A New *Parechthrodryinus* Girault, 1916 Attacking *Xylococculus* Morrison, 1927 in California, with a Discussion of the Host Relationship (Hymenoptera: Encyrtidae; Homoptera: Margarodidae.)[1]

JOHN W. BEARDSLEY, JR.[2] and GORDON GORDH[3]

ABSTRACT

Parechthrodryinus xylococculi New Species is described from material taken at several localities in California. The species parasitizes *Xylococculus macrocarpae* (Coleman). This account represents the first bona fide recored of an encyrtid attacking representatives of the Xylococcinae, a primitive subfamily of margarodid.

The Encyrtidae are a large, cosmopolitan family including about 500 nominal genera and many species that are important for the biological control of some agricultural pests. The host spectrum of the Encyrtidae is exceptionally broad but if acumulated host records accurately reflect host preferences, then encyrtids prefer sternorrhynchous Homoptera. Tachikawa (1981) provided a host list for the Encyrtidae. The list is noteworthy in the relatively limited number of records for members of the Margarodidae. Most available records from which the list was developed associate a few encyrtids with *Icerya* Signoret, a member of the Monophlebinae.

A purpose of the present account is to document association of the Encyrtidae with the Xylococcinae. Another purpose of this paper is to provide a scientific name for ecological studies by Ms. Sharon Tait and Dr. Don Dahlsten, University of California, Berkeley. The species described here was sent to us in conjunction with their studies on *Xylococculus macrocarpae* (Coleman).

PARECHTHRODRYINUS XYLOCOCCULI Beardsley and Gordh, **NEW SPECIES**

Female: 1.74mm long. Dorsum of body predominantly dark with weak metallic reflections; ventral surface of body including mesopleuron and face below ventral margins of compound eyes brown. Antenna concolorous with brown of body. Forewing hyaline with weak fuscous spot near marginal and stigmal veins, and very weak infuscations near base

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[2]Department of Entomology, University of Hawaii, Honolulu, HI 96822
[3]Division of Biological Control, Department of Entomology, University of California, Riverside, CA 92521

and near triangular enlargement of submarginal vein (fig. 7); hindwing hyaline. Coxae, hind femur, hind tibia brown; anterior face of front and middle femur, front and middle tibia somewhat more pale than corresponding parts of hindlegs, tarsomeres pale yellow. Body weakly, yet distinctly, dorsoventrally compressed.

Head in dorsal aspect weakly reticulate, sparsely setose, with frontovertex rather broad, 0.54 times as wide as head; vertexal margin broadly rounded; ocelli ellipsoidal, forming obtuse triangle. Head in lateral aspect broadest just above ventral margin of compound eye; malar space nearly as long as compound eye, narrowly and finely striate-reticulate; malar sulcus not evident in point-mounted specimen. Head in frontal aspect broad (fig. 1), about 0.75 times as wide as long; toruli widely separated and below ventral margins of compound eyes; intertorular area weakly convex; scrobal impression very weak, shallow, nearly absent; clypeal margin transverse. Antenna as illustrated (fig. 3); mandible (fig. 12) with 3 distinct teeth, anterior tooth more slender than posterior teeth; maxillary palpus four-segmented; labial palpus three-segmented.

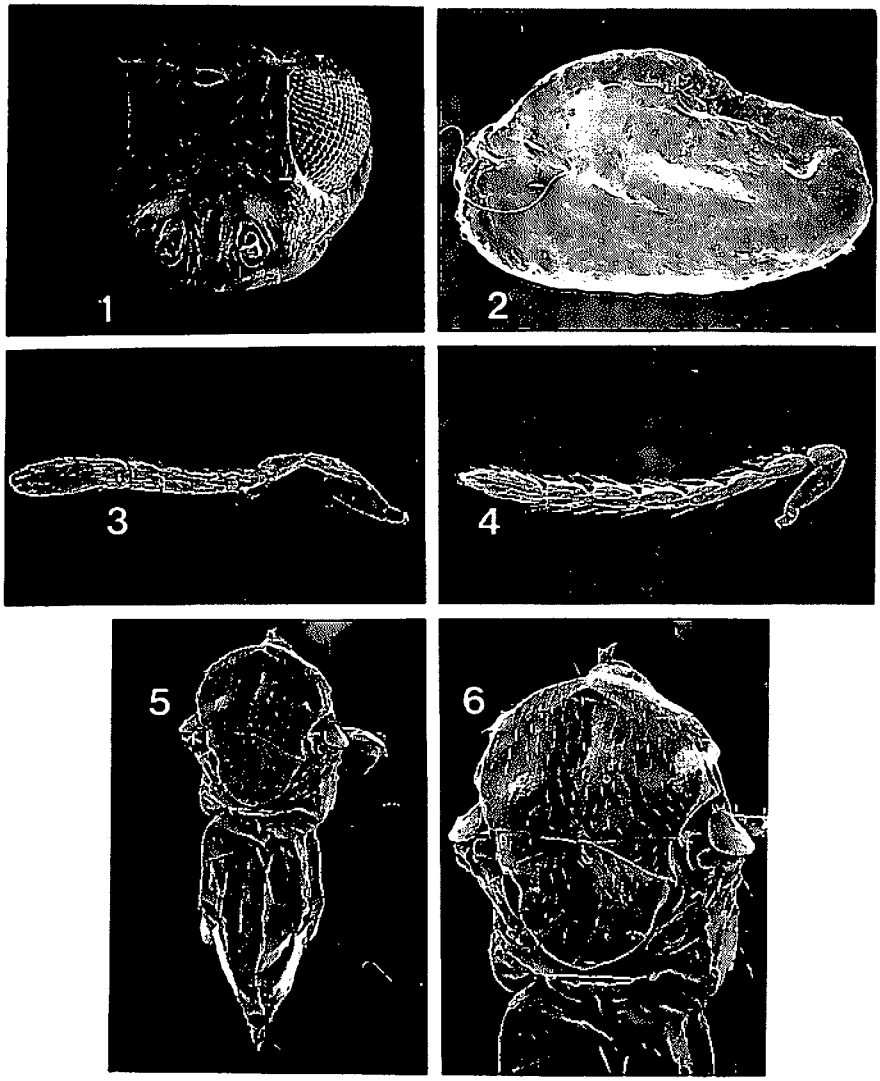
Body somewhat elongate (fig. 5); thoracic notum weakly reticulate (fig. 6); parapsidal sutures absent; axillae not contiguous medially; mesoscutum and scutellum with moderate vestiture of pale, stout setae. Mesopleuron reticulate, rather narrow. Propodeum smooth, medially very short; a few setae posteriad of spiracle. Forewing as illustrated (fig. 7); costal cell appearing rather short with anterior margin curving toward venation near triangular expansion of submarginal vein. Middle tibial spur rather short and slender, not particularly robust, nearly as long as basal tarsomere; apex of middle tibia with a cuticular thickening or flange opposite tibial spur.

Gaster somewhat elongate (fig. 5), terga with faint reticulations; paratergites absent. Gonostyli slightly but distinctly exserted. Ovipositor extending entire length of gaster (fig. 13). Pygostyli anterior of gastral midline. Hypopygium with posterior margin apparently transverse, near basal one-third of gaster.

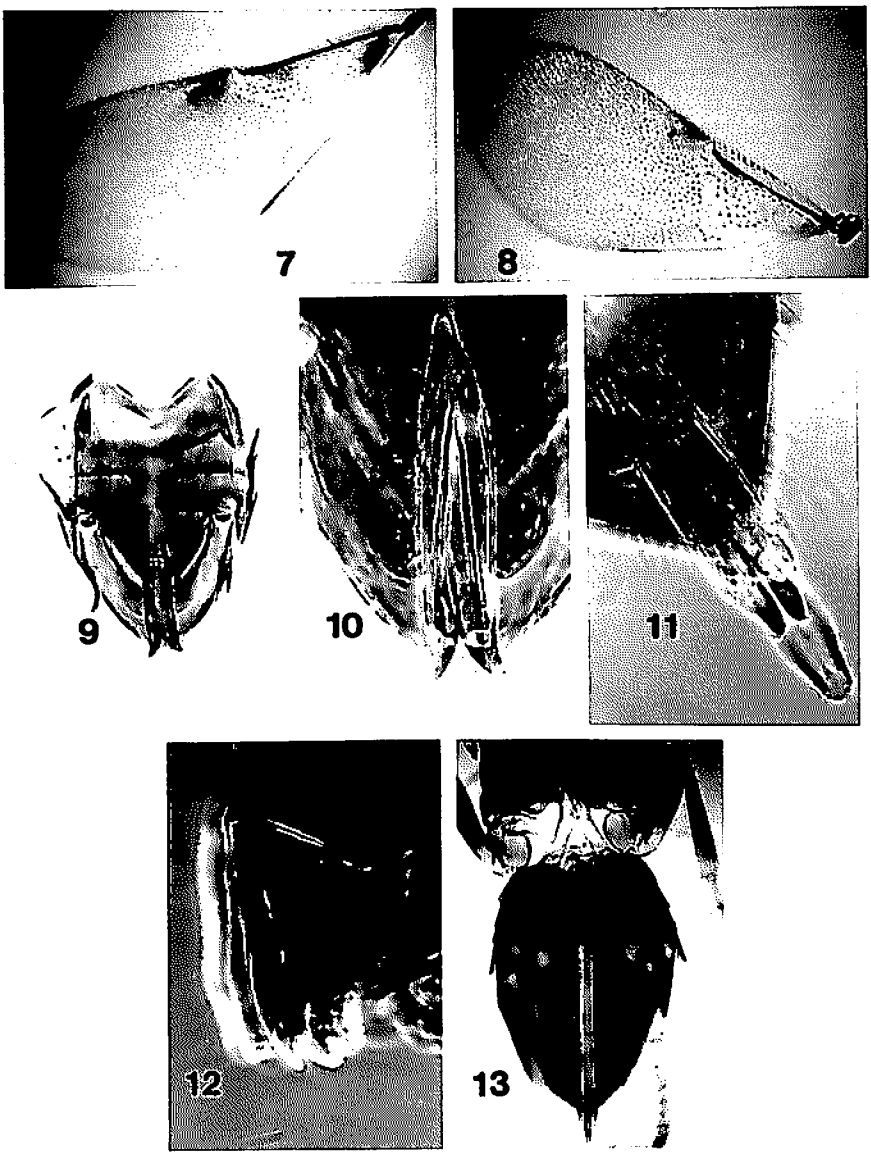
Male: 1.30 mm long. Similar in habitus to female. Body and leg coloration generally as female; forewing (fig. 8) more nearly hyaline with faint indication of brown near marginal and stigmal veins; costal cell not apparently shortened but decidedly projecting to marginal vein. Ocelli larger than female, anterior ocellus circular. Antenna, gaster and genitalia as illustrated (figs. 9, 10, 11).

MATERIAL EXAMINED: HOLOTYPE female taken at IDYLLWILD, RIVERSIDE CO., CALIFORNIA on 12 August 1912 by P. H. Timberlake. Allotype male taken by Timberlake at same locality on 7 August 1912. Both specimens reared from "Xylococcus sp." (Collection Number 14681A) card-point mounted; female with host.

PARATYPES: IDYLLWILD, RIVERSIDE, CO., CA: 26 females, 7 males taken 27 July - 18 August 1912 by P. H. Timberlake. EL DORADO, EL DORADO CO., CA: 5 females taken 2 March 1985 by S. Tait, from *Xylococculus macrocarpae* (Coleman) on *Calocedrus* (=*Libocedrus*) *decurrens*



FIGURES 1-6. *Parechthrodryinus xylococculi* Beardsley and Gordh. Figure 1, head, frontal aspect; Figure 2, host mummy, *Xylococculus macrocarpae* (Coleman); Figure 3, antenna; Figure 4, antenna; Figure 5, dorsal aspect of mesosoma and gaster; Figure 6, dorsal aspect of mesosoma.



FIGURES 7-13. *Parechthrodryinus xylococculi* Beardsley and Gordh. Figure 7, forewing; Figure 8, forewing; Figure 9, gaster; Figures 10 and 11, genitalia; Figure 12, mandible; Figure 13, gaster and ovipositor.

Torrey; 18 females, 1 male taken 21 May 1985 at same locality on same host by same collector. YOSEMITE VALLEY, YOSEMITE NATIONAL PARK, CA: 3 females, 2 males taken 6 May 1967 by J. W. Beardsley from *Xylococculus macrocarpae* under bark of *Calocedrus* (=*Libocedrus*) *decurrens*. EMIGRANT GAP, PLACER CO., CA: 3 females reared 1967 from *Xylocucculus macrocarpae* by J. W. Beardsley. MOUNT ST. HELENA, NAPA CO., CA: 1 female, taken 1 March 1967 from *Cupressus macnabiana* (Murr.) with *Xylococculus macrocarpae*.

Holotype, allotype deposited in U. S. National Museum, paratypes deposited in the following institutions: Department of Entomology, University of Hawaii, University of California at Berkeley and Riverside.

VARIATION: The specimens collected by Ms. Tait are darker than material taken by Timberlake or Beardsley. However, this difference is attributed to age; the pattern is similar throughout the type-series. Specimens taken by Timberlake appear more slender than other material, but this difference may be due to the method of preservation. The material taken by Ms. Tait was preserved in alcohol; specimens taken by Beardsley dried naturally.

DISCUSSION: *Parechthrodryinus* contains fewer than 10 species. The genus is widely distributed but most described species occur in the Indo-Australian Zoogeographical Realm. Currently it is carried among the Cheiloneurini, sensu Trjapitzin (1973), but this group needs considerable attention. Placement here is based on convenience and not necessarily relationship. Species of *Parechthrodryinus* attack mealybugs, soft scales and lac insects. Females of *P. xylococculi* may be distinguished from the type-species, *P. convexus* Girault, in that the latter bears punctations on the frons, the frontovertex is rather narrow, the axillae are medially contiguous with a longitudinal carina between them, and the forewing is hyaline.

The broad frontovertex in *P. xylococculi* and consequent change in ocellar triangle shape contrasts to the narrow frontovertex and acute ocellar triangle found in the type-species, *P. albiclavatus* (Shafee et al.) and *P. nigriclavatus* (Shafee et al.) These differences may be attributed to the habitat in which host is found. Indeed, the body of *P. xylococculi* is dorsoventrally flattened which suggests an adaptation for searching for hosts in concealed situations. Nothing is known of the biology of *P. convexus; P. nigriclavatus* has been taken from a coccoid on *Ficus; P. albiclavatus* has been taken from *Nipaecoccus* sp. Host association may be a useful diagnostic character.

The existence of *P. xylococculi* has been known for many years. The earliest collection known to us was made by P. H. Timberlake at Idyllwild in the San Jacinto Mountains during July and August 1912 (see type-series). Timberlake's series contains several specimens associated with host mummies (fig. 2). Timberlake sent several of these specimens to A. Arsene Girault at the U. S. National Museum. Girault gave this species a manuscript name under *Parasyrpophagus*, but apparently did not validate the name before he emigrated to Australia.

Earlier, Gordh (1979) mentioned the new species, based on material in the U. S. National Museum and University of California, Riverside Collections that had been identified as a new species of *Parasyrpophagus* by A. A. Girault during the First World War. *Parasyropophagus* Girault is currently recognized as a junior synonym of *Exoristobia* Ashmead.

Particularly noteworthy is the host association of this parasite. The scale insect belongs to a subdivision of Coccoidea for which no encyrtid parasite has previously been recorded. The group, the Xylococcinae of the Margarodidae (sensu Morrison, 1928), is unquestionably one of the most primitive extant taxa within the Coccoidea (Beardsley, 1968). Recently discovered fossil evidence suggests that species similar to those placed in the extant genera *Matsucoccus* Cockerell and *Xylococculus* Morrison existed during the Lower Cretaceous (Koteja, unpublished).

Morrison (1928) subdivided the Xylococcinae into three tribes, the Stigmatococcini, Xylococcini and Matsucoccini. The latter group includes only the Holarctic *Matsucoccus*, which is restricted to hosts of the genus *Pinus* Linnaeus. Despite being widely distributed and containing several species which are important forest pests, *Matsucoccus* spp. have no known hymenopterous parasites. Based on morphological differences, particularly of the adult males, Beardsley (1968) suggested that *Matsucoccus* was sufficiently distinct from other Margarodidae to warrant its placement in a separate subfamily, the Matsucoccinae.

Morrison's Stigmatococcii contains one Neotropical species, *Stigmacoccus asper* Hempel, about which nothing is known. The Xylococcini, like the Matsucoccini, is Holarctic. It contains about a dozen described species which occur on arborescent hosts in the Gymnospermae (*Cupressus* Linnaeus, *Libocedrus* Endl.) and the Angiospermae (*Alnus* Hill, *Betula* Linnaeus, *Populus* Linnaeus and *Quercus* Linnaeus). These scales occur under bark on the trunks and branches of their hosts. Unlike *Matsucoccus* spp., the feeding stages of *Xylococculus* and its relatives often produce copious honeydew.

Parechthrodryinus xylococculi, as noted above, has been taken at several localities in California. In every case, the adult parasite emerged from the apodous preadult feeding stage (third instar) host. Adult females of *X. macrocarpae* have functional legs but do not feed. In the field females have been observed to leave the feeding site after molting and migrate to a different location where they form loose ovisacs of wax filaments (Beardsley, unpublished).

Examination of preserved mummies shows more than one encyrtid within some individual hosts. This suggests that the parasite develops gregariously. An undetermined pteromalid also develops within *Xylococculus*. We believe this pteromalid may be a hyperparasite.

During 1967 Beardsley reared several specimens on *P. xylococculi* from *X. macrocarpae* collected on the bark of *Libocedrus decurrens* at Yosemite Valley (4,500 feet) and Emigrant Gap (5,000 feet) in the Sierra Nevadas, and from bark of *Cupressus macnabiana* Murray at Mt. St. Helena (1,500 feet). More recently, Donald Dalsten and Sharon Tait have reared this

parasite from *X. macrocarpae* collected on *L. decurrens* at several localities in the Sierra Nevada Mountains.

To our knowledge, *X. macrocarpae* has been collected only in California on *Cupressus* and *Libocedrus*. Coleman (1908) described the species from material collected at Pacific Grove, California on *C. macrocarpae* Hartweg. Although Timberlake's material of *P. xylococculi* does not specify the host-tree species on which it was taken, we assume that it was probably *Libocedrus decurrens*, which occurs commonly in the vicinity of Idyllwild (elevation 5,000 feet). Other species of *Xylococculus* occur on species of the angiosperm genera previously listed, both within California and elsewhere in the United States. The related Palearctic genera, *Xylococcus* Loew and *Trichococcus* Kanda are represented by species in Europe, mainland Asia and Japan. Published biological studies of these scales (Hubbard and Pergande 1898, Oguma 1919) do not mention hymenopterous parasites. However, there is a strong possibility that *P. xylococculi* or other encyrtids eventually will be found parasitizing some of these scale insects.

The orthezioid Coccoidea (Ortheziidae and Margarodidae sensu lato) have been generally regarded as the more primitive of the two major subdivisions of the Coccoidea. Although coccid systematists disagree on the appropriate rank various family-level taxa should be assigned, there is general agreement that Coccoidea with abdominal spiracles and adult males with well developed compound eyes are more closely related to the presumed aphidoid stem of the superfamily than more specialized forms which lack these characteristics. The two major subdivisions have been referred to as the "archeococcids" and "neococcids". These terms have no nomenclatural status but serve to delineate the two groups without specifying the rank which they should be given.

Of considerable biological interest is that nearly all of the parasitic Hymenoptera which utilize Coccoidea as hosts attack species of neococcids. Among the Encyrtidae, a major group of coccoid parasites, only a few species have been confirmed to develop as parasites of archeococcids. Until now, all of these species have been associated with margarodids in the Monophlebinae, a large and relatively specialized group. Therefore, the occurrence in the Encyrtidae of a primary parasite of one of the less specialized archeococcids (*Xylococculus*) is of considerable biological importance.

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