exotic marine invertebrates to California, introduced species may be expected to complicate systematic work with the biota of harbors and estuaries in California.

## ACKNOWLEDGMENTS

I am grateful to Dr. Desmond Hurley, Dr. Peter Jansen, and Mr. William Tong for the gift of living *Iais* and *Sphaeroma* from New Zealand, and to Dr. R. Hamond for the opportunity to borrow specimens of *S. quoyanum* from Sydney, Australia.

This research was supported by an N.I.H. (National Institutes of Health) pre-doctoral fellowship in the Division of Entomology, University of California, Berkeley.

## ZUSAMMENFASSUNG

1. Die zur Verfügung stehenden Informationen über die Verbreitung der symbiotischen Isopoden *Iais californica* und *Sphaeroma quoyanum* legen die Vermutung nahe, daß diese Tiere in Kalifornien Neueinwanderer sind. Sie sind vermutlich von Neuseeland oder der Südküste von Australien im späten 19. Jahrhundert eingewandert.

2. Die Verbreitung von *Sphaeroma quoyanum* und ihrer holzbohrenden Verwandten deutet darauf hin, daß diese Arten durch den Menschen transportiert worden sind.

3. Die Lebensgewohnheiten von *Iais californica*, einem Kommensal von *Sphaeroma*, lassen vermuten, daß diese Art primär durch das Wirtstier verbreitet worden ist.

4. *I. californica* und *S. quoyanum* zeigen nicht das Ausmaß der Speziation oder die Breite der geographischen Amplitude in Kalifornien, wie sie von der verwandten Sphaeromatiden-Gattung *Gnorimosphaeroma* bekannt sind. Dieser Sachverhalt deutet darauf hin, daß *Sphaeroma* und *Iais* erst kürzlich in Kalifornien eingetroffene Arten darstellen.

5. Diskussionen über die Isopoden in der frühen zoologischen Literatur von Kalifornien geben Anlaß zu der Annahme, daß *Sphaeroma* und *Iais* vor 1870 noch nicht in Kalifornien vorhanden waren.

## LITERATURE CITED

- ANONYMOUS, 1875. Minutes of the regular meeting, February 17, 1873. Proc. Calif. Acad. Sci., **5**: 19, 24.
- BAKER, W. H., 1926. Species of the isopod family Sphaeromidae, from the eastern, southern, and western coasts of Australia. Trans. Proc. Roy. Soc. South Australia, **50**: 247-279.
- BARRETT, E. M., 1963. The California oyster industry. Calif. Dept. Fish Game, Fish Bull., **123**: 1-103.
- BOWEN, O. E., JR., 1951. Highways and byways of particular geologic interest. In: O. P. JENKINS, ed., Geologic guidebook of the San Francisco Bay Counties. Bull. Calif. Div. Mines, **154**: 3, 5-379.
- HANNA, G. D., 1966. Introduced molluscs of western North America. Occ. Pap. Calif. Acad. Sci., **48**: 1-108.
- HOESTLANDT, H., 1969. Sur un Sphérome nouveau de la côte pacifique américaine, *Gnorimosphaeroma rayi* n. sp. C. R. Acad. Sci. Paris, **2682**: 325-327.
- HURLEY, D. E., 1956. The New Zealand species of *Iais*. Trans. Roy. Soc. New Zealand, **83** (4): 715-719.
- LOCKINGTON, W. N., 1876. Description of seventeen new species of Crustacea. Proc. Calif. Acad. Sci., **7**: 41-48.
- MENZIES, R. J., 1954. A review of the systematics and ecology of the genus 'Exosphaeroma', with the description of a new genus, a new species, and a new subspecies. Amer. Mus. Novit., **1683**: 1-24.

- MENZIES, R. J. & J. L. BARNARD, 1951. The isopodan genus *Iais*. Bull. South. Calif. Acad. Sci., **50** (3): 136-151.
- MILLER, R. L., 1969. *Ascophyllum nodosum*: A source of exotic invertebrates introduced into west coast near-shore marine waters. *Veliger*, **12** (2): 230-231.
- RICHARDSON, H., 1904. A monograph of the Isopoda of North America. Bull. U. S. nation. Mus., **54**: 1-727.
- RICKETTS, E. F. & J. CALVIN, 1962. *Between Pacific tides*, (ed. 3, revised by J. W. Hedgpeth): i-xiii, 1-516.
- ROTRAMEL, G., unpubl. The symbiotic relationships of *Sphaeroma quoyanum* and *Iais californica*. (Ph.D. dissertation, Univ. Calif. Berkeley, 90 pp., 1971).