Acarologia is proudly non-profit, with no page charges and free open access

Please help us maintain this system by encouraging your institutes to subscribe to the print version of the journal and by sending us your high quality research on the Acari.

Subscriptions: Year 2018 (Volume 58): 380 €
http://www1.montpellier.inra.fr/CBGP/acarologia/subscribe.php

Previous volumes (2010-2016): 250 € / year (4 issues)
Acarologia, CBGP, CS 30016, 34988 MONTFERRIER-sur-LEZ Cedex, France

The digitalization of Acarologia papers prior to 2000 was supported by Agropolis Fondation under the reference ID 1500-024 through the « Investissements d’avenir » programme (Labex Agro: ANR-10-LABX-0001-01)

Acarologia is under free license and distributed under the terms of the Creative Commons-BY-NC-ND which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original author and source are credited.
A REVIEW OF THE GENUS
HOLOCELAENO BERLESE, 1910 (ACARINA : MACROCHELIDAE) 1

BY

G. W. KRANTZ 2

(Oregon State University, Corvallis).

INTRODUCTION.

The genus Holocelaeno was characterized by Berlese (1910) as being similar to Celaenopsis Berlese 1886, particularly in leg and cheliceral structures. Vitzthum (1930) included Holocelaeno in the family Macrochelidae, and in a later paper (1941) included Berlese’s Euholocelaeno as a subgenus under Holocelaeno s. l. Turk (1948) considered Holocelaeno and Euholocelaeno (= Euholocelaeno) as separate genera, tentatively grouping them, along with Tricholocelaeno Berlese, as a potential subfamily of the Macrochelidae. TragärDH (1949) erected the macrochelid subfamilies Macrocheliinae and Protoholaspinae and included Holocelaeno in the former category. TragärDH subsequently added the monotypic subfamily Areolaspinae to the Macrochelidae (1952), basing it on a single species, Areolaspis bifoliatus Trag. Evans (1956) intimated a close association between A. bifoliatus and the monotypic genus Euholocelaeno on the strength of a peritrematal-exopodal fusion in both forms. In the same paper, Evans included Holocelaeno within the genus Macrocheles. Also included as a provisional synonym of Macrocheles was the genus Neoholaspis Turk 1948. Krantz (1962) gave generic status to Holocelaeno, and considered Euholocelaeno as being a closely related group which was separated from Holocelaeno only on the strength of the peritrematal-exopodal fusion mentioned above. The genus Neoholaspis was synonymized with Holocelaeno in the same paper. The resulting generic classification of the Macrochelidae differed from that of Evans (1956) in several ways, the most important having to do with the relationships between genera (fig. 1). The character of an anterior projection of the dorsal shield which was utilized by Evans in establishing his

1. Technical Paper No. 2182, Oregon Agricultural Experiment Station. This research was supported, in part, by National Science Foundation Grants Nos. GB-2323 and GB-5377
2. Professor of Entomology.

primary separations was found to be variable (Krantz 1962) thus making ques-
tionable the implied relationship between Euholocelaeno and the Areolaspis-Holos-
taspella-Prholaspina complex. A dendrogram included in a revision of the Parho-
laspinae by Krantz (1960) illustrated a similar scheme. Subsequent study also
has shown that Berlese’s cheliceral brush character, in addition to other features,

---

Evans 1956

- Macrocheles
  - Holocelaeno
  - Prholaspina
  - Holostaspella
  - Euholocelaeno
  - Areolaspis

Krantz 1962

- Areolaspis
  - Holostaspella (Prholaspina)
  - Macrocheles
  - Holocelaeno
  - Euholocelaeno

---

Fig. 1. — Two schemes illustrating possible intergeneric relationships in the Macrochelidae

groups a number of species so similar phenetically that it is virtually impossible
to divide them logically into smaller entities. These include Holocelaeno, Euholo-
celaeno and Tricholocelaeno, all of which will be treated as Holocelaeno in this review.
Although Evans and Hyatt (1963) could find no justification for separating either
Holocelaeno or Neoholaspis from Macrocheles, it is felt by the writer that the diagnoses
which follow below clearly delineate Holocelaeno s. l. as a supraspecific group.
Species of *Holocelaeno* have been recovered from the gular and coxal regions, and occasionally from under the elytra, of a wide variety of coprophilous beetles, apparently in purely phoretic associations. Like other macrochelid groups, members of the genus *Holocelaeno* are thought to feed on small arthropods or nematodes in the substrate frequented by the beetle "hosts," utilizing the beetles as means of transportation to outlying loci. Females and, less frequently, males are found on the beetles but immature specimens have not been collected in the field or from beetles in museum collections. 1

Krantz (1965) has pointed out that members of the phoretic macrochelid genus *Neopodocinum* inhabit tropical, subtropical and temperate regions of Asia, Africa and Europe. Representatives of this group have never been recorded from the Western Hemisphere. Conversely, the genus *Holocelaeno* appears to be confined to the Western Hemisphere, with the preponderance of species occurring in South America (fig. 2). The mutually exclusive distributional pattern of these genera is correlated with strong differences in basic morphological characters, despite an obvious suprageneric relationship. The exclusively phoretic habit in *Holocelaeno* and *Neopodocinum* indicates a higher level of evolutionary development than in the cosmopolitan genus *Macrucheles*, where both phoretic and free-living forms share similar morphological characters, and in which the basic facies of both *Neopodocinum* and *Holocelaeno* may be found. Evolution of each group apparently was independent in the Old and New Worlds, with parallelism occurring only in the development of phoretic relationships with coprophagous scarabs. As can be seen from the host indices at the conclusion of this paper (Tables 1 and 2), both *Holocelaeno* and *Neopodocinum* exhibit a striking degree of specificity in their relationships to their scarab hosts. This is particularly evident in *Holocelaeno*, and points to an association with the scarab which often may be as intimate as that found in true parasitism. More than one species of *Holocelaeno* may be associated with a single scarab species (multiple phoresy) or a single species of *Holocelaeno* may be carried by more than one species of beetle host (non-specific phoresy). Non-specific phoresy appears to be confined to associations with hosts of the same genus, or of closely related genera. However, an example of a species of *Holocelaeno* phoretic on unrelated scarabs in temperate habitats is cited later in this section. It is likely that multiple phoresy leads to interspecific competition between feeding stages in the substrate niche, as well as to competition between adult mites in procuring attachment sites on the beetle. Behavior studies in situ will be necessary in order to clarify this relationship. Non-specific phoresy in *Holocelaeno* often is accompanied by subtle but measurable variations between populations from different hosts (fig. 3). The status of such populations is questionable

1. Since the completion of this paper, deutonymphs of *Holocelaeno* spp. have been collected by the writer in northeastern Brazil.
FIG. 2. — A map illustrating the known distribution of the macrochelid genera *Holocelaeno* and *Neopodocinum*. *Holocelaeno* has been collected from coprine scarabs only in the New World, while *Neopodocinum* occupies an identical niche in Europe, Africa and Asia. Geographical overlap between the two genera has never been observed.
but, due to the lack of long series of specimens, overlapping populations of morphologically similar specimens from more than one beetle host generally have been considered as variants of a single species. The occurrence of multiple or non-specific phoresy appears to be exceptional in Holocelaeno when considered in light of the high degree of specificity noted.

Unlike the genus Neopodocinum, the many species of Holocelaeno, while distinct, cannot logically be "grouped" through the use of common features. Although

![Graph showing morphological characters of Holocelaeno amygdaligera populations from two beetle species.](image)

**Fig. 3.** A scatter diagram illustrating intraspecific grouping, on the basis of two randomly selected morphological characters, of populations of Holocelaeno amygdaligera from two different beetle species (Phanaeus splendidulus and Taurocospis mimas). The overlap illustrated here is similar in scatter diagrams based on setal length characters (see page 12). Holocelaeno axelli, a closely related species, occupies another area of the chart.

the species of the genus are separable on the basis of one or more characters, there appears to be a continuous character gradient in Holocelaeno which does not allow for species grouping. This gradient, coupled with their high degree of specificity, leads the writer to believe that Holocelaeno represents a recent species "explosion" brought on by the reduction or elimination of abiotic and biotic stress through close association with successfully competing hosts, or with hosts which successfully avoid competition. The assumption of loss of abiotic stress may be further clarified from the standpoint of the dung substrate in which the scarab hosts are found.
Deposits of dung are like islands, in that contact by faunal inhabitants of a given deposit with adjacent deposits may be accomplished only by migration through or across an adverse environment. Such migration must often be necessary for those members of the dung community which cannot tolerate the radical changes to which dung is subject, such as changes in moisture content, pH or temperature. Diminution in optimal conditions brought about by any or all of the factors mentioned above would favor mite migration. However, the distances involved in migration to other dung loci generally would be such that transfer would be difficult for a wingless, slow-moving arthropod. Coprophilous macrochelid mites, including members of the genera *Holocelaeno* and *Neopodocinum*, have evolved strong phoretic associations with scarabaeine beetles which eliminates the problem, inasmuch as the beetles are capable of comparatively swift and safe migration.

The Scarabaeinae is a large group of dung-inhabiting beetles with virtually a world-wide distribution. The great number of species and genera of scarabaeine beetles existing side by side in semi-tropical and tropical areas attests to the fact that, by some means, the beetle species have achieved ecological independance within the dung loci. The phenomenon of accelerated speciation under conditions of low competition has been discussed by Mayr (1963). Reduction or elimination of competition apparently has been achieved by niche specialization among scarabaeine species occurring in identical geographical areas. This may have occurred through the utilization by the beetles of different portions of the dung substrate, by utilization of only certain kinds of dung, or by utilization of dung located only in an exposed or a hidden site (Landin 1961). Matthews (1965) indicates that canthonine scarabs in Puerto Rico are highly restricted in their habitat preferences, with species of *Canthochilum*, for example, occupying adjacent but mutually exclusive altitude ranges. Such behavior is suggestive of that hypothesized in most coprophilous groups, including *Phanaeus* and other subtropical and tropical genera. The low incidence of competition among tropical and semitropical species may be influenced to a great degree by the lack of abiotic stresses more evident in temperate climates. Mayr mentions examples of low competition situations and states that there is continued evidence of speciation even in old faunas, particularly in the humid tropics "where seasonal stability and low demands by the physical environment permit strong niche specialization, resulting in great faunal richness and considerable radiation of closely related species." Those mite species intimately associated with dung beetle species in tropical climates are therefore subjected to an "insular" existence closely akin to monophagy, in which the beetle carriers provide the isolation mechanism of niche specialization. The opportunity for radial speciation seemingly is provided for the mites in much the same way as true spatial isolation leads to geographic speciation. On the other hand, it would appear from at least one beetle-mite association cited in this review (*H. axtellii* on *Phanaeus igneus* and *Ph. vindes*, and on *Onthophagus pennsylvanicus*) that the insular effect breaks down where the beetle species occur in a temperate climate (page. 23). Periods of low temperature, such as are experienced in the
southeastern United States, prevent the seasonal stability deemed necessary for niche specialization in overlapping geographical and habitat zones. It is quite possible, for example, that the beetle species cited above are competitive in their overlapping range, and that their mite associates are in large part identical. Other cases of non-specific phoresy in Holocelaeno are not so easily explained (i.e. H. brachychaeta on Dichotomius carolina in North America, and on Phanaeus telamon in Venezuela).

Species radiation may also have occurred in Neopodocinum in southern Europe or in Africa. The wide range of species distribution, and the presence of at least one distinctive discontinuous morphological character in Neopodocinum (the presence or absence of ambulacra on tarsi I), may indicate an earlier species radiation than that observed in Holocelaeno in the New World (Krantz 1965). The exclusion of Neopodocinum from the Western Hemisphere and the corresponding absence of Holocelaeno in the Old World probably is a function of the limited distribution of the beetle associates, rather than of geographical isolation or exclusion of the mites involved.

It should be kept in mind that, while phoresy in Holocelaeno may be so well established as to illustrate specificity in many cases, it is by no means obligate. Species determination cannot be made for H. amygdaligera, for example, on the strength of an established association between it and P. splendidulus Fabr. (page 16). However, such an association may well serve as a strong indicator of species identity, both of the mite and of the scarab host.

The hypotheses put forth above reflect primarily laboratory observations and analysis of collection data. It is essential that field observations on behavior of the scarab hosts be carried out so that niche specialization may be demonstrated, and specificity of associated mites confirmed. It is especially important that immature stages of Holocelaeno be found and observed in field situations, for it is at this level of development that the key to mite-scarab specificity may be found.

**Collecting and preparation.**

The majority of mite specimens utilized in this review were removed from coprine scarabaeids in museum collections. The dried and brittle condition of the mites, coupled with the fact that most of them were secreted in the deep gular recesses or coxal cavities of their beetle associates, made removal of intact mite specimens somewhat difficult. With the aid of a stereoscopic microscope, a small droplet of glycerin was placed on the mites so as to loosen them from the surface of the beetle host. Wetting of the mites also seemed to soften them, and to help prevent breakage of the specimens during removal operations. When possible, the mites were loosened and picked up with a fine camel's hair brush. However, their inaccessibility often necessitated the use of a microprobe to expose them for removal. It often was possible to recover a mass of mite specimens in a single operation,
thus reducing the chance of excessive loss due to handling. The mites were collected into vials of 70% alcohol, in which they were carried back to the laboratory. While the glycerin used in removing the mites from their beetle hosts served to decrease the brittleness of the specimens, it was necessary to further restore them before microscope slide preparations could be made. This was accomplished by placing the mites in lactophenol for a minimum of 48 hours at room temperature. Specimens treated in this manner reverted to a condition resembling freshly collected material. Thus, it was possible to dissect them without difficulty, and to handle them without breakage. Lactophenol-treated specimens were washed in four rinses of water, and mounted in Hoyer's solution. Specimens were further cleared by heating at 40°C for 48-72 hours, after which time they were deemed ready for examination.

EXTERNAL MORPHOLOGY

ADULTS.

Dorsal Shield.

Members of the genus Holocelaeno have an ovate dorsal shield which often is weakly reticulate and punctate, and ornamented with muscle insertion patterns. Posterior attenuation is common in males (fig. 18). A series of transverse lines may be found anteriorly, with the line connecting setae D3 being distinct in almost every instance (fig. 11). Other transverse lines may be present posterior to setae D4, but these generally are confined to the lateral edges of the shield (fig. 15). An anterior projection of the dorsal shield occurs in some species (e.g., H. rotunda (Berlese)), and extensive sculpturing of the shield is not unknown (H. bursiformis (Berlese)).

With one exception, the dorsal shield has 29 pairs of smooth or weakly plumose setae (H. floridanus Evans and Hyatt has only 27 pairs due to the absence of D3 and M2), most of which tend to be quite slender and often minute. Setae D1 usually are large and spinose, and may be distally plumose. Setae D9 are variable in length, but usually are distinctly plumose. The humeral setae (Mg1) may be long and conspicuous as in H. amygdaliger Berlese (fig. 4), or they may be subequal to the smaller adjacent setae, as in H. phanei Berlese (fig. 110). Setae D5-D7 and M5-M6 often are minute, and usually are shorter than adjacent setae. A series of dorsal pores is present (fig. 4), many being large distinctive entities which are round or elliptical in shape. A pair of lyriform pores is present between setae D2 and M1.

1. Lactophenol is prepared as follows:
   Lactic acid ....................... 50 cc.
   Phenol crystals ................... add enough to bring volume up to 75 cc.
   Distilled water .................... 25 cc.

2. Dorsal setae have been named according to the system used by Krantz (1965).
Unlike related genera, the anterodorsal extensions of the peritremes in *Holo­celaeno* rarely extend beyond coxae I, and never to the region of insertion of M₁ (figs. 4, 58).

The integument adjacent to the dorsal shield may be strongly sclerotized and distinctly striated (fig. 44), and a posterodorsal sclerotized “tail” may be seen on some specimens (fig. 96). The presence of sclerotized integument of this type may be correlated with the advanced age of the specimen. The integumental setae surrounding the dorsal shield are smooth and usually slender. These setae may be shorter than or subequal to the adjacent marginal setae (figs. 11, 81). Dorsal setae of the male tend to be longer than those of the female (figs. 123, 124).

**Venter.**

The tritosternum is well developed, the slightly broadened base giving rise to a pair of plumose laciniae. The female possesses the usual sternal, metasternal, epigynial and ventrianal shields, in addition to the peritrematal and usually discernible metapodal shields. The parapodal and endopodal sclerites frame the coxal insertions, with the peritrematal shields occasionally being fused into a parapodal-peritrematal-endopodal-sternal complex (e.g. *H. bursiformis* Berlese, fig. 32).

The sternal shield is closely punctate and may be variously ornamented with lines. Generally, there is an expression of the *linea obliqua anteriore* (l.o.a.) in the anterolateral portions of the shield, often forming a complete or medially interrupted arch (fig. 71)¹. A *linea media transversa* (l.m.t.) and lateral *lineae oblique posteriores* (l.o.p.) often are present. Sculpturing on the shield, when present, usually is weak (fig. 20). Three pairs of smooth setae and two pairs of pores are found on the sternal shield. The metasternal shields are free, and are located at varying distances from the sternal shield. Sternal-metasternal fusion has not been observed. The metasternals each are equipped with an anterior pore and a smooth posterior seta. The epigynial shield is truncate or convex posteriorly, rounded anteriorly, and with a pair of strong lateral accessory sclerites. The epigynial setae are smooth, and are inserted in the postero lateral portions of the shield. A pair of pores is located behind and laterad of the setae, both of which are generally free in the integument. A line arising at each epigynial setal insertion and proceeding anteromedially may be present. The ventrianal shield is highly variable in shape and ornamentation. For example, *H. trochantalis* Berlese possesses a broad subtriangular shield with a well-defined reticulate pattern, while that of *H. scapularis* (Evans and Hyatt) is ovoid and without reticulation. Intermediate types, as well as more extreme examples, are known in the genus. Typically, there are three pairs of ventrianal setae, although some species may have two (*H. floridanus* Evans and Hyatt and *H. hypocrita* Berlese). The adanal setae

¹ *Evans and Hyatt* (1965) refer to this line as the *linea arenata*. Such an interpretation appears to be inconsistent with the linear scheme of *Berlese* (1918), *Sellnick* (1940) and others.
usually are noticeably longer than the preanal setae, and are always at least as long as preanals I. The cribellar area, a finely spiculated band, lies behind the anal opening and postanal seta, and essentially is confined to the border area between the posterior pores (fig. 73). The peritremes are strongly looped behind and laterad of the stigma and proceeds anteriorly and dorsally to a point laterad of coxa I. The peritremes of *H. hadrosoma* is atypical in that it extends beyond this point (fig. 61). The stigmata are laterad of coxae III-IV, each stigma and attached peritreme being enclosed in a peritrematal shield which attaches to the dorsal shield at the humeral angles.

Ventrally, the male possesses a completely fused holoventral shield on which are inserted a series of smooth setae. The posterior shield region corresponding to the ventrianal shield of the female generally has extra setae, presumably because of the additional lateral sclerotization behind coxae IV (fig. 38). The "sternal" portion of the holoventral shield often is somewhat like that of the female. Peritremes and stigmata are similar to those of the female.

**Gnathosoma.**

The tectum of *Holocelaeno* is strongly tripartite, with both the central and lateral extensions terminally divided. The lateral portions are broad and flag-like, and are free from the central element for most of their length. The tectal base is gently convex and usually is distinctly spined. The palpi have five free segments, with a setal formula in the proximal three segments being 2-5-6. The palp claw is three-tined, the proximal tooth being well developed. The rod-like sensory spine on the terminus of the palpal tarsus may be little longer than the surrounding setae. The chelicerae are chelate-dentate, with the fixed digit having a strong mediiodistal tooth and a distal hook. A distinct *pilus dentilis* is inserted in the region between the latter structures. One or more small teeth may be found adjacent to the distal hook. The seta on the fixed digit is simple or slightly broadened terminally. A mediiodistal tooth and hook also occur on the movable digit, and additional teeth often are present (figs. 34, 65). The internal cheliceral brush is filamentous rather than brush-like as in other macrochelid genera, and extends to or beyond the end of the *digitus mobilis*. The external brush is reduced and usually difficult to discern. A sperm transfer organ is found on the median internal aspect of the *digitus mobilis* of the male. Usually it is longer than the *digitus mobilis*, may be curved or angled, and is aciculate distally (fig. 53; st0).

The epipharynx is conical and spiculate throughout its length. Salivary and hypopharyngeal styli are present, the latter extending well beyond the salivary styli and often appearing smooth. Salivary styli in some species may be distally divided. The labrum is smooth and distally aciculate and arises ventral of the tectum. The hypostomal and deutosternal setae are smooth, with hypostomals II being the longest. Five rows of deutosternal teeth are present, the number of
teeth per row varying from two to around 25. The corniculi are broad basally and bluntly pointed distally.

Legs.

Tarsus I is without ambulacrum and claws, while tarsi II-IV have both structures well developed. The posterior paradoactyls are broad basally and abruptly acuminate distally. The setation of the legs is typical of the general macrochelid type as illustrated by Evans and Hyatt (1963). Genu IV has seven setae, rather than six as in many other macrochelids (figs. 13, 33). Leg II generally is stouter than leg I, and possesses several stout distal setae. Development of spurs on legs II of the male is limited to the femur where, on those specimens observed, a distally rounded spur arises on the ventral aspect. No spurs were seen on other legs. Setae pd₁ and pd₂ of femur I of the female (fig. 52) vary in length between species, and may provide a means of species separation in some instances.

Immature stages.

Examination of collection records in the Stazione di Entomologia Agraria in Florence, Italy, revealed that Berlese failed to find a nymph or larva of any of the fifteen species of Holocelaeno described in his studies. The writer's collection of several hundred specimens also is without immatures, nor am I aware of a description of a nymph or larva in the literature\(^1\). Apparently the adult is the only phoretic stage, with the immatures being confined to the dung substrate, or to the galleries or chambers of the beetle host.

Classification.

In an earlier section of this paper it was noted that there exists in Holocelaeno a continuous gradient of morphological characters which makes species grouping within the genus difficult or impossible (see section entitled Biology and Distribution). While it is obvious that any taxonomic key is, in large part, an arbitrary tool, it should have a basis in species similarity. Species grouping on the strength of morphological correlates gives the resulting key some room for assimilation of species which are unknown at the time of key construction. Because of the lack of basic character discontinuities, the key to species of Holocelaeno which follows unfortunately is based more on differences than on similarities, and provides little or no information on intrageneric relationships. Indications of "species groups" do exist, i.e. the trochantalis-bursiformis group, and the amygdaligera group, but it has not been possible thus far to adequately diagnose them. It is hoped that additional information on biology and phoretic associations may add another dimension to the systematics of Holocelaeno, and result in a better basis for a key to species.

\(^1\) See footnote on page 3.
A KEY TO THE FEMALES OF THE GENUS *Holocelaeno*.

1. Peritrematal and parapodal shields fused around coxae (fig. 32); dorsal shield with distinctive heavy sculpturing; ex *Dichotomius carolinus*... *bursiformis* (Berl.)
   - Without fusion as described above; dorsal shield with light to moderate reticulation
   - ................................................................. 2
2. With two pairs of preanal setae on the ventrianal shield
   - ................................................................. 3
3. Setae D₁ minute, shorter than D₁; line l.m.t. apparently absent; ex *Deltochilum orbiculare*... *floridanus* Evans and Hyatt
   - Setae D₂ spinose, longer than D₁ (fig. 69); l.m.t. well developed; ex *Bolbites onitoides*, *hypocrita* (Berlese)
   - ................................................................. 4
4. Mg₅-Mg₈ (dorsal marginals) longer than distances between their insertions
   - Mg₅-Mg₈ shorter than distances between their insertions
   - ................................................................. 5
5. Sternal setae II surpassing insertions of sternals III; epigynial setae considerably longer than preanals I (fig. 62); ex *Dichotomius protectus*... *hadrosoma* n. sp
   - Sternal setae II not long enough to surpass sternals III (fig. 12); epigynial setae subequal to preanals I; ex *Megathopa astyanax*... *aeinotrix* n. sp
   - ................................................................. 6
6. Setae D₁ minute, no longer than setae M₁ (fig. 134); ex *Deltochilum brasiliense*, *thyreos* n. sp
   - Setae D₁ large, distinctly longer and heavier than M₁.
   - ................................................................. 7
7. Sternal setae II long, easily surpassing the insertions of sternals III (fig. 85)
   - Sternal setae II not long enough to distinctly surpass sternals III, often quite short (fig. 135)
   - ................................................................. 8
8. Ventrianal shield elongate and very narrow, almost twice as long as broad (fig. 85); ex *Bolbites onitoides*... *jugulans* Berlese
   - Ventrianal shield subtriangular or quite broad
   - ................................................................. 9
9. Ventrianal shield broader than long, often with lateral sclerotized “extensions” (fig. 45); ventral shields with strong sculpturing
   - Ventrianal shield not broader than long, appearing subtriangular, rarely with sclerotized rim; ventral shield sculpturing variable
   - ................................................................. 10
10. Line l.o.a. of sternal shield forming a smooth uninterrupted arch between sternals II (fig. 45); epigynial setae distinctly longer than preanals I; ex *Dichotomius carolinus* and *Phanaeus faunus*... *cosmothorax* n. sp
    - Line l.o.a. with a median interruption formed by the *linea-angulata* (fig. 120); epigynial setae subequal to preanals I; ex *Dichotomius carolinus*, *rotunda* Berlese
    - ................................................................. 11
11. Setae Mg₁ (numerals) considerably longer and stouter than adjacent setae L₁ and Mg₂ (fig. 4); line l.o.a. without median interruption (fig. 6); ex *Phanaeus splendidulus* and *Taurocopteris minus*... *amygdaligera* Berlese
    - Setae Mg₁ similar in length and breadth to setae L₁ and Mg₂; line l.o.a. of sternal shield weakened medially (fig. 64)
    - ................................................................. 12
12. *Linea media transversa* (l.m.t.) of dorsal shield strongly developed (fig. 64); most of the anterior dorsal setae long, surpassing length of D₁; ex *Phanaeus ensifer*, *hanselli* n. sp

1. One specimen of *H. cosmothorax* (page 32) from *Phanaeus faunus* has shorter sternals II, and will not fit this portion of the key.
— 13 —

13. Trochanter IV greatly enlarged, bulbous (fig. 37); ventrianal shield little longer than broad, only slightly wider anteriorly than posteriorly; ex Megathopa yucateca... condyla n. sp.

14. Larger species attaining an idiosomal length of at least 700 μ. ................. 15

15. Ventrianal shield as broad, or broader, than long (fig. 135)......................... 16

16. Line l.o.a. of sternal shield interrupted medially by development of linea angulata (fig. 135); with well-developed secondary sternal shield pattern posterior to line l.m.t.; ex Dichotomius mormon. ...................... trochantalis Berlese

17. Setae pd 1 and pd 2 of genu IV greatly thickened proximally (fig. 119); ventrianal shield broad and elongate, at least twice the size of the sternal shield; ex Phanaeus endymion and Phanaeus velutinus. ....................... ritcheri n. sp.

18. Ventrianal shield obovoid to elongate (fig. 92); secondary sternal shield pattern generally well developed. ........................................ 19

19. Setae D 4 nearly as long as setae Mg 10 (fig. 90), most of the dorsal setae minute; ventrianal shield obovoid. ........................................ 20

20. Line l.o.a. of sternal shield well-developed medially, secondary sternal pattern distinctive (fig. 92); setae D 4 thickened throughout and plumose distally; ex Oxysternon festivum and O. conspicillatum. .................. magna Berlese

21. Setae D 1-D 8 subequal in length (fig. 75); lateral and posterior setae only slightly longer than D 3-D 6 ; ex Phanaeus batesi. ...................... interrupta Berlese

22. Ventrianal shield reticulate, broader than long, with a sclerotized laterally developed rim (fig. 125); sternal shield with characteristic median and posterior secondary development; ex Oxysternon conspicillatum. ................ shoemakei n. sp.

23. Setae Mg 4 (humerals) distinctly longer and stouter than adjacent setae L 4 and Mg 5 . 24

24. Line l.m.t. of sternal shield evanescent or absent; without transverse lines on reticulation on ventrianal shield. ...................... 25
14

25. Marginal setae (Mg series) minute, no longer than setae M₁; ex *Deltochilum lobipes... scapularis* Evans and Hyatt
Marginal setae considerably longer than the minute setae M₁; ex *Phanaeus milon... expolita* Berlese

26. Ventrianal shield with a single anterior transverse line through preanals I, with weak lateral portions of more posterior lines (fig. 57); ex *Phanaeus milon* and *Ph. corythus*... *fuscata* Berlese

27. Line l.m.t. arched medially; reticulate pattern of ventrianal shield somewhat indistinct (fig. 98); ex *Deltochilum gibbosum*... *mitis* Berlese

28. Posterior border of sternal shield deeply excavated, the median posterior border being anterior to sternal pores II (fig. 114); ex *Deltochilum sp... pontigera* Berlese

29. Ventrianal shield with a single anterior transverse line through preanals I (fig. 141), shield with evanescent posterior ornamentation; lines l.m.t. and l.o.a. evanescent medially; ex *Phanaeus telamon* and *P. corythus... turki* Evans and Hyatt

30. Line l.m.t. of sternal shield nearly touching posteromedian margin of the shield, (fig. 105), sternals II attain insertions of sternals III; ex *Phanaeus daradanus... neophanaei* n. sp.

31. Ventrianal shield not as above......

32. Anterior and anterolateral portions of dorsal shield with distinctive pattern of arched transverse lines (fig. 77); sternal and ventrianal shields with evanescent pattern of lines and reticulations (fig. 78); ex *Phanaeus bellicosus... lota* n. sp.

33. Pattern of lines on ventrianal shield absent or confined to evanescent portions of lines which may be difficult to discern......

34. D₁ over four times the length of D₂; ex "scarabaeid beetle"... *coprophilus* (Turk)

35. Line l.m.t. evanescent or absent medially (fig. 16); lines on ventrianal shield confined to short weak portions around preanal setae; ex *Phanaeus bellicosus... anogmos* n. sp.

36. Line l.m.t. complete medially (fig. 79); with a series of evanescent lines on ventrianal shield which are indiscernible in some specimens; ex *Coprophanaeus jasius... jasius* n. sp.
36. Dorsal setae uniformly small to minute (fig. 110); dorsal integumental setae short, not attaining insertions of setae behind them.  
37. Line l.o.a. interrupted medially; with strongly developed transverse dorsal line through setae D₄ (fig. 110); ventrianal shield subtriangular, ornamented throughout (fig. 108); ex Phanaeus splendidulus, P. perspicillatus and Oxysternon conspicillum.  
— Phanaeus Berlese  
38. Setae D₂ and D₁ subequal, dorsal integumentals not long enough to surpass insertions behind them (fig. 21); ventrianal shield subtriangular; ex Phanaeus igneus and Onthophagus pennsylvanicus.  
— setae, n. sp.  

Genus Holocelaeno.  

Holocelaeno, A. Berlese (1910) Redia 6 : 249.  

Dorsal shield without extensive reticulate patterns, finely punctate, often with transverse ridges or lateral portions of ridges; with nine pairs of D setae, of which D₉ commonly are plumose; shield with or without an anterior projection on which D₁ may be inserted; D₅-D₈ and M₃-M₄ often minute. Anterior extension of peritreme on the dorsal shield short, never attaining insertions of setae M₁. Lateral and posterior integumental areas often sclerotized and strongly striated. Sternal shield variously ornamented, with three pairs of spinose setae. With a pair of spinose epigynial setae inserted on a posteriorly truncate or convex epigynial shield; metasternal shields free. Ventrianal shield obtuse to triangular in shape, with or without ornamentation and with 2-4 pairs of preanal setae; adanal setae generally longer than other setae on shield. Internal cheliceral brush filamentous, extending well beyond the cheliceral digits. Genus IV with seven setae; posterior paradactyli broad, distally divided or acuminate. Phoretic associates of Scarabaeinae in the Western Hemisphere.  

Type species — Holocelaeno mitis Berlese, 1910.
Holocelaeno amygdaligera Berlese.


Berlese (1918) described H. amygdaligera from a series of five slides (one male and four females) collected from Phanaeus splendidulus Fabr. (= P. menelas Lap.) in Argentina. Additional collections have been noted by Evans and Hyatt (1963).

The general facies of a "typical" Holocelaeno includes many features found in Berlese's H. amygdaligera. The latter might be compared with the species glaber in Macrocheles, which is considered by many to be "typical" of that genus. A number of specimens in the writer's collection fall into the broad spectrum of which amygdaligera is representative. The range of variation in characters such as length of various dorsal and ventral setae, and in sternal shield ornamentation is wide, with some "variants" being easily separated by discontinuities in measurable characters, as well as by host. Others cannot be set apart completely on any basis but that of host species. In these "variants" measurable characters tend to separate populations from different hosts, but the resulting entities overlap. Discontinuity in selected measurable characters does not occur in H. amygdaligera from Phanaeus splendidulus Fabr. and from Taurocpris mimas L., a species representing a genus closely related to Phanaeus (Blackwelder 1944). Measurements of idiosomal width and length (fig. 3), and of lengths of preanal setae I and dorsal setae D1 — either singly or paired in the order given — show that those specimens found on P. splendidulus tend to group together, as do those specimens from T. mimas. The apparent differences between these populations is based only on the characters listed, and it is clear that the use of other features such as length of sternal setae, dentition of chelicera, or setal structure on genu IV may have resulted in a more continuous gradient. The characters used were chosen to illustrate the correlation between habital and morphological variation, rather than to prove the existence of morphological uniqueness in populations from different hosts. It is assumed, however, that population variants of Holocelaeno species do exist but that the occurrence of partial overlap of a limited number of measurable characters from a small sample of specimens provides a fair indication of an intraspecific relationship between the populations.

While the present writer has not had an opportunity to check the collections of H. amygdaligera mentioned by Evans and Hyatt (1963), numerous specimens of Holocelaeno from a wide variety of Phanaeus spp., including most of those seen by the above authors, have been examined. On the basis of obvious characters, it is evident that these specimens represent related species which differ morphologically from amygdaligera and from each other. Thus, Phanaeus lancifer L.
Figs. 4-10. — Holocelaeno amygdaligera Berlese.

4: Dorsum of female; 5: Genu IV of female; 6: Venter of female; 7: Chelicera of female; 8: Venter of male (drawn from type specimen, slide 191/18, Berlese collection, Florence); 9: Portion of anterior dorsal shield of male (drawn from type specimen, slide 191/18, Berlese collection, Florence); 10: Femur II of male.

is host to a species of \textit{Holocelaeno} which resembles \textit{H. amygdaligera} collected from \textit{Phanaeus splendidulus} Fabr.

The following description of \textit{H. amygdaligera} is based on studies of Berlese’s type material, and specimens in the writer’s collection.

\textbf{FEMALE (figs. 4-7).}

Length of dorsal shield of Berlese’s type (slide 191/18) 665 $\mu$; width of idiosoma at level of coxae II 411 $\mu$. Length of dorsal shield of specimens in author’s collection ranging from 688-840 $\mu$; width ranging from 464-528 $\mu$.

\textit{Dorsal shield} (fig. 4) with or without a striate, strongly sclerotized “shelf” laterally and posteriorly, finely punctate, with weakly reticulate pattern over much of the surface, and a pattern of muscle insertions; with a complete transverse line through setae D$_3$, L$_1$ and M$_g_1$, and a medially interrupted line connecting D$_4$, L$_2$ and M$_g_2$ on either side; with lateral portions of lines posterior to M$_g_2$. Shield with 29 pairs of setae, of which only D$_9$ are plumose; D$_1$ long, broad basally and acuminate distally, and subequal to D$_2$; M$_1$ half the length of D$_2$, setae D$_4$ less than half the length of D$_4$; D$_1$-D$_4$, M$_2$, lateral (L) and marginal (Mg) setae longer than dorso-centrals; none of the dorsal setae appearing minute; M$_g_1$ distinctly longer than other dorsal setae, M$_g_{10}$ usually appearing longer than D$_9$. Dorsal pores as described for genus.

\textit{Sternal shield} (fig. 6) finely punctate, broader than long, with a complete l.o.a. which may be concave or weakly defined medially, and an uncurved l.m.t., lines l.o.p. present posterolaterally; sternal setae long, equal to or exceeding the longitudinal distances between insertions.

\textit{Ventrianal shield} (fig. 6) subtriangular, transversely striate or striate-reticulate, and with three pairs of smooth preanal setae which are little more than half the length of the sternals; adanal setae subequal to sternals.

Peritremes extend anteriorly and dorsally to a point adjacent to setae M$_2$. Mouthparts typical for genus; \textit{digitus mobilis} of chelicera with a subterminal tooth distad of the main tooth, which is bicuspid. Setae of genu IV spinose, sometimes lightly plumose, easily surpassing the insertions of the setae behind them (fig. 5).

\textbf{MALE (figs. 8-10).}

Length of idiosoma of Berlese’s type 540 $\mu$; width of idiosoma at level of coxae II 370 $\mu$. Length of idiosoma of specimens in author’s collection 460 $\mu$; width of idiosoma at level of coxae II 306 $\mu$.

\textit{Dorsal shield} (fig. 9) punctate, with weak patterns of muscle insertions and some reticulation, transverse lines also present; anterior, lateral and marginal setae considerably longer than those of female, many surpassing the insertions of the setae behind them; D$_1$ as in female, D$_2$ over half the length of D$_1$; dorso-central setae shorter, as illustrated.
Ventrally, with a *holoventral shield* which is ornamented as illustrated (fig. 8); spur on femur II small, rounded (fig. 10) genu IV and peritreme as in female. Mouthparts similar to those of female except for the presence, on the *digitus mobilis*, of a proximally curved, distally acuminate sperm transfer organ.

**Immature stages.**

Nymphs and larvae are unknown. An embryo of *H. amygdaligera* was found with a female specimen, but has not been described in this paper.

**Habitat and locality**.

Five females on *Phanaeus splendidul*s Fabr. from Buenos Aires, Argentina (Berlese Collection, Florence, Italy; slides 191/18-20, 190/30, 35/1726); seven females on *P. splendidul*s from "Brazil, S. A." (FMC); one male on *P. splendidul*s from Brazil (SEA); four females on *Taurocophris minas* L. from "Brazil, S. A." (FMC); four females on *Taurocophris minas* L. From Villarcia, Paraguay, 1926 (FMC); one female on *Taurocophris minas* L. from Sapucay, Paraguay, May 1903, W. T. Foster, coll (USNM).

**Holocelaeno acinothrix** n. sp.

**Female** (figs. 11-13).

Length of dorsal shield with a range of 656-695 μ; width at level of coxae II ranging from 356-371 μ.

*Dorsal shield* (fig. 11) with a lateral sclerotized shelf, finely punctate and patterned with muscle insertions; with a complete transverse line through *D*_3, *L*_1, and *Mg*_1, and portions of lines posteriorly and laterally connecting *L*_2 and *Mg*_2; short lateral lines posterior to *Mg*_2. Setae *D*_1 spinose and distinctly pectinate, inserted on a slight anterior projection of shield; *M*_1 half the length of *D*_1 and *D*_2; *D*_2 twice the length of *D*_3, *D*_4 and most of the *M* and *Mg* setae long, with the *Mg* setae attaining or surpassing the insertions of the setae behind them; *D*_10 plumose, less than half the length of *Mg*_10, other dorsal setae smooth or rarely pectinate; integmental setae nearly as long as marginals, smooth or weakly pectinate.

1. The following abbreviations of type repositories are used throughout this study:

   - **BM(NH)**: British Museum (Natural History), London.
   - **FMC**: Field Museum of Natural History, Chicago.
   - **ISR**: Istituto Superiore di Sanità, Rome.
   - **ZAL**: Zoological Academy, Leningrad.
   - **IA**: Institute of Acarology, Wooster, Ohio.
   - **SEA**: Stazione di Entomologia Agraria, Florence.
   - **OSU**: Oregon State University.
Sternal shield (fig. 12) nearly as long as broad, finely punctate; l.o.a. complete medially, l. ang. present, l.m.t. slightly procurred medially, l.o.p. distinct; sternal setae aciculate, not attaining insertions of setae behind them.

Ventralian shield (fig. 12) subtriangular, transversely striate; preanal setae long, equal in length to adanals; perianal setae also long, inserted as illustrated.

Peritremes, gnathosoma typical for genus. Trochanter IV somewhat swollen, genu IV with weakly pectinate ad and pd setae, seta pd₂ not reaching insertion of pd₁, all seven setae quite long (fig. 13).

Male.
Unknown.

Habitat and locality.

Two females on Megathopa astyanax Bl. from Surinam; April, 1927 (USNM Collection). The holotype female will be deposited in the collection of the U. S. National Museum, Washington D. C. The paratype female will be retained in the collection of Oregon State University.

Holoeelaeno anogmos n. sp.

Female (figs. 14-17).

Length of dorsal shield ranging from 608-616 μ; width at level of coxae II with a range of 403-410 μ.

Dorsal shield (fig. 15) without sclerotized shelf, finely punctate and with a series of anterior transverse lines, including one through D₉, L₁ and Mg₄; laterally, with a distinct pattern of punctate-reticulate lines which orient on a posteriorly curved angle, without reticulation medially. Setae D₁ strongly spinose, twice the length of M₁; M₂, L₁, Mg₂-Mg₄ somewhat longer than other dorsals; Mg setae considerably shorter than distance between insertions; D₉ plumose, shorter than Mg₁₀. Integumental setae slightly longer than marginals, smooth and distally acicular.

Sternal shield (fig. 16) with l.o.a. incomplete medially, l.m.t. absent or represented by a weak ridge, l.o.p. present; sternal setae distally aciculate, attaining or nearly attaining the insertions of the setae behind them.

Ventralian shield (fig. 16) subtriangular, transverse markings barely discernible and confined to areas of preanal setal insertions; preanal setae not as long as adanals, perianal setae similar to preanals. Setae of genu IV (fig. 17) smooth, shorter than those of H. amygdaligera (fig. 5), seta pd₂ not extending to insertion of pd₁.
Figs. 11-13. — Holocelaeno acinotrix n. sp.
11: Dorsum of female, showing setal nomenclatorial system;
12: Venter of female; 13: Genu IV of female, show setal nomenclatorial system.

Figs. 14-15. — Holocelaeno angus n. sp.
FIGS. 16-19. Holocelaeno anomos n. sp.
16: Venter of female; 17: Genu IV of female; 18: Dorsum of male; 19: Venter of male.

FIGS. 20-22. Holocelaeno axtelli n. sp.

Fig. 23. Holocelaeno berlesii n. sp. Genu IV of female.
MALE (figs. 18-19).

Length of idiosoma 505 μ; width of idiosoma at coxae II 348 μ.

Dorsal shield (fig. 18) reticulate laterally as in female, but with additional ridges and lines; dorsal setae generally longer than those of female.

With a finely punctate holoventral shield which is weakly ornamented (fig. 19). Spur on femur II typical for genus, genu IV and peritreme similar to those of female. Sperm transfer organ longer than digitus mobilis, narrow and curved.

HABITAT AND LOCALITY.

Three females and one male on Phanaeus bellicosus (Ol.) from Brazil (FMC). The holotype female and allotype male will be placed in the collection of the Field Natural History Museum, Chicago, Illinois. Paratype females will be deposited as follows: USNM, OSU.

Holocelaeno axtelli n. sp.

FEMALE (figs. 20-22).

Length of dorsal shield with a range of 545-672 μ; width at level of coxae II ranging from 348-453 μ.

Dorsal shield with a narrow sclerotized shelf (fig. 21), finely punctate, reticulate except in the medial portion; transverse lines, and portions of lines, as illustrated. Setae D₁ spinose, subequal to D₂, situated on a slight projection, setae M₁ half the length of D₁, other dorsal setae spinose, the dorsocentrals shorter than the laterals and marginals; D₄ and D₅ subequal, D₉ plumose, considerably shorter than Mg₁₀; posterior marginals may be weakly pectinate. Integumental setae subequal to marginals, long enough to attain insertions of setae behind them.

Sternal shield (fig. 20) broader than long, finely punctate and distinctly reticulate, with strong l.o.a., well developed l.m.t. which is evenly concave, and l.o.p.; sternal setae as long as the distances between insertions.

Ventrianal shield (fig. 20) subtriangular, rounded anteriorly and with transverse striae; preanal setae approximately half the length of adanal setae; perianal setae sparse, generally longer than preanal.

Setae ad₁₋₂ and pd₁₋₂ of genu IV pectinate distally, a₁ also may be weakly ornamented; seta pd₂ surpassing insertion of ad₁, but not attaining that of pd₁; genual setae, long, spinose (fig. 22).

MALE.

Unknown.
Habitat and locality.

Four females on Phanaeus igneus M'Leay from North Carolina (FMC); four females "on dung beetle," Lake Alfred, Florida, 4 February 1940 (M. H. Muma, leg.); two females on Phanaeus vindex M'Leay, Jeanette, Pennsylvania (H. G. Klages, coll.); one female on Onthophagus pennsylvanicus from Tifton, Georgia, August, 1957 (T. B. Stewart, coll.). The holotype female will be placed in the collection of the U. S. National Museum, Washington, D. C. Paratypes will be deposited in FMC, BM(NH) and OSU.

No differences between specimens of H. axtelli from Phanaeus igneus or Ph. vindex and the single specimen from Onthophagus pennsylvanicus have been observed. This example of non-specific phoresy might be explained on the basis of climate in the host range. The range of the beetle species involved includes a portion of southeastern United States, with no extension into the more environmentally stable tropical regions of Central and South America. While the southeastern United States has a generally mild climate, periods of low temperature prevent the seasonal stability necessary for niche specialization in overlapping geographical and habitat zones (Mayr 1963). Thus it is possible that Phanaeus igneus, P. vindex and Onthophagus pennsylvanicus are competitive in their habitat, and that their mite associates are, in large part, identical.

The resemblance of H. axtelli to H. amygdaligera (figs. 4-7) may be seen through comparison of descriptive material in this text. Differences in setation, shield pattern, host and size (fig. 3) prompts separation of axtelli from the populations of amygdaligera described earlier.

Holocelaeno berlesei n. sp.

Female (figs. 23-24, 26).

Length of dorsal shield with a range of 482-561 μ; width at level of coxae II with a range of 324-374 μ.

Dorsal shield (fig. 24) finely ornamented in a pattern similar to that found on the sternal shield (fig. 26); with transverse lines and lateral portions of lines as illustrated. Setae D₁ long, spinose, not quite as long as D₉; most of the lateral and marginal setae long, Mg setae often attaining the insertions of the setae behind them; D₉ weakly plumose and shorter than M₉₁₀. Integumental setae subequal in length to marginals, attaining and surpassing the insertions of the setae behind them.

Sternal shield (fig 26) finely patterned, broader than long; with l.o.a. complete and sometimes concave medially, l.m.t. strong, straight or curved, l.o.p. present; sternal setae spinose, nearly reaching insertions behind them.
Figs. 24-28. — *Holocelaeno berlesii* n. sp.
24: Dorsum of female; 25: Dorsum of male;
26: Venter of female; 27: Venter of male; 28: Chelicera of male.
Fig. 29. — *Holocelaeno brachychaeia* n. sp. Venter of female.
Ventrianal shield pyriform, convex anteriorly and striated in the anterior half; preanal setae considerably shorter than marginals, adanals subequal to preanals; perianal setae long, similar to marginals.
Setae pd\textsubscript{4} of genu IV barely attains insertion of pd\textsubscript{1} (fig. 23); genual setae smooth.

**Male** (figs. 25, 27, 28).

Length of dorsal shield 442 μ; width at coxae II 269 μ.

Dorsal shield punctate and laterally reticulate (fig. 25), attenuated posteriorly; many dorsal setae missing on available specimens, D\textsubscript{1} long and spinose, D\textsubscript{9} as in female.

Sternal portion of holoventral shield (fig. 27) with medially interrupted l.o.a.; l.m.t. and l.o.p. similar to those of female; posterior portion of shield strongly striate. Integumental setae long as in female. Spur on femur II distally bilobed; genu IV not observed. Sperm transfer organ "S"-shaped, little longer than the digitus mobilis (fig. 28).

**Habitat and Locality.**

Two females and one male on *Dichotomi\textsc{s} satanus* (Har.) from Ecuador (FMC); one female and one male "on beetle", Barro Colorado Island, Canal Zone; 22 March, 1955 (C. W. Rettenmeyer, coll.). The holotype female and allotype male will be deposited in the Field Natural History Museum, Chicago, Illinois. Paratypes will be placed in the collection of the U. S. National Museum, Washington, D. C.

Although the males of *H. berlesei* from both collections mentioned above are virtually identical, differences in contour of lines l.m.t. and l.o.a. were observed in females. It is possible that these collections actually represent two species.

**Holocelaeno brachyachaeta** n. sp.

**Female** (figs. 29-30).

Length of dorsal shield ranging from 545-616 μ; width at level of coxae II with a range of 292-395 μ.

Dorsal shield (fig. 30) with a weak sclerotized shelf, punctate and with the typical series of anterior lines; lateral portions of lines weak or indistinct behind M\textsubscript{22}. Setae D\textsubscript{1} strongly spinose, at least twice the length of M\textsubscript{1}; D\textsubscript{2} acicular distally, subequal to D\textsubscript{1}; dorsal setae uniformly short, distally acicular; setae D\textsubscript{9} plumose, as long as setae M\textsubscript{810}. Integumental setae short, hair-like, similar to shield setae.

Sternal shield (fig. 29) with strongly developed l.o.a., l.m.t. and l.o.p., finely punctate and often with a weak reticulate pattern medially; sternal setae long,
attaining the insertions behind them; sternals III, and metasternals, shorter than sternals II.

*Ventrianal shield* (fig. 29) broadly obovate, longer than broad, finely punctate and with a series of transverse lines; preanal setae short, similar to dorsal and integumental hairs, adanals approximately twice the length of the preanals; perianal setae hair-like.

Seta pd₂ of genu IV often weakly pectinate distally, not long enough to reach insertion of pd₁; genual setae fairly short, narrow.

**Male.**

Unknown.

**Habitat and locality.**

Ten females on *Dichotomius carolinus* (L.) from North America (FMC). A single female specimen of what appears to be *H. brachychaeta* was taken from *Phanaeus telamon* Er. collected in Venezuela (FMC). It differs from the typical *brachychaeta* only in the following details:

1. Sternal shield with stronger pattern anteriorly.
2. Sternal setae III subequal to sternals II.
3. Ventrianal shield broader than those observed in the *brachychaeta* series.

This example of non-specific phoresy is exceptional in two ways: a) the beetle hosts are not closely related and b) the geographical ranges of the beetle hosts do not overlap to any appreciable degree.

The holotype female will be deposited in the Field Museum of Natural History, Chicago, Illinois. Paratypes will be deposited in following institutions: USNM, BM(NH), IA, ZAL, OSU.

*Holocelaeno bursiformis* Berlese.


The description presented below is based, in large part, on examination of Berlese’s type specimens. Additional specimens are in the writer's collection.

**Female** (figs. 31-33).

Length of dorsal shield of holotype (slide 90/26) 595 μ; width ca. 400 μ; dorsal shield length of three specimens at hand with a range of 584-616 μ, and width ranging from 339-403 μ.
Fig. 30. — *Holocelaeno brachychaeta* n. sp. Dorsum of female.

Figs. 31-33. — *Holocelaeno bursiformis* (Berlese).
31: Dorsum of female; 32: Venter of female; 33: Genu IV of female.

Figs. 34-35. — *Holocelaeno condyla* n. sp.
34: Chelicera of female; 35: Genu IV of female.
Dorsal shield (fig. 31) with strong sclerotized ridges and lines in the anterior and anteromedial portions, finely punctate posteriorly; with a strong anterior projection on which broad, plumose setae D₁ are distally inserted; M₁ short, smooth, D₂ as long as, or slightly longer than, D₁; dorsal setae virtually equal in length, acicular and smooth except for D₉ which is plumose; Mg₁₀ somewhat longer than D₉. Integumental setae small, hair-like, inserted close to dorsal shield border.

Sternal shield (fig. 32) with l. ang. and l. arc. interrupting the medial portion of line l.o.a.; central portion of l.m.t. apparently fused with l.o.p. to form a strong convex arch ending at insertions of sternals III, with punctate areas as illustrated; sternal setae long, nearly attaining insertions of setae behind them.

Ventrianal shield (fig. 32) broader than long, punctate-striate throughout and with subequal preanal and adanal setae; perianal setae similar to dorsal setae.

Peritrematal and exopodal shields fused around coxae to the endopodal-sternal complex. Genu IV little longer than broad (fig. 33); genual setae short and spinose, ad₁ and pd₁ being distally pectinate.

MALE.

While the male of H. bursiformis has never been described, it is of interest to note that Berlese’s Holocleaeno (Trichocleaeno) longicoma, a species described only from the male and collected on Dichotomius carolinus in North America, apparently comprised part of a series of a single collection from which at least one female bursiformis was taken. This collection (Habitat super Copris carolina, “America boreale”) includes a female specimen of bursiformis numbered 90/31, while longicoma is numbered 90/32. It might well be inferred that the male and female are representatives of a single species, except for the great differences in dorsal shield pattern and dorsal setae. The fact that distinct dimorphism in dorsal shield characters does occur in Holocleaeno (figs. 39, 41) lends substantial support to the inference. However, until additional collections of longicoma may be examined (only one specimen is known), the writer prefers to treat bursiformis and longicoma as separate species.

Habitat and locality.

Two females (slides 90/26 and 90/13) in the collection of the Stazione di Entomologia Agraria, Florence, Italy, on Dichotomius carolinus (L.) (= Copris carolina) from North America; two females on D. carolinus from State College, Mississippi, 10 April 1940 (R. A. Simmons, coll.); one female on D. carolinus from Nelson County, Virginia, 7 August 1908 (W. Robinson, coll.).
Holocelaeno condyla n. sp.

**Female** (figs. 34-37, 39).

Length of dorsal shield with a range of 640-687 μ; width at level of coxae II ranging from 403-419 μ.

*Dorsal shield* (fig. 39) finely punctate, with a narrow band of sclerotization laterally and posteriorly, and with muscle and linear patterns as illustrated; setae D₁ on an anterior projection of the shield, smooth and broad basally, twice the length of M₁ and distinctly longer than D₂; dorsal setae narrow, acicular, long, but generally not long enough to attain insertions of setae behind them; setae D₉ plumose and unusually long, subequal to Mg₁₀. Integumental setae acicular, somewhat shorter than marginals.

*Sternal shield* (fig. 36) similar to that of *H. brachychaeta* (fig. 29); l. ang. bisects l.o.a.; l.m.t. evenly concave, l.o.p. present and distinct; sternal setae I extending to or beyond insertions of sternals II, sternals II-III slightly shorter.

*Ventrianal shield* (fig. 36) broadly obovate, finely punctate and with transverse lines; preanals hairlike, subequal in length to Mg setae; adanal setae little longer than preanals; perianal setae also hair-like, subequal to or shorter than preanals.

Trochanter IV greatly swollen, considerably broader than more distal leg segments (fig 37); seta pd₄ of genu IV reaches insertion of pd₁; genual setae long and virtually smooth (fig. 35).

**Male** (figs. 38, 40-42).

Length of dorsal shield 474 μ; width at coxae II 269 μ.

*Dorsal shield* (fig. 41) finely punctate and evenly reticulate, with most of the dorsal setae greatly elongated, easily surpassing the setae behind them, generally somewhat pectinate; setae D₉ elongate but only little more than half the length of M₉. Integumental setae elongate but shorter than Mg setae.

*Holoventral shield* (fig. 38) strongly patterned throughout, and with long smooth setae.

Trochanter IV swollen as in female; genu IV also similar to that of female. Femur II (fig. 42) with typical ventral spur. Sperm transfer organ of *chelicera* (fig. 40) weakly hooked terminally, no longer than *digitus mobilis*.

**Habitat and locality.**

Two females on *Megathopa yucateca* Har. from Brownsville, Texas, 30 May 1903; one female and one male on *Megathopa yucateca* from Mexico, 1937. The holotype
Figs. 36-40. — *Holocelaeno condyla* n. sp.

36: Venter of female; 37: Portion of leg IV of female, showing greatly expanded trochanter;
38: Venter of male; 39: Dorsum of female; 40: Chelicera of male.
female and allotype male will be deposited in the collection of the U. S. National Museum, Washington, D. C. Paratype females will be placed as follows: BM(NH), OSU.

_Holocelaeno coprophilus_ (Turk).


Specimens of _H. coprophilus_ are not presently available, so that the short description which follows is derived from that presented by Turk (1948).

**Female.**

Length of dorsal shield 560-580 μ; width 380-400 μ.

_Dorsal shield_ without unusual striae or patterns; setae D1 extremely long, over three times the length of setae D2.

_Sternal shield_ finely punctate, with l.o.a. medially interrupted; l.m.t. evanescent medially, or strong throughout, virtually straight; sternal setae long, reaching the insertions of the setae behind them. Epigynial setae may appear to be in the integument adjacent to the shield; _ventrianal shield_ pentagonal, finely punctate but without striate or reticulate patterns.

**Male.**

Unknown.

**Habitat and Locality.**

A series of females on a scarabaeid beetle from St. Augustine, Trinidad, 13 October 1945 (R. G. Donald, coll.).

Turk (1948) erected a new variety of _coprophilus_ (var. _elongatus_) primarily on the basis of sternal and epigynial inconsistencies. Since _elongatus_ was part of the series described as _coprophilus_ s. str., and inasmuch as the differences described by Turk are minor, it is assumed that _elongatus_ represents a part of the normal range of variation within the species _coprophilus_.

_Holocelaeno cosmothorax_ n. sp.

**Female** (figs. 43-45).

Length of dorsal shield ranging from 758-822 μ; width at level of coxae II with a range of 489-514 μ.

_Dorsal shield_ (fig. 44) finely punctate throughout and weakly reticulate posteriorly, with a wide striated band of chitinized integument laterally and posteriorly;
Figs. 41-42. — *Holocelaeno condyla* n. sp.
41: Dorsum of male; 42: Femur II of male.

Figs. 43-44. — *Holocelaeno cosmotheras* n. sp.
43: Genu IV of female; 44: Dorsum of female.

portion of tranverse line between setae D₃ may be indistinct or absent; setae D₁ smooth and spinose, on an anterior projection of the shield, over twice the length of M₁; D₂ hair-like, nearly equal in length to D₁; L₁-L₂, Mg₁-Mg₄ also long and hair-like, other L and Mg setae acicular, somewhat shorter than D₂, other dorsal setae shorter; D₉ plumose, nearly as long as Mg₁₀. Integumental setae hair-like, shorter than marginals.

*Sternal shield* (fig. 45) with coarse punctate pattern, l.o.a. and l.m.t. convex and concave respectively, meeting at insertions of sternals II, i.o.p. present but often indistinct due to punctate pattern; sternal setae long; extending beyond insertions of setae behind them, in most cases ¹.

*Ventrianal shield* (fig. 45) as broad or broader than long, striate and finely punctate; preanal setae approximately the same length as posterior Mg setae, adanals distinctly longer than preanals; perianal setae subequal to preanals.

Setae pd₁-₂ slightly pectinate distally, pd₄ not surpassing insertion of pd₁; other genual setae smooth, with av₁ somewhat longer than other setae (fig. 43).

**MALE.**

Unknown.

**HABITAT AND LOCALITY.**

Four females on *Dichotomius carolinus* (L.) from North America (FMC); one female on *Phanaeus faunus* Fabr. from Tumupaso, Bolivia, 1921 (W. M. MANN, coll.). The holotype female will be sent to the U. S. National Museum, Washington, D. C. Paratypes will be deposited in the following collections: FMC, BM(NH), OSU.

**Holocelaeno costai** n. sp.

**FEMALE** (figs. 46, 48-49).

Length of dorsal shield with a range of 585-616 μ; width at level of coxae II ranging from 395-403 μ.

*Dorsal shield* (fig. 48) without sclerotized band or anterior projections, finely punctate and weakly reticulate, with transverse lines and portions of lines as illustrated; setae D₁ smooth, spinose but not expanded, twice the length of M₁ and subequal to D₂; setae D₂, M₂, L₁, Mg₁₂ and Mg₄ slightly longer, or stronger, than other dorsal setae; D₉ plumose, less than half the length of Mg₁₀. Integumental setae spinose, as long as posterior Mg setae.

¹ A single female specimen on *Phanaeus faunus* Fabr. from Bolivia has shorter, somewhat narrower sternal setae than specimens on *Dichotomius carolinus* (L.).
Sternal shield (fig. 46) punctate-reticulate, with medial portion of l.o.a. indistinct or absent, l.m.t. virtually straight, l.o.p. present; sternal setae short, spinose, not long enough to reach the insertions of the setae behind them.

Ventral shield (fig. 46) subtriangular, finely punctate and reticulate in a manner similar to that of sternal shield; preanal setae shorter than sternals, adanal setae subequal to sternals; perianal setae similar to preanals.

Setae of genu IV short, spinose (fig. 49), seta pd₂ does not reach insertion of pd₁.

MALE (fig. 47).

Length of dorsal shield 521 μ; width at level of coxae II 332 μ.

Dorsal shield reticulate, with some of the anterior and lateral setae somewhat expanded and elongated.

Holoventral shield (fig. 47) finely punctate, more heavily sclerotized anteriorly than posteriorly, and ornamented as illustrated, l.m.t. absent; preanal I extend to or beyond insertions of preanal II, nearly the length of adanal.

Femur IV with a single ventral spur. Sperm transfer organ of chelicera S-curved, distally acuminate, and longer than the digitus mobilis.

HABITAT AND LOCALITY.

Seven females and one male on Phanaeus bellicosus (Ol.) from Brazil (FMC). The holotype female and allotype male will be deposited in the U. S. National Museum, Washington, D. C. Paratype females will be placed in the following collections: BM(NH), IA, ZAL, OSU.

This species is named in honor of Dr. Michael Costa.

Macrocheles crispa (Berlese) new combination.

Holocelaeno crispa, A. Berlese 1910, Redia 6 : 249.

M. crispa was described from a series of female specimens taken on a variety of Coleoptera, chiefly coprophilous species on Copris and related forms ("Habitat super coleoptera varia, praecipue coprophila (Copris et gen. affinia)") from Java. This radical departure from what had been assumed to be the geographic range of Holocelaeno prompted a thorough study of crispa in the Berlese collection, Florence.

It was found that crispa is not a species of Holocelaeno, but rather belongs to the genus Macrocheles. The following combination of features points to this conclusion:

1. Dorsum with 28 pairs of setae, many of which are strongly pectinate, setae D₁ strongly plumose (fig. 50).
2. Chelicera without long filamentous brush.
**FIG. 45.** — *Holocelaeno cosmothorax* n. sp. Venter of female.

**FIGS. 46-49.** — *Holocelaeno costai* n. sp.

3. Adanal setae subequal to preanals.

4. Peritremes extend well beyond coxae I, nearly to setae M₁.

In light of these findings, the species *crispa* herewith is placed in the genus *Macrocheles*, probably near *M. hirsutissima* Berlese.

*Holocelaeno dubius* (Evans and Hyatt).


*H. dubius* has been described by Evans and Hyatt from female specimens only. A male specimen has since been identified through various common characters with the female, including collection of both sexes from a single host. The following augments the description provided by Evans and Hyatt.

**FEMALE** (figs. 52, 54-56).

Length of dorsal shield of type series averages 1, 111 μ; width averages 726 μ (the length of the dorsal shields of the four female specimens available to the writer range in length from 1125-1248 μ; width at level of coxae II with a range of 760-790 μ.)

**Dorsal shield** (fig. 56) finely punctate, weakly reticulate posteriorly, with a narrow band of sclerotized integument laterally and posteriorly; setae D₁ spinose and rarely weakly plumose distally, nearly twice the length of M₁ and longer than D₂; dorsal setae generally short, acicular; D₉ plumose, nearly as long as M₉. Integumental setae spinose, no longer than marginals.

**Sternal shield** (fig. 55) finely punctate, with reticulate pattern throughout; l.o.a. interrupted medially, l.m.t. virtually straight, l.o.p. extending medially, forming a partial line nearly parallel to l.m.t.; sternal setae spinose, not reaching insertions of setae behind them.

**Ventrianal shield** (fig. 55) convex anteriorly, obovate, finely punctate and with series of transverse and connecting lines as illustrated; preanal setae spinose, shorter than sternals and adanals; perianal setae similar to preanals.

Setae pd₂ and pd₄ of femur I subequal, somewhat enlarged and weakly plumose distally (fig. 52). Setae pd₂ of genu IV not surpassing insertion of pd₄, both may be weakly pectinate distally; genual setae spinose, inserted as illustrated (fig. 54).

**MALE** (figs. 51, 53).

Length of idiosoma 1067 μ; width of idiosoma at level of coxae II 774 μ.

**Dorsal shield** reticulate, similar to female shield except that some setae may be longer on the male shield; integumental setae as in female.
FIG. 50. — Macrocheles crispa (Berlese)
(drawn from specimen on slide 130/24, BERLESE Collection, Florence).

FIGS. 51-55. — Holocelaeno dubius (Evans and Hyatt).
51: Venter of male; 52: Femur I of female; 53: Chelicera of male (sto = sperm transfer organ); 54: Genu IV of female; 55: Venter of female.
Holocelaeno expolita Berlese.

Holocelaeno expolita, A. Berlese (1918), Redia 13: 176.

The following description is based almost entirely on Berlese's original description, and on drawings from his unpublished notebooks.

FEMALE.

Length of dorsal shield of type specimen (191/16) 540 µ; width 330 µ.

Dorsal shield finely punctate, with dorsal setae smooth and spinose; D₁ and M₂ longer than other setae; M₂ and L setae apparently longer than dorsocentrals. Integumental setae similar to M₂ series.

Sternal shield punctate, with extremely weak l.o.a. and l.m.t., other lines not observable; sternal setae long, extending to the insertions of the setae behind them.

Ventral shield subtriangular, completely without ornamentation; preanals, perianals somewhat shorter than adanals. Gnathosoma and legs not observed.

MALE.

Unknown.

HABITAT AND LOCALITY.

The female type series on slides in the Berlese Collection, Florence (Nos. 191/16-17, 190/32) and in alcohol (Vial No. 35/1723) on Phanaeus milon Blanch, from "alto Parana" Cl. Spegazzini, coll.

Examination of Berlese's type material by the writer revealed that H. expolita is very similar to H. interrumpita Berlese (figs. 71-75). Weak ventral sculpturing is common to both forms, but differences are apparent in length of the dorsal and
sternal setae, and in details of ornamentation on the venter. Possible difference in other characters, such as genual setal length and type, and femoral setae on leg I, may further separate these forms. Unfortunately, a detailed study of H. expolita was not made during the writer's stay in Florence. The specific status of expolita, therefore, must be considered valid until further study of type material is possible.

Holocelaeno floridanus (Evans and Hyatt).


_H. floridanus_ was described from a single female specimen collected on _Deltochilum orbiculare_ Lansb. in Florida. Blackwelder (1944) gives the known range of _D. orbiculare_ as Brazil, Peru and Bolivia, nor is the species recorded as a member of the North American fauna in Leng's Catalogue and supplements (1920, 1927, 1933, 1939, 1948). This collection, then, represents an unusual find of a beetle species apparently well outside of its previously known range.

_H. floridanus_ is a distinctive species which may be briefly diagnosed as follows:

Length of dorsal shield 930 μ; width of dorsal shield 620 μ; finely punctate and irregular laterally; setae D₃ and M₂ absent on type specimen (indications of insertions for each appear to be present in the drawing of the holotype); D₁ spinose, short; Mg₉–Mg₁₀ longer than other dorsals, D₉ plumose and half the length of Mg₁₀.

Sternal shield with complete arched l.o.a., other major lines absent; sternal setae short, spinose.

Ventrianal shield ovate and unornamented, with only two pairs of short preanal setae anteriorly, adanal setae longer than preanal.

**Male.**

Unknown.

**Habitat and Locality.**

A single female on _Deltochilum orbiculare_ Lansb., S. E. Columbia [County ?], Florida, U. S. A.; 1937 (G. Klug, coll.). The type is in the collection of the British Museum (Natural History), London.
Holocelaeno fuscata Berlese.

Holocelaeno mitis Berlese, variety fuscata, A. Berlese (1917), Redia 12: 154.

FEMALE (figs. 57-59).

Length of dorsal shield of type specimen 510 μ; width 330 μ (shield length of four available specimens with a range of 498-514 μ; width at level of coxae II with range of 316-332 μ).

Dorsal shield (fig. 58) with a broad lateral and posterior band of sclerotized integument; shield finely punctate and with strong transverse lines, and portions of lines; line connecting D4 and and L5 may extend mediad of D4 in some specimens, finely punctate, weakly reticulate in posterior portion; setae D1 three times the length of D2 or M1, Mg1 longer than other dorsal setae; D9 plumose, shorter than Mg10, dorsal setae short and smooth. Integumental setae short, spinose.

Sternal shield (fig. 57) punctate throughout, l.o.a. adjacent and parallel to the anterior border of the shield, often indistinct medially; l.m.t. without curve, strongly developed in some specimens or somewhat evanescent; sternal setae not long enough to surpass setal insertions behind them.

Ventrianal shield (fig. 57) rounded anteriorly, finely punctate and with only one clearly developed transverse line (connecting insertions of preanals I); preanals short, approximately half the length of the adanal setae; perianals similar to preanals.

Setae pd2 of femur I not greatly expanded. Setae of genu IV short, stubby and smooth (fig. 59); pd4 does not reach insertion of pd1.

MALE.

Unknown.

HABITAT AND LOCALITY.

The holotype female (slide 176/15) and three additional female specimens were collected in "La Plata" (Brazil) on a scarab resembling members of the Old World genus Ateuchus ("Habitat super Scarabaeum quemdam, sat Atheco similem... "). Four females in the writer's collection also have been examined. They are as follows: two females on Phanaeus milon Blanch, one from Paraguay and one from Rosario, Bolivia, 1921 (W. M. Mann, coll.); two females on Phanaeus corythus Har. from Honduras (USNM).

Berlese's "Atheuco similem" may well have been either of the two Phanaeus species from which specimens of H. fuscata have been collected. There are a few noticeable differences between those specimens taken from P. milon
Fig. 56. — *Holocelaeno dubius* (Evans and Hyatt). Dorsum of female.

Figs. 57-59. — *Holocelaeno fuscata* Berlese.

57: Venter of female; 58: Dorsum of female; 59: Genu IV of female.

Fig. 60. — *Holocelaeno hadrosoma* n. sp. Genu IV of female.
and from *P. corythus*, with Berlese's description fitting that of the former "population" more closely. Variations from the norm which have been noted in specimens from *P. corythus* may be described as follows:

1. Transverse line connecting dorsal setae *D*₄ and *L*₂ terminates at *D*₄.
2. Line l.m.t. of sternal shield less pronounced than in type, or in specimens from *P. milon* (fig. 57).

These variations do not appear distinctive enough to warrant assignment of specific, or subspecific, rank to the *corythus* population.

*Holocelaeno grandis* (Evans and Hyatt).


The following description is derived from that given by Evans and Hyatt.

**FEMALE.**

*Dorsal shield* (930 μ in length, 620 μ wide) with only limited areas of faint reticulation; *D*₁ long, spinose, half again as long as *D*₂ or *M*₁; *D*₄ considerably longer than more anterior *D* setae, and over three times the length of *D*₅-₈ and *M*₅-₄; lateral and marginal setae long, but not attaining insertions of setae behind them, generally pilose distally; *D*₉ apparently smooth, shorter than *M*₉₁₀.

*Sternal shield* with medially interrupted l.o.a., straight l.m.t. and distinct l.o.p.

*Ventrianal shield* triangular, with series of transverse reticulations; preanals spinose, distinctly shorter than adanals. Seta *ad*₁ of genu IV long and pilose, others stout and smooth.

**MALE.**

Unknown.

**HABITAT AND LOCALITY.**

The holotype female and one paratype female on *Deltochilum lobipes* Bates from Honduras, are in the collection of the British Museum (Natural History), London.

*Holocelaeno hadrosoma* n. sp.

**FEMALE** (figs. 60-62).

Length of dorsal shield 1011 μ; width at level of coxae II 672 μ.

*Dorsal shield* (fig. 61) finely punctate, weakly reticulate in some portions, and bordered laterally and posteriorly by a broad band of sclerotized integument;
Figs. 61-62. *Holocelaeno hadrosoma* n. sp.

Figs. 63-64. *Holocelaeno hanselli* n. sp.
63: Dorsum of female; 64: Venter of female.
with well-developed transverse lines and lateral portions as illustrated; D₁ not observed, D₂ extending to the insertions of D₃, slightly pilose distally, D₆ missing on type specimen; D₄, M₃ and other dorsocentral setae either short or not observed, D₄, M₂, L and Mg setae long, generally surpassing insertions of setae behind them, smooth or lightly pilose distally; D₉ long, plumose and considerably shorter than Mg₁₀. Integumental setae spinose, less than half the length of most Mg setae.

**Sternal shield** (fig. 62) finely punctate, lightly patterned anterior to l.m.t. and evenly reticulate behind it; l.o.a. arched, interrupted laterally; l.m.t. virtually straight, l.o.p. well-developed; sternal setae smooth, elongate, surpassing the insertions of setae behind them.

**Ventral shield** (fig. 62) triangular, broader than long and with strong reticulate pattern; adanalgs distinctly longer than preanalgs, perianalgs similar in length to preanalgs.

Peritreme extends anteriorly and dorsally beyond coxae I to a point posterior to M₁. Seta pd₂ of femur I not overly expanded distally pilose. Genu IV (fig. 60) with only al₁, pl₁, and av₁ observable; setae long and smooth.

**Male.**

Unknown.

**Habitat and Locality.**

A single female on *Dichotomius protectus* Har. from Venezuela (FMC). The holotype will be deposited in the collection of the Field Museum of Natural History, Chicago, Illinois.

**Holoeelaeno hanselli** n. sp.

**Female** (figs. 63-66).

Length of dorsal shield with a range of 790-924 µ, width at level of coxae II ranging from 498-561 µ.

**Dorsal shield** (fig. 63) finely punctate, weakly reticulate laterally, with a band of sclerotized striated integument laterally and posteriorly, with anterior transverse lines as illustrated; setae D₁ spinose, not as long as D₂; M₁ half the length of D₉; D₂-₃, M₂, L₁-₂, Mg₁₄ longer than other dorsal setae, occasionally weakly pilose distally; Mg₁ surpassing insertions of Mg₂, other Mg setae not so situated; D₉ plumose throughout, not quite as long as Mg₁₀. Integumental setae spinose, somewhat shorter than Mg setae.

**Sternal shield** (fig. 64) punctate throughout, weakly punctate-reticulate centrally; with l.o.a. weak or interrupted medially, l.m.t. slightly curved, joining l.o.a. at
insertions of sternal setae II, i.o.p. weakly developed; sternal setae long, easily surpassing insertions behind them; metasternal and epigynial setae equal to sternals in length.

_Ventrinal shield_ (fig. 64) subtriangular, punctate and with series of transverse lines as illustrated; preanal setae acicular, not as long as sternals or adanals, which are subequal; perianal setae as long or longer than preanal.

Seta pd₁ of femur I subequal to pd₂, may be slightly pilose distally; seta pd₁ of genu IV attains insertion of pd₁; other genual setae also long (fig. 66).

**MALE.**

Unknown.

**HABITAT AND LOCALITY.**

Six females on _Phanaeus ensifer_ (Germ.) from Brazil (FMC). The holotype female will be deposited in the collection of the Field Museum of Natural History, Chicago, Illinois. Paratypes will be placed in the following institutions: USNM, BM(NH), ZAL, OSU.

This species is named in honor of Mr. Rodger I. C. HSVELL, former student and collaborator on macrochelid research.

_Holocelaeno hypocrita_ Berlese.


The male and female type specimens of _H. hypocrita_ are mounted on a single slide (176/19) which was labelled by BERLESE as _Macrocheles hypocrita_. His description of the species, however, was under the generic name of _Holocelaeno_. The differences between _H. magna_ Berlese s. str. (page 56) and _H. hypocrita_ are considered sufficient to warrant complete separation on a species level.

BERLESE's specimens were found hidden under the elytra of some sort of scarab resembling _Phanaeus_ ("Habitat absconditus sub elitris cuiusdam Phanaei"). Two specimens in the writer's collection were taken from _Bolbites onitoides_ Har., a phanaeid beetle. The following description is derived from examination of type material, and from specimens at hand.

**FEMALE** (figs. 67-69).

Length of dorsal shield of holotype 800 µ; width 490 µ (length of dorsal shield of two available specimens 790 µ; width at level of coxae II averages 482 µ).

_Dorsal shield_ (fig. 69) finely punctate, with transverse lines and portions of lines as illustrated, without strongly sclerotized lateral and posterior band of integument;
Figs. 65-66. — *Holocelaeno hanselli* n. sp.

Figs. 67-70. — *Holocelaeno hypocrita* (Berlese).
67: Genu IV of female; 68: Venter of female; 69: Dorsum of female;
70: Venter of male (drawn from type specimen, slide 176/19, Berlese Collection, Florence).
setae D₁ short, spinose, longer than M₁ but shorter than D₂; other dorsal setae (except D₉) smooth and spinose, with Mg and L setae generally longer than dorso-centrals; D₉ plumose, shorter than Mg. Integumental setae as long as Mg setae, with some attaining insertions of setae behind them.

Sternal shield (fig. 68) as long as broad, reticulate medially, and with strongly arched l.o.a., l.m.t. slightly curved, l.o.p. distinct; sternal setae spinose, not long enough to reach insertions of setae behind them.

Ventrianal shield (fig. 68) reduced posterolaterally, reticulated as illustrated, and with only two pairs of preanals which are short and spinose; adanals subequal to sternals; perianal setae similar to preanals.

Cheliceral brush barely extending beyond end of digitus mobilis. Seta pd₂ of femur I short, spur-like. Setae of genu IV narrow, of medium length (fig. 67); pd₂ not quite surpassing insertion of pd₁.

**MALE** (fig. 70).

Length of dorsal shield of allotype 660 µ; width 410 µ.

Dorsal shield similar to that of female, with short dorsocentral setae.

Holoventral shield (fig. 70) with reticulate punctate pattern anteriorly, without ornamentation posteriorly; holoventral setae short, spinose; with only two pairs of preanals.

Femur II with a single, somewhat hooked, ventral spur; genu IV with the usual seven setae. Sperm transfer organ of chelicera over twice the length of the digitus mobilis, nearly equal in length to the gnathosoma.

**HABITAT AND LOCALITY.**

The holotype female and allotype male from under the elytra of a phanaeid beetle, “La Plata”, Cl. Bruck, coll. (slide 176/19, SEA). Two additional collections as follows: one female on Bolbites onitoides Har. from Mendoza, Argentina (FMC); one female on B. onitoides from Rosario, Argentina (USNM). **Holocelaeno interrupta** Berlese.


Berlese included *H. interrupta* as a variety of *amygdaligera* on the basis of characters subsequently used as specific features (sternal shield sculpturing, for example). Examination of some of Berlese’s type material of *interrupta* (slides 190/29-31) revealed major differences from *amygdaligera* in dorsal setal length, ventrianal shield ornamentation, and holoventral shield ornamentation and overall size of the male.
The following brief description of *H. interrupta* is derived from a study of type material at Florence, Italy.

**FEMALE** (figs. 71, 73, 75).

Length of dorsal shield 720 μ; width 470 μ.

*Dorsal shield* similar to that of *amygdaligera* in sculpturing and ornamentation; setae D₁ somewhat shorter than D₂; D₅–₆, M₃–₄ only slightly shorter than adjacent lateral and posterior setae (fig. 75).

*Sternal shield* (fig. 71) finely punctate, l.o.a. medially interrupted, l.m.t. virtually straight; sternal setae spinose, not extending to insertions of setae behind them.

*Ventrianal shield* (fig. 73) with obscure ornamentation, without distinct transverse lines as in *amygdaligera*; adanalts distinctly longer than preanals.

**MALE** (figs. 72, 74).

Length of dorsal shield 390 μ; width 250 μ.

*Dorsal shield* similar to that of female, observed setae generally shorter than those of the male of *amygdaligera* (fig. 74).

*Holoventral shield* (fig. 72) ornamented as illustrated, without anterior reticulation; line l.o.a. complete medially, l.m.t. slightly procurred; holoventral setae short spinose; adanalts longer than preanal setae and subequal to the more anterior holoventral setae.

Spur on femur II large, narrowed distally. Chelicerae, genu not observed.

**HABITAT AND LOCALITY.**

The holotype female and allotype male on *Phanaeus batesi* Har. from "La Plata"; Cl. SPGAZZINI, coll. (BERLESE Collection, Slide No. 190/29). Additional specimens on slides 190/30–31, and in alcohol (Vials 35/1724–25).

**Holocelaeno iota** n. sp.

**FEMALE** (figs. 76–78).

Length of dorsal shield 514 μ; width at level of coxae II 356 μ.

*Dorsal shield* (fig. 77) finely punctate and distinctly reticulate, particularly in the anterior and lateral portions; setae D₁ short, spike-like, longer than M₁ (D₉ not clear); other dorsal setae short and smooth, with the anterior and lateral setae slightly longer than the more medial hairs; setae D₉ and M₉ₐ subequal; integumental setae similar to shield setae.

*Sternal shield* (fig. 78) with punctate pattern throughout, lineae not well defined, with a medial punctate-reticulate pattern as illustrated; sternal setae not long enough to reach setal insertions behind them.
Figs. 71-75. — *Holocelaeno interrupta* Berlese
(drawn from type specimens, slide 190/39, Berlese Collection, Florence).
71: Sternal shield of female (l.o.a. = linea obliqua anteriore; l.m.t. = linea media transversa;
l.o.p. = linea obliqua posteriore); 72: Venter of male; 73: Ventrianal shield of female;
74: Anterior portion of male dorsal shield; 75: Anterior portion of female dorsal shield.
Fig. 76. — *Holocelaeno iola* n. sp. Genu IV of female.
Ventrianal shield (fig. 78) similarly punctate, with very weak indications of transverse lines; preanal setae somewhat shorter than sternals, with preanals I being subequal to adanal setae; perianal setae equal to preanals II.

Cheliceral brush appearing little longer than digitus mobilis. Seta pd₂ of femur I similar to pd₁, not enlarged. Setae of genu IV smooth, short (fig. 76); pd₄ not reaching insertion of pd₁.

Male.

Unknown.

Habitat and locality.

A single female on Phanaeus bellicosus (Ol.) from Brazil (FMC). The holotype female will be placed in the collection of the Field Natural History Museum, Chicago, Illinois.

H. iota was found with H. costai on one specimen of Phanaeus bellicosus. Thorough examination of both mite species was made to determine whether H. iota might be conspecific with costai. It appears that H. iota is a distinct species.

Holocelaeno jasius n. sp.

Female (figs. 79, 80, 87).

Length of idiosoma with a range of 537-576 μ; width of idiosoma at level of coxae II ranging from 324-356 μ.

Dorsal shield (fig. 80) finely punctate, with transverse lines and portions of lines as illustrated. Setae D₁ spinose, smooth, quite long; setae D₃ and M₂ somewhat thickened, as long or longer than D₁, nearly reaching insertions of D₃, M₇ and M₉ subequal; dorsocentral setae short, but others nearly as long or surpassing length of D₃; Mg setae not attaining insertions of setae behind them; D₄ short, plumose, less than half the length of Mg₁₀. Integumental setae long, similar to Mg setae.

Sternal shield (fig. 79) finely punctate; l.o.a. indistinct or absent medially, l.m.t. with a slight dip, l.o.p. indistinct on some specimens; sternal setae spinose, not reaching insertions of setae behind them.

Ventrianal shield (fig. 79) subtriangular, finely punctate and weakly striate (striations may not be discernible on some specimens); preanal setae somewhat shorter than posterior marginals, adanal considerably longer than preanals; perianal setae generally longer than preanals.

Setae pd₂ of femur I not enlarged, similar to pd₁; genual setae smooth, of medium length (fig. 87).
FIGS. 77-78. — Holocelaeno iota n. sp.
77 : Dorsum of female ; 78 : Venter of female.

FIGS. 79-80. — Holocelaeno jasius n. sp.
79 : Venter of female ; 80 : Dorsum of female.
MALE.

Unknown.

HABITAT AND LOCALITY.

Eight females on Coprophanaeus jasius Oliv. from Paraguay (FMC). The holotype female will be deposited in the collection of the Field Museum of Natural History, Chicago, Illinois. Paratype females will be placed in the following institutions: USNM, BM(NH), IA, ISR, ZAL.

The general facies of $H. jasius$ are similar to Berlese’s $H. interrupta$ (page 48). Differences in dorsal setation are, however, sufficient to warrant separation of the two species.

**Holocelaeno jugulans** Berlese.


Several specimens of $H. jugulans$ are in Berlese’s collection under the name *Macrocheles jugulans*. The type specimens are on a slide numbered 176/17 (one male and two females), with a second slide (male and female) bearing the number 176-18. These specimens were collected from the gular region of a phaneid beetle (“Inveni arcte adfixum ad collum Phanaei cuisdam”), possibly the same specimen from which $H. hypocrita$ was taken (slide 176/19). Several specimens in the writer’s collection were found on Bolbites oritoides, a known host for $H. hypocrita$. This example of multiple phoresy is of interest because of the degree of similarity between males and females of $H. jugulans$ and $H. hypocrita$. Reduction in the ventrianal shield of the female and of the setation in the ventrianal area of the male, for example, is common to both forms. The location on the beetle carrier of the two species ($H. hypocrita$ under the elytra and $H. jugulans$ in the gular area) may point to specificity in attachment sites on the beetle, a phenomenon heretofore not observed.

Berlese’s collection of *jugulans* includes, in addition to the specimens mentioned above, another slide (9/33) and a vial of specimens in alcohol. The following description is based on the study of type material, and on examination of specimens at hand.

FEMALE (figs. 81, 84-85).

Length of dorsal shield of type specimens 860-920 μ; width 510-570 μ (length of dorsal shield of available specimens with a range of 790-869 μ; width at level of coxae II with a range of 474-506 μ).

**Dorsal shield** (fig. 81) finely punctate, with transverse lines and muscle insertion patterns as illustrated; shield somewhat narrowed posteriorly, not covering a
FIGS. 81-85. — *Holocelaeno jugulans* (Berlese).
81: Dorsum of female; 82: Dorsum of male; 83: Chelicera of male; 84: Genu IV of female; 85: Venter of female.
large portion of the posterior dorsum; without lateral and posterior band of chitinized integument; setae D₁ long and narrow, subequal to D₂ and half again as long as elongated, smooth M₁; D₂–, M₂, L₁– and Mg setae longer than other dorsals, often reaching or surpassing the insertions of the setae behind them; other lateral and median setae somewhat shorter, but not as short as the D₅–, M₃– central group; D₉ short, plumose, less than 1/2 the length of Mg₁₀. Integumental setae long, spinose, generally surpassing insertions of setae behind them.

Sternal shield (fig. 85) punctate throughout, with l.o.a. strongly arched, often appearing weak; l.m.t. slightly curved or virtually straight, also appearing weak in some specimens, l.o.p. distinct; sternal setae long and smooth, extending beyond insertions of the setae behind them; metasternal and epigynial setae similarly long.

Ventrianal shield (fig. 85) obovate-elongate, punctate and ornamented as illustrated; with three pairs of long preanal setae, the two posterior pairs being close to the border of the shield; adanal setae longer than preanals, but shorter than sternals; perianal setae as long as, or longer than, preanals.

Setae pd₁–pd₄ of femur I subequal; setae of genu IV long, with pd₄ easily surpassing insertion of distally pilose pd₁; ad₄ and al₁ also may be pilose distally (fig. 84).

Male (figs 82–83, 86).

Length of dorsal shield of type specimen 630 μ; width 400 μ (length of dorsal shield of two examples at hand averages 616 μ; width at coxae II averages 357 μ).

Dorsal shield (fig. 82) similar to that of female, but covering virtually the entire dorsum; some of the dorsal setae longer than those of female.

Holoventral shield (fig. 86) reticulate-punctate anteriorly and medially, with transverse pattern posteriorly; holoventral setae spinose, long, the third pair (sternals III) attaining the insertions of the fourth (metasternals); adanals and perianals subequal, distinctly longer than preanals.

With a spur on the venter of femur II; setation on genu IV similar to that of female (fig. 84); sperm transfer organ of chelicera (fig. 83) S-curved; as long as digitus mobilis; cheliceral brush approximately twice the length of the digitus mobilis.

Habitat and locality.

The type specimens (slide 176/17, Berlese Collection, Florence) were taken from a phanaeid beetle. Additional collections are as follows: two females on Bolbites onitoides Har. from Rosario, Argentina (USNM); one female on B. onitoides from Cordoba, Argentina, 23 December 1952 (USNM); three females and two males on B. onitoides from Mendoza, Argentina (FMC).
Holocelaeno longicoma Berlese.

Holocelaeno longicoma, A. Berlese (1910), Redia 6 : 250.
Holocelaeno (Trichoholocelaeno) longicoma, A. Berlese (1918), Redia 13 : 176.

H. longicoma was described from a single male specimen (slide 90/32) which is in the Berlese collection, Florence, Italy.

It has already been noted that H. longicoma and H. bursiformis Berlese may be conspecific (page 29), but that evidence to support this theory is yet to be found.

The following description is taken from observations of the poorly preserved type specimen, and from unpublished drawings in Berlese’s notebooks.

Male (figs. 88-89).

Length of dorsal shield 364 μ; width 220 μ.

Dorsal shield (fig. 89) with punctate pattern; D1 spinose, short, subequal to D2; D3-4, M4-5 short, smooth; other dorsal setae moderately to extremely long, and pectinate throughout most of their length; many setae extending well beyond the borders of the shield and measuring over half the length of the body (e.g., seta D4 measures 188 μ, as compared to a dorsal shield length of 220 μ). Integumental setae also long, but not equal to Mg setal length.

Holoventral shield weakly reticulate, with short smooth setae; adanals somewhat longer than preanals.

Spur on femur II large, dentate on internal angle. Sperm transfer organ of chelicera curved, longer than digitus mobilis (fig. 88).

Female.

Unknown.

Habitat and locality.

One male on Dichotomius carolinus (L.) from North America, in the collection of the Stazione di Entomologia Agraria, Florence, Italy.

Holocelaeno magna Berlese.


H. magna was described from a short series of female specimens (Slides 91/38-40) from Phanaeus perspicillatus, a species which is not listed in the check list by Black-
Fig. 86. — *Holocelaeno jugulans* (Berlese). Venter of male.

Fig. 87. — *Holocelaeno jasius* n. sp. Genu IV of female.

Figs. 88-89. — *Holocelaeno longicoma* (Berlese).
88 : Chelicera of male; 89 : Dorsum of male.

Figs. 90-91. — *Holocelaeno magna* Berlese.
90 : Dorsum of female; 91 : Genu IV of female.
FEMALE (figs. 90-92).

Length of dorsal shield of type (Slide No. 91/38) ca. 1000 μ; width 600 μ (length of dorsal shield of specimens at hand with a range of 956-1019 μ; width at level of coxae II ranging from 608-671 μ).

Dorsal shield (fig. 90) finely punctate, with or without a sclerotized band of integument adjacent to it; without distinct series of anterior reticulate lines, transverse line through D3-L1-Mg, strong, punctate; portions of lines posterior to D3 line also strongly punctate. Setae D1 distally plumose, broad throughout, longer than D2; other dorsal setae short to minute, with lateral and marginal setae little longer than dorsocentrals, D9 as long, or longer than, Mg. Integumental setae acicular, no longer than Mg setae.

Sternal shield (fig. 92) strongly punctate-reticulate throughout, with distinctive pattern as illustrated; l.o.a., l.m.t. well-developed, but generally no more so than surrounding lines of ornamentation, l.m.t. virtually straight or slightly procurved; sternal setae smooth, long, not quite reaching the insertions of the setae behind them.

Ventral shield (fig. 92) obovate, with strong reticulate pattern of punctate lines; preanals long, the anterior pair surpassing the insertions of preanals II; adanals considerably longer and stouter than preanals, often slightly pilose; occasionally with a lateral and posterior "shelf" of sclerotized striated integument adjacent to the shield. Perianal setae generally shorter than preanals.

Cheliceral brush extending well beyond digitus mobilis. Seta pd2 of femur I noticeably stouter than pd1, pilose distally. Seta pd2 of genu IV distally pilose, not extending to insertion of pd1, ad1 similarly pilose; genual setae spinose, fairly short (fig. 91).

MALE.

Unknown.

HABITAT AND LOCALITY.

The holotype and paratype females (Slides 91/38-40) on Phanaeus perspicillatus [?] from Ecuador (BERLESE Collection). Additional specimens as follows: two females "on green scarabaeid", Muzo, Colombia, BEQUAERT, coll.; one female on Oxysternon festivum L. from Brazil (FMC); two females on Oxysternon conspicillatum Web. from Peru (FMC).
Fig. 92. — Holocelaeno magna Berlese. Venter of female.

Figs. 93-95. — Holocelaeno melisi n. sp.
93: Dorsum of male; 94: Venter of male; 95: Venter of female.
Holoeelaeno melisi n. sp.

**Female** (figs. 95-97).

Length of dorsal shield with a range of 751-948 μ; width at level of coxae II ranging from 474-561 μ.

*Dorsal shield* (fig. 96) granular, with transverse lines and portions of lines as illustrated; observed specimens with a strong lateral and posterior band of sclerotized, striated integument; setae D₁ long, spinose, subequal to acicular D₂; Mg₁ (humeral setae) subequal to D₁, central and posterior marginal hairs small to minute, M₉, L₉, and anterior Mg setae somewhat longer; D₉ plumose, subequal to or shorter than Mg₁₀. Integumental setae short, acicular, similar to posterior Mg setae.

*Sternal shield* (fig. 95) similar to that of *H. brachychaeta* (fig. 29), l.o.a. and l.m.t. strong, l.m.t. broken medially of insertions of sternals II; l.o.p. distinct; sternal setae II attaining insertions of sternals III.

*Ventral shield* (fig. 95) granular, subtriangular, somewhat rounded, approximately as broad as long and with transverse lines as illustrated; preanal setae short, acicular, not as long as adanals; perianals similar to preanals.

Cheliceral brush extending beyond *digitus mobilis* by nearly half its length; seta pd₂ of femur I somewhat broader, but no longer, than pd₁. Seta pd₂ of genu IV, (fig. 97) does not reach insertion of pd₁; genual setae smooth, not overly long.

**Male** (figs. 93-94).

Length of dorsal shield 608 μ; width at coxae II 458 μ.

*Dorsal shield* (fig. 93) ornamented as illustrated, with posterior ridges not found in the female; lateral sclerotized strip not developed. Setae D₁ as in female; D₃-₄, M₂-₄ short, but longer than the corresponding setae of the female; other dorsal setae considerably longer than those of female, with many being distally pilose as in *H. longicauda* (fig. 89); D₂ longer than D₁; D₃-D₄, M₂, L₁-₆, and Mg setae easily long enough to surpass insertions behind them; D₉ plumose proximally, not as long as Mg₁₀; with some of the integumental hairs inserted on the edge of the dorsal shield.

*Holovenal shield* (fig. 94) strongly ornamented as illustrated; l.o.a., l.m.t. distinct as in female, posterior portion of the shield reticulate; holovenal setae long, but only a few long enough to surpass setal insertions behind them.

Sperm transfer organ of *chelicera* stout, little longer than movable digit; femoral spur rounded distally.
Figs. 96-97. — *Holocelaeno melisi* n. sp.
96: Dorsum of female; 97: Genu IV of female.

Figs. 98-99. — *Holocelaeno mitis* Berlese.
98: Venter of female; 99: Dorsum of female.
HABITAT AND LOCALITY.

Two females and one male on Phanaeus bonariensis (Gory) from Brazil (FMC); four females on Taurocops mimas L. from Brazil (FMC); three females on Taurocops cadmus Har. from Brazil (FMC). The holotype female and allotype male will be placed in the collection of the Field Natural History Museum, Chicago, Illinois. Paratype females will be deposited in the following institutions: USNM, BM(NH), IA, OSU.

The occurrence of H. melisi on species of both Phanaeus and Taurocops reflects a similar situation in the known host range of H. amygdaligera (page 19). The populations of amygdaligera on Phanaeus splendidulus have been found to vary in certain ways from populations of amygdaligera on Taurocops mimas (fig. 3). Such variation is not quite so obvious between specimens of H. melisi from Phanaeus bonariensis, and from Taurocops mimas and T. cadmus, although specimens of H. melisi from T. mimas generally are larger than those from other scarab species. The involvement of Holocelaeno species on species of both Phanaeus and Taurocops may reflect a degree of competition between these scarabs where their geographic ranges coincide. Unfortunately, little is yet known of the behavior of these insects in natural situations.

This species is named in honor of the late Dr. Antonio Melis, who was Director of the Stazione di Entomologia Agraria in Florence until his death in 1963.

Holocelaeno mitis Berlese.

Holocelaeno mitis, A. Berlese (1910), Redia 6 : 249.

H. mitis, the type species of the genus Holocelaeno, was cited by Berlese as occurring around the head region of Deltochilum gibbosum (F.) in Texas. A single specimen in the writer’s collection is from the same host, also collected in Texas. The following description is based both on the type specimen (slide 90/27, Berlese Collection, Florence) and on the specimen at hand.

FEMALE (figs. 98-100).

Length of dorsal shield of type specimen 510 µ; width 380 µ (length and width of dorsal shield of specimen in collection 321 × 344 µ).

Dorsal shield (fig. 99) finely granular, with tranverse lines and portions of lines as illustrated, narrowed in posterior half. Setae D₁ spinose, thicker but no longer than D₂; M₁ less than half the length of D₁; D₉₄ short, equal in length to dorso-centrals; M₂ and L₁ longer than D₃; Mg₁ considerably longer than any of the dorsal setae, other Mg setae little longer than dorso-centrals; D₉ short and plumose, shorter than Mg₁₀; integumental setae spinose, subequal to marginals.
Sternal shield (fig. 98) with l.o.a. and l.m.t. arched anteriorly, l.o.a. is weak and concave medially, l.o.p. distinct; sternal setae not quite long enough to attain insertions of setae behind them; metasternal and epigynial setae subequal to sternals.

Ventralian shield (fig. 98) pyriform, granular, with weak pattern of lines; preanals short, smooth, approximately half the length of the adanals; perianal setae equal to preanals.

Cheliceral brush extends beyond the movable digit by less than half its length; pd₂ of femur I subequal to pd₁, setae of genu IV (fig. 100) short, smooth.

MALE.
Unknown.

HABITAT AND LOCALITY.

Holotype female (BERLESE Collection) and one additional female on Deltochilum gibbosum (F.) from Texas, U. S. A.

Holocelaeno neophanei n. sp.

FEMALE (figs. 101-102, 104).

Length of dorsal shield with a range of 498-514 μ; width at level of coxae II ranging from 332-356 μ.

Dorsal shield (fig. 104) finely granular, with a strong anterior and lateral pattern of transverse lines, lines through D₄-L₄, D₅-L₅ and posterolateral lines punctate; with a broad lateral and posterior band of chitiniized integument adjacent to shield. Setae D₁ long, spinose, approximately twice the length of D₂, M₁ minute; Mg₁ (humeral setae) as long as D₁, other Mg setae shorter; dorsocentrals minute, D₉ plumose and shorter than Mg₁₀; integumental setae short, similar to posterior marginals.

Sternal shield (fig. 102) strongly granular; medial portion of l.o.a. evanescent, l.o.p. represented by a weak punctate line which terminates short of l.m.t.; sternal setae may or may not barely attain insertions of setae behind them.

Ventralian shield (fig. 102) pyriform, with a single anterior transverse line through preanals I and a series of weak broken punctate lines posteriorly; preanals quite short, with preanals I not reaching line of insertion of preanals II; adanals twice as long as preanal setae; perianals generally longer than preanals but not quite as long as adanals.

Cheliceral brush not extending over half its length beyond movable digit. Seta pd₂ of femur I not enlarged, subequal to pd₁. Setae of genu IV (fig. 101) short, spinose, without pilosity; pd₂ does not reach insertion of pd₁.
Fig. 100. — *Holocelaeno mitis* Berlese. Genu IV of female.

Figs. 101-104. — *Holocelaeno neophanaei* n. sp.
101: Genu IV of female; 102: Venter of female;
103: Venter of male; 104: Dorsum of female.

Fig. 105. — *Holocelaeno palaeno* n. sp. Venter of female.
MALE (fig. 103).

Length of dorsal shield 387 μ; width at level of coxae II 277 μ.

Dorsal shield granular, similar in some respects to that of female (i.e. anterior and lateral line patterns); most of the anterior setae subequal to seta D, Mg longer than D; shield without chitinized integumental rim.

Holoventral shield (fig. 103) with ornamentation similar to that found on female, with a well developed I.m.t. and medially evanescent l.o.a.; posterior portion strongly granular and lightly reticulate; preanal setae shorter than other holoventral setae.

Sperm transfer organ of chelicera S-curved, equal in length to the movable digit; spur on femur IV large, lightly toothed internally. Setae of genu IV similar to those of female, but appearing slightly longer.

HABITAT AND LOCALITY.

Seven females and one male on Phanaeus dardanus M’Leay from Brazil (FMC). The holotype female and paratype male will be deposited in the collection of the Field Museum of Natural History, Chicago, Illinois. Paratype females will be deposited in the following collections: USNM, BM(NH), IA, ZAL, OSU.

Holocelaeno palaeno n. sp.

FEMALE (figs. 105-107).

Length of dorsal shield with a range of 514-577 μ; width at level of coxae II with a range of 332-387 μ.

Dorsal shield (fig. 106) finely granular, with the usual anterior and lateral lines; shield strongly reticulate except in median portion. Setae D1-D4 subequal, longer than D9-D3, M, more than half the length of D; M, L, and anterior Mg setae longer than more posterior setae; D9 short, broad, basally plumose, half the length of Mg10. Integumental setae long, smooth, similar to posterior Mg setae.

Sternal shield (fig. 105) considerably broader than long, granular; line l.o.a. interrupted or evanescent medially, I.m.t. curved, nearly touching the posterior border of the shield in its central portion, l.o.p. distinct; sternal setae long and smooth, attaining insertions of setae behind them; epigynial and mestasternal setae similarly elongate.

Ventrianal shield (fig. 105) pyriform, rounded anteriorly, granular throughout and with reticulate pattern; preanal setae distinctly shorter than adanals, which are subequal to sternals I; perianals generally longer than preanals.

Figs. 106-107. — Holocelaeno palaeno n. sp.

Figs. 108-110. — Holocelaeno phanaei Berlese
(drawn from type specimen, slide 91/14, Berlese Collection, Florence).
108: Ventrianal shield of female; 109: Sternal shield of female;
110: Anterior portion of dorsal shield of female.
Cheliceral brush extending only a short distance beyond end of movable digit. Setae pd₄ and pd₁ of femur I subequal, not enlarged; setae of genu IV smooth; seta pd₄ not long enough to surpass insertion of pd₁, seta al₁ somewhat longer than other genual setae (fig. 107).

**Male.**

Unknown.

**Habitat and locality.**

Six females on *Phanaeus palaeo* Blanch. from Villarcia, Paraguay (FMC). The holotype female will be placed in the collection of the Field Museum of Natural History, Chicago, Illinois. Paratypes will be deposited in the following collections: USNM, BM(NH), ZAL, IA, OSU.

*Holocelaeno phanaei* Berlese.


Examination of the type specimen of *H. phanaei* in Florence (slide No. 91/14) revealed certain characters which differ both from the description by Evans and Hyatt (1963), and from the specimens in my collection. These differences, however, are not considered sufficient for the erection of a new specific category. They will be mentioned in the course of the description which follows.

**Female** (figs. 108-110, 113).

Length of dorsal shield with a range of 506-553 μ; width at level of coxae II ranging from 316-348 μ.

**Dorsal shield** (fig. 110) finely granular, often with a lateral and posterior rim of striated, chitinized integument; with a series of strong transverse lines anteriorly and laterally, including a partial line which connects the insertions of D₄ and L₂ (this line is interrupted between D₄ and L₂ in the type specimen); setae D₁ spinose, longer than D₂, dorsal setae generally short and smooth: D₉ plumose, nearly as long as M₉₁₀. Integumental setae as long as, or longer than, the adjacent marginal setae.

**Sternal shield** (figs. 109) granular, with medially interrupted l.o.a. which terminates anterior to insertions of sternals II (line l.o.a. of the type specimen (fig. 109) appears to curve posteriorly to the insertions of sternals II, although the lateral extensions of the line may have been obscured); line l.m.t., virtually straight, well-defined, l.o.p. weak, often hard to discern; sternal setae long, not quite attaining the insertions of the setae behind them.
**Ventrianal shield** (fig. 108) subtriangular, rounded anteriorly, granular and with a series of distinct reticulations; preanal setae short, smooth, with preanals I not quite surpassing the insertions of preanals II; adanal distinctly longer than preanals, perianals and preanals subequal in length.

Cheliceral brush extends beyond end of movable digit by nearly half its length.

Seta pd₂ of genu IV not attaining insertion of pd₁ (fig. 113); genual setae short, smooth.

**MALE** (figs. III-I12).

Length of dorsal shield 474 μ; width at level of coxae II 356 μ.

**Dorsal shield** (fig. III) with anterior and lateral transverse lines less developed than in the female; line between D₄ and L₂ interrupted; dorsocentral setae short as in female, but anterior and lateral setae longer, as illustrated.

Anterior portion of **holoventral shield** (fig. II2) with l.m.t. weakened medially, l.o.a. as in female; granular throughout and with a strong reticulate pattern in the posterior portion; holoventral setae long and smooth, but none surpassing the insertion behind it.

Sperm transfer organ of **chelicera** curved basally, somewhat longer than movable digit; femur II with a knobbed ventral spur, genu II with a broad-based acuminate seta ventrally; genu IV similar to that of female.

**Habitat and Locality.**

The holotype female (slide 91/14) and additional females (91/15, 91/16, 147/19, 191/24) on Phanaeus perspicillatus [?] in Ecuador. Evans and Hyatt (1963) examined four females from Phanaeus splendidulus F. collected in Ecuador. The collection at hand includes four females and a male from Phanaeus splendidulus found in Brazil (FMC), and two females on Oxysternon conspicillatum (Web.) from Peru.

The male specimen of **phanaei**, along with representative female examples, will be deposited in the Field Museum of Natural History, Chicago, Illinois.

The association of **H. phanaei** with at least two closely related species of phanaeid scarabs (the identity of **P. perspicillatus** is in question) parallels that of **H. melisi** with P. bonariensis and species of Taurocopsis except that, in the case of **H. phanaei**, size differences between populations from different hosts are not discernible. Both examples indicate a competitive situation for the host scarabs where there is an overlap of geographic range.

**Holocelaeno pontigera** Berlese.


The following brief description is derived from examination of Berlese's type specimens at Florence, Italy.
Figs. 111-113. — Holocelaeno phanaei Berlese.
111: Dorsum of male; 112: Venter of male; 113: Genu IV of female.

Figs. 114-116. — Holocelaeno pontigera Berlese
(drawn from type specimen, slide 191/23, Berlese Collection, Florence).
114: Sternal shield of female; 115: Anterior portion of female dorsal shield;
116: Ventrianal shield of female.
FEMALE (figs. II4-II6).

Length of dorsal shield 650 μ; width 500 μ.

Dorsal shield (fig. II5) finely granular, without distinct transverse lines anteriorly and laterally; setae D1 spinose, considerably longer than D2. M1 minute; Mg1 (humerals) subequal to D1, other dorsal setae short and smooth. Integumental setae subequal to posterior Mg setae.

Sternal shield (fig. II4) finely punctate, deeply concave posteriorly; line l.m.t. virtually straight, l.o.a. evanescent medially, l.o.p. not clear; sternal setae not long enough to attain insertions of setae behind them.

Ventralan shield (fig. II6) subtriangular, with distinct anterior transverse lines and less distinct posterior ornamentation; preanals short, the anterior pair not reaching insertions of preanals II, adanals distinctly longer than preanals.

Setal conditions of femur I and genu IV not observed.

MALE.

Unknown.

HABITAT AND LOCALITY.

Several females on Deltochilum sp. from "La Plata" (Cl. SPEGAZZINI, coll.). The holotype female (slide 197/23) and several specimens in alcohol (vial 35/1721) are in the collection of the Stazione di Entomologia Agraria, Florence, Italy.

Holocelaeno ritcheri n. sp.

FEMALE (figs. II7-II9).

Length of dorsal shield with a range of 790-830 μ; width at level of coxae II with a range of 450-458 μ.

Dorsal shield (fig. II8) granular, with typical anterior and lateral lines; with distinctive line pattern posterolaterally as illustrated. Setae D1 spinose, broadened basally, longer than D2; dorsocentral setae minute, other dorsals longer but none as long as D1; D9 minute, plumose, shorter than Mg10. Integumental setae similar to posterior marginal setae.

Sternal shield (fig. II7) granular throughout, with medially interrupted l.o.a. and virtually straight l.m.t., l.o.p. poorly defined; sternal setae not quite long enough to surpass insertions of setae behind them.

Ventralan shield (fig. II7) elongate, broad, with strong reticulate pattern throughout; preanal setae long, with preanals I attaining the line of insertion of preanals II; adanals subequal to sternals, perianals shorter than preanals.
Figs. 117-119. — *Holocelaeno ritcheri* n. sp.

Figs. 120-122. — *Holocelaeno rotunda* Berlese.
120: Venter of female; 121: Genu IV of female; 122: Venter of male.
Cheliceral brush short, barely surpassing the end of the movable digit. Seta pd₂ of femur I subequal to pd₁, not greatly enlarged. Seta pd₂ of genu IV broadened, not quite reaching insertion of pd₁ which also is broad (fig. 119); genual setae generally short (al₁ slightly longer than others).

**MALE.**

**HABITAT AND LOCALITY.**

Two females on *Phanaeus endymion* Har. from Mexico, and one female on *P. velutinus* Murr. from Panama (FMC). The holotype female will be sent to the Field Museum of Natural History, Chicago, Illinois. Paratypes will be deposited as follows: USNM, OSU.

This species is named in honor of Dr. Paul O. Ritcher, specialist on larval Scarabaeidae at Oregon State University.

*Holocelaeno rotunda* Berlese.

*Holocelaeno rotunda*, A. Berlese (1910), Redia 6: 249.

Berlese’s type series of *H. rotunda* contains at least one specimen on which may be found four pairs of preanal setae, rather than three (slide 90/21). Specimens from the same host — most probably the same insect — have only three pairs of preanals (slide 90/22, for example). Specimens with three and four pairs of preanal setae also are found in the collection presently available for study. Inclusion of a fourth pair of setae on the shield may be as a result of laterally extended sclerotization of the shield due to aging.

The following description is derived from examination of Berlese’s type material, and from study of material in the collection at hand.

**FEMALE** (figs. 120-121, 123).

Length of dorsal shield of one type specimen (90/21) 660 μ; width 420 μ (length of shield of available specimens with a range of 585-656 μ; width at coxae II ranging from 379-411 μ).

*Dorsal shield* (fig. 123) well sclerotized, with line pattern as illustrated; with a broad chitinized striated rim laterally and posteriorly. Setae D₁ broad basally, spinose, situated on a slight anterior projection, longer than D₂ or M₁; other dorsal setae short, acicular, smooth except for D₉ which is subequal to M₉₁₀. Integumental setae also short, smooth.

*Sternal shield* (fig. 120) strongly chitinized, with well-developed l.o.a.; l.m.t. and l.o.p. forming punctate transverse line; sternal setae elongate, easily surpassing insertions of setae behind them.
Ventral shield (fig. 120) strongly chitinized, broader than long and with pattern of transverse punctate lines; with three pairs of short preanal setae (occasionally with a pair of anterior perianal setae inserted on the shield anterolateral of preanal II); adanal considerably longer than preanal. Perianal setae similar in length to preanals.

Cheliceral brush extends beyond movable digit by less than half its length. Setae pd₁-pd₄ of femur I subequal, not enlarged. Seta pd₄ of genu IV (fig. 121) not quite attaining insertion of pd₁; genual setae long, narrow, smooth.

**Figs. 123-124.** — *Holocelaeno rotunda* Berlese.
123 : Dorsum of female; 124 : Dorsum of male.

**Male** (figs. 122, 124).

Length of dorsal shield of type specimen (slide 90/20) 470 μ; width 300 μ (length of dorsal shield of specimen in collection 456 μ; width at level of coxae II 308 μ).

Dorsal shield (fig. 124) with pattern of lines as illustrated; anterior, lateral and posterior dorsal setae considerably longer than in female; Mg₁ longer than other setae; with integumental setae inserted on the chitinized rim of the shield.
Holocelaeno scapularis (Evans and Hyatt).


The following brief description is derived completely from the original description by Evans and Hyatt.

FEMALE.

Dorsal shield 570 μ long and 370 μ wide, finely granular, without ornamentation. Setae D₁ short, spinose, little longer than D₃; Mg₁ (humerals) considerably longer than D₁, other dorsal setae quite short and smooth [D₉ ?].

Sternal shield coarsely granular marginally, with medially interrupted l.o.a. and without apparent l.m.t.; l.o.p. not observed; sternal setae not quite long enough to surpass insertions behind them.

Ventral shield ovoid, granular, and without ornamentation; preanals longer than most dorsal setae but preanals I do not reach line of insertion of preanals II; adanals similar to sternals in length.

Cheliceral brush little longer than movable digit; genual setae simple.

MALE.

Unknown.
HABITAT AND LOCALITY.

A single female on Deltochilum lobipes Bates from North America (British Museum Collection).

Holocelaeno shoemakei n. sp.

FEMALE (figs. 125-126, 128).

Length of dorsal shield with a range of 585-600 μ; width at level of coxae II ranging from 371-395 μ.

Dorsal shield (fig. 126) strongly reticulate, with a nearly continuous line through D₁-L₂-Mg₂; with a strong chitinized striated rim of integument laterally and posteriorly. Setae D₁ short, acuminate, somewhat longer than D₂; dorsal setae, including Mg₁, short, smooth (D₉ plumose, slightly shorter than Mg₁₀); integumental setae short, smooth, similar to Mg setae.

Sternal shield (fig. 125) heavily sclerotized, with punctate reticulate medial and posterior patterns as illustrated; L.o.a. strongly punctate, variously divided medially; l.m.t. and l.o.p. forming strongly arched punctate line (or lines) curving posterolaterally to the region of sternals III; lateral portions of l.m.t. connect to arched l.m.t.-l.o.p. line from insertions of sternals II; sternal setae long, acicular, not quite reaching insertions of setae behind them.

Ventrianal shield (fig. 125) heavily sclerotized, broader than long, and with distinct punctate-reticulate pattern; specimens at hand with lateral strips of striated chitinized integument similar to that found bordering the dorsal shield; preanals short, smooth, half as long as adanals; perianal setae similar to preanals, with one pair inserted in the chitinized rim laterad of preanals I-II, and one pair laterad of preanals III.

Cheliceral brush little longer than movable digit. Seta pd₂ of femur I somewhat shorter than pd₁, but not broadened. Seta pd₂ of genu IV short, broad, not long enough to reach insertion of pd₁; other genual setae also short (fig. 128).

MALE (fig. 127).

Length of dorsal shield 482 μ; width at level of coxae II 340 μ.

Dorsal shield strongly chitinized and reticulate, similar in most respects to that of female; dorsal setae as in female; lateral and posterior chitinized rim absent.

Holoventral shield (fig. 127) strongly punctate-reticulate, the anterior portion similar to the sternal shield of the female.

Sperm transfer organ of chelicera curved basally, acuminate distally, little longer than movable digit. Spur on femur II (present only on one side!) rounded distally, typical of genus; genual setae as in female.
Figs. 125-128. — Holocelaeno shoemakeri n. sp.
Figs. 129-130. — Holocelaeno singeri n. sp.
129: Genu IV of female; 130: Venter of female.
HABITAT AND LOCALITY.

Two females and a male on Oxysternon conspicillatum (Web.) from Peru (FMC). The holotype female and allotype male will be deposited in the collection of the Field Museum of Natural History, Chicago, Illinois. The paratype female will be sent to the U. S. National Museum, Washington, D. C.

This species is named in honor of R. O. Shoemaker, former student and collaborator on research in the Acarina.

Holocelaeno singeri n. sp.

FEMALE (figs. 129-131).

Length of dorsal shield with a range of 743-806 μ; width at level of coxae II ranging from 450-513 μ.

Dorsal shield (fig. 131) finely punctate, ornamented with transverse lines as illustrated; with a broad lateral and posterior sclerotized striated strip of integument; setae D₁ spinose, longer than M₁; D₂ subequal to D₁, but not reaching D₃ insertions; anterior setae (D₁₉, M₂, L₁, Mg₁₄) longer than more posterior setae but not long enough to reach insertions of setae behind them; D₉ shorter than Mg₁₀, plumose. Integumental setae short, spinose, similar to posterior Mg setae.

Sternal shield (fig. 130) with weakly developed l.o.a., l.m.t. and l.o.p., punctate throughout and reticulate medially, as in H. hanselli (fig. 64); sternal setae long, extending slightly beyond insertions of setae behind them.

Ventrianal shield (fig. 130) subtriangular, finely punctate and with transverse lines as illustrated; preanal setae short, spinose, subequal to or shorter than perianal setae; adanal considerably longer than preanals.

Cheliceral brush little longer than digitus mobilis. Seta pd₂ of femur I short; stout; pd₄ spinose. Seta pd₄ of genu IV (fig. 129) extends to or beyond insertion of pd₁; genual setae long, smooth.

MALE.

Unknown.

HABITAT AND LOCALITY.

Seven females on Phanaeus lancifer (L.) from “South America” (FMC); two females on Phanaeus lancifer from British Guiana, Wm. Schaus, coll. (USNM). The holotype female will be sent to the U. S. National Museum, Washington, D. C. Paratype females will be deposited in the collections of the following institutions: FMC, BM(NH), IA, ZAL, OSU.
Fig. 131. — *Holocelaeno singeri* n. sp. Dorsum of female.

Figs. 132-134. — *Holocelaeno thyreos* n. sp.

132: Venter of female; 133: Genu IV of female; 134: Dorsum of female.
This species is named in honor of Dr. George Singer, former student and collaborator on macrochelid research.

**Holocelaeno thyreos** n. sp.

**Female** (figs. 132-134).

Length of dorsal shield with a range of 916-995 μ; width at level of coxae II with a range of 553-632 μ.

*Dorsal shield* (fig. 134) finely granular, weakly reticulate throughout, and without typical distinct line pattern anteriorly and laterally; setae D₁ very short, similar to other D setae, and to M₁; L and Mg setae slightly longer than D and M setae, D₉ lightly plumose, shorter than Mg₁₀. Integumental setae subequal to Mg setae.

*Sternal shield* (fig. 132) granular, weakly reticulate medially; l.o.a. arched laterally, evanescent medially, lateral portions of l.o.a. also may be weak; procurred line formed by l.m.t. and l.o.p. terminates at pores II, between setae II-III; lateral portions of l.m.t. evanescent, meeting the arched l.m.t.-l.o.p. in the lateral portions; anterior line connecting sternals I (linea anterior transversa) strong, distinctive; sternal setae not reaching insertions of setae behind them.

*Ventrianal shield* (fig. 132) elongate, pyriform, granular and with reticulate pattern throughout; preanal setae shorter than distances between their insertions, adanal subequal to sternals, considerably longer than preanals or perianals.

Cheliceral brush extending beyond movable digit less than half its length; seta pd₂ of femur I subequal to pdᵥ not enlarged. Seta pd₂ of genu IV long enough to reach insertion of pd₁ (fig. 133), ad₁ pilose distally.

**Male.**

Unknown.

**Habitat and Locality.**

Five females on *Deltochilum brasiliense* (Cart.) from Brazil (FMC). The holotype female will be sent to the Field Museum of Natural History, Chicago, Illinois. Paratype females will be placed as follows: USNM, BM(NH), OSU, ZAL.

*Holocelaeno trochantalis* Berlese.


*H. trochantalis* is represented on three slides in the BERLESE collection (91/17-19). The following description is based on a study of these slides, and on two specimens in the collection at hand.
Female (figs. 135-138).

Length of dorsal shield of type specimen (91/17) 850 μ; width 530 μ (length of dorsal shield of specimens at hand 727-822 μ; width at coxae 490-537 μ).

Dorsal shield (fig. 137) granular, with punctate line patterns as illustrated, with or without a narrow chitinized lateral and posterior rim. Setae D₁ spinose, sometimes inserted on a small anterior projection, subequal in length to D₂ but considerably longer than M₁; M₂, L₁-₂ and Mg setae as long as, or somewhat longer than D₁, other dorsals shorter; D₄ longer than D₅, D₉ plumose, slightly shorter than Mg₁₀; integumental setae not quite as long as Mg setae.

Sternal shield (fig. 135) strongly sculptured throughout; lightly reticulate medially and coarsely punctate-reticulate posteriorly; l.o.a. incomplete medially, the separation forming a short vertical "collar"; l.m.t., l.op. forming a strong punctate line pattern as illustrated; sternal setae long, reaching or nearly reaching the setal insertions behind them.

Ventrianal shield (fig. 135) large, broader than long and punctate-reticulate; preanals I barely reaching line of insertion of preanals II; adanals longer than preanal and perianal setae.

Cheliceral brush extends nearly half its length beyond movable digit. Seta pd₂ of femur I broader and longer than pd₁, distally pilose. Seta pd₄ of genu IV almost reaching insertion of pd₁ (fig. 138); genual setae long, smooth.

Male.

Unknown.

Habitat and locality.

Type series on "Copris ephialtes" (synonym of Dichotomius mormon Ljungh), Brazil. Two additional females on Dichotomius mormon from Brazil (FMC).

Holocelaeno turki (Evans and Hyatt).


H. turki was described from two specimens collected on Phanaeus telamon Erichs. from Panama. Two specimens in my collection were collected from a beetle identified as Phanaeus corythus Har., collected in Costa Rica.

Female (figs. 139-141).

Length and width of dorsal shield of type specimen 620 × 390 μ (length of dorsal shield of available specimens 624-648 μ).
Figs. 135-138. — Holocelaeno trochantalis Berlese.

135: Venter of female; 136: Portion of leg IV of the female, showing expanded trochanter; 137: Anterior portion of female dorsal shield (drawn from specimen on slide 91/18, Berlese Collection, Florence); 138: Genu IV of female.

Figs. 139-141. — Holocelaeno turki (Evans and Hyatt).

139: Genu IV of female; 140: Dorsum of female; 141: Venter of female.

Dorsal shield (fig. 140) granular, with series of anterior and lateral transverse lines as illustrated; with a chitinized band of striated integument laterally and posteriorly. Setae D₁ spinose, longer than D₂ or other dorsal setae; D₉ short, plumose, not as long as Mg₁₀; dorsal setae generally short and smooth; integumental setae equal in length to Mg setae.

Sternal shield (fig. 141) granular, with l.o.a. and l.m.t. medially interrupted or evanescent, l.o.p. represented by a short line originating at pores II; sternal setae long but not quite reaching insertions behind them.

Ventral shield (fig. 141) obovate, granular, with a transverse line through preanals I and a weak reticulate pattern posteriorly, preanals I longer than II-III, subequal to adanal setae; perianals shorter than preanals.

Cheliceral brush extends beyond movable digit by approximately half its length. Seta pd₂ of femur I not enlarged, subequal to pd₁. Seta pd₂ of genu IV (fig. 139) broadened basally, long enough to attain insertion of pd₁.

Male.

Unknown.

Habitat and locality.

The holotype and paratype females on Phanaeus telamon Erichs. collected at Volcan de Chiriqui, Panama (BM(NH)). Two additional females on Phanaeus corythus Har. from Santa Clara, Costa Rica; 2 December, 1924 (NEVERMANN, coll.).

Holocelaeno wenzeli n. sp.

Female (figs. 142-144).

Length of dorsal shield with a range of 1035-1090 µ; width at level of coxae II ranging from 640-687 µ.

Dorsal shield (fig. 142) granular and weakly reticulate, with transverse line pattern reduced as illustrated; shield somewhat attenuated posteriorly, exposing a portion of the dorsal integument. Setae D₁ widely separated, long, subequal to D₂; M₂, L₁-₃ and Mg setae elongate, some reaching or surpassing the insertions behind them, and some distally pilose; D₉ lightly pilose, less than half the length of Mg₁₀; integumental setae numerous, many reaching and surpassing setal insertions behind them.

Sternal shield (fig. 143) strongly granular and reticulate throughout; l.o.a. broken or divided medially, l.m.t. straight, sometimes divided laterally or confused.

1. One of the two available specimens of turki has an extra pair of ventrianal setae laterad of preanals II-III. An illustration of the ventrianal shield was included in a paper by KRANTZ (1962) and labeled as Holocelaeno sp.
with anterior ramifications of l.o.p.; l.a.t. (linea anterior transversa) strong, setting off a well chitinized anterior border; sternal setae long, sternals II reaching insertions of sternals III.

Ventral shield (fig. 143) oblong-ovate, granular and lightly reticulate throughout; preanal setae long, subequal to adanals; perianals smooth or pilose distally subequal to or shorter than preanals.

Cheliceral brush extending beyond movable digit for less than half its length. Setae pd₂ and pd₁ of femur I broadened and slightly pilose distally. Seta pd₂ of genu IV (fig. 144) not quite reaching pd₁ insertion; setae pd₁–₂, al₁, av₁, and pl₁ may be pilose distally.

**Male.**

Unknown.

**Habitat and Locality.**

Three females on *Phanaeus haroldi* Kirsch from Ecuador (FMC). The holotype female will be sent to the Field Museum of Natural History, Chicago, Illinois. Paratypes will be deposited in the following institutions : USNM, OSU.

This species is named in honor of Dr. R. E. Wenzel of the Field Museum of Natural History, Chicago, Illinois.

**Species incertae sedis.**

*Macrocheles fuscus* Berlese.


The type specimen of *M. fuscus* (slide 19/42) is the only preparation of the species available for examination (a sealed vial of specimens also exists). While some of the features of the type specimen are obscure, it appears that *fuscus* may belong to the genus *Holocelaeno*. The dorsal shield has 29 pairs of setae (fig. 146) and transverse anterior lines, and there are seven setae on genu IV. The chelicerae are obscure on the type, but may have filamentous brushes typical of the genus. The anterior end of the peritreme could not be determined with certainty, but it does appear to extend medially to setae M₁. The preanal setae are long (fig. 147), but are no longer than the adanals. The sternal shield is ornamented as illustrated (fig. 145).

Measurements of the dorsal shield length and width are 700 × 400 μ. The type series was collected at "La Plata" and no host was cited.

Examination of paratype specimens may clarify whether *fuscus* is a species of *Holocelaeno* or, possibly, a member of the species group *bregetovae* of Evans and Hyatt (1963).
FIGS. 142-144. — Holocelaeno wenzeli n. sp.
142: Dorsum of female; 143: Venter of female; 144: Genu IV of female.

FIGS. 145-147. — Macroleles fuscus Berlese
(drawn from type specimen, slide 19/42, Berlese Collection, Florence).
Summary.

The genus *Holocelaeno* Berlese (Acarina : Macrochelidae) is reviewed in light of several hundred collections from a variety of scarab beetle “hosts,” and from a study of the Berlese collection in Florence, Italy. Preliminary observations on mite-beetle relationships reveal a certain degree of specificity of a given mite species for a given species of beetle. It is hypothesized that this specificity is the result of niche specialization of the beetle host, with concomitant isolation of their mite associates.

Descriptions of 40 species of *Holocelaeno* are presented, of which 20 are listed as new. These are:

*Holocelaeno acinothrix*, *anogmos*, *axtelli*, *berlesei*, *brachychaeta*, *condyla*, *cosmothorax*, *costai*, *hadrosoma*, *hanselli*, *iota*, *jasius*, *melisi*, *neophanaei*, *palaeno*, *ritcheri*, *shoemakei*, *singeri*, *thyreos*, and *wenzeli*.

The following species are herein removed from the genus *Macrocheles* and placed in the genus *Holocelaeno*:


*Holocelaeno crispa* Berlese is reassigned to the genus *Macrocheles*. A key to species of the genus *Holocelaeno* is included.

Acknowledgements.

The author wishes to express his thanks to the following persons for their kind assistance in making mite and beetle specimens available for study: Drs. E. W. Baker and O. L. Cartwright, U. S. National Museum, Washington, D.C.; Dr. R. E. Wenzel, Field Museum of Natural History, Chicago, Illinois; the late Dr. Antonio Melis and Dr. F. Pegazzano, Stazione di Entomologia Agraria, Florence, Italy; Dr. G. O. Evans, British Museum (Natural History), London; Dr. M. H. Muma, Citrus Experiment Station, Lake Alfred, Florida; Dr. C. W. Rettenmeyer, Kansas State University, Manhattan.
<table>
<thead>
<tr>
<th>Species of Holocelaeno</th>
<th>Coprine scarab &quot;hosts&quot;</th>
</tr>
</thead>
</table>
| amygdaligera                 | *Phanaeus splendidulius*
|                              | *Taurocpris miras*           |
| acinontrix                   | *Megathopa astyanax*         |
| anogmos                      | *Phanaeus bellicosus*        |
| axtellii                     | *Phanaeus igneus*            |
|                              | *Onthophagus pennsylvanicus*|
| berclesi                     | *Dichotomius satans*        |
| brachycheila                 | *Phanaeus telamon*          |
| bursiformis                  | *Dichotomius carolinus*     |
| condyla                      | *Megathopa yucaeca*         |
| coprophilus                  | "scarabaeid beetle"         |
| cosmothorax                  | *Dichotomius carolinus*     |
|                              | *Phanaeus faunus*           |
| costai                       | *Phanaeus bellicosus*       |
| dubius                       | *Phanaeus splendidulius*    |
| expolita                     | *Phanaeus milon*            |
| floridanus                   | *Deltolchilum orbiculare*   |
| fuscata                      | *Phanaeus milon*            |
|                              | *Phanaeus corythus*         |
| grandis                      | *Deltolchilum lobipes*      |
| hadrosoma                    | *Dichotomius protectus*     |
| hanselli                     | *Phanaeus ensifer*          |
| hypocrita                    | *Bolbites notitoides*       |

1. Coprine hosts for *amygdaligera* listed by Evans and Hyatt (1963) are not included here. It is probable that species other than *amygdaligera* were included in their description and host list.
<table>
<thead>
<tr>
<th>interrupta</th>
<th>Phanaeus batesi</th>
</tr>
</thead>
<tbody>
<tr>
<td>iota</td>
<td>Phanaeus bellicosus</td>
</tr>
<tr>
<td>jasius</td>
<td>Cophropanaeus jasius</td>
</tr>
<tr>
<td>jugulans</td>
<td>Bolbites onitoides</td>
</tr>
<tr>
<td>longicoma</td>
<td>Dichotomius carolinus</td>
</tr>
</tbody>
</table>
| magna      | Phanaeus perspicillatus [?]
|            | Oxysternon conspicillatum |
|            | Oxysternon festivum |
| melisi     | Phanaeus bonariensis
|            | Taurocops minus |
|            | Taurocops cadmus |
| mitis      | Deltochilum gibbosum |
| neophanaei | Phanaeus dardanus |
| palaeno    | Phanaeus palaeno |
| phanaei    | Phanaeus perspicillatus [?]
|            | Phanaeus splendidulus |
|            | Oxysternon conspicillatum |
| pontigera  | Deltochilum sp. |
| ritcheri   | Phanaeus endymion
|            | Phanaeus velutinus |
| rotunda    | Dichotomius carolinus |
| scapularis | Deltochilum lobicps |
| shoemakei  | Oxysternon conspicillatum |
| singeri    | Phanaeus lancifer |
| thyreos    | Deltochilum brasiliense |
| trochantalis | Dichotomius mormon |
| turki      | Phanaeus telamon
|            | Phanaeus corythus |
| wenzeli    | Phanaeus haroldi |

1. Hyatt (1964) has a record of interrupta occurring on Megacephala carolina L., a cicindelid beetle. The present writer has not seen this collection.
<table>
<thead>
<tr>
<th>Species of Neopodocinum</th>
<th>Coprine scarab &quot;hosts&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>afrum</td>
<td><em>Heliocopris andersoni</em></td>
</tr>
<tr>
<td></td>
<td><em>Heliocopris antenor</em></td>
</tr>
<tr>
<td></td>
<td><em>Heliocopris hunteri</em></td>
</tr>
<tr>
<td></td>
<td><em>Heliocopris dilloni</em></td>
</tr>
<tr>
<td></td>
<td><em>Heliocopris haroldi</em></td>
</tr>
<tr>
<td>bartkei</td>
<td>Copris sp.</td>
</tr>
<tr>
<td>benoiti</td>
<td><em>Catharsius dux</em></td>
</tr>
<tr>
<td></td>
<td><em>Catharsius gorilla</em></td>
</tr>
<tr>
<td></td>
<td><em>Catharsius satyrus</em></td>
</tr>
<tr>
<td>benoiti var. ectopothrix</td>
<td><em>Catharsius dux</em></td>
</tr>
<tr>
<td>caputmedusae</td>
<td>Copris hispanus</td>
</tr>
<tr>
<td></td>
<td>Homalocopris tmolus</td>
</tr>
<tr>
<td>emodi</td>
<td>Geotrupes sp.</td>
</tr>
<tr>
<td>emodioides</td>
<td>Geotrupes genestieri</td>
</tr>
<tr>
<td>jaspersi</td>
<td>Heliocopris sp.</td>
</tr>
<tr>
<td></td>
<td>Copris molossus</td>
</tr>
<tr>
<td>javensis</td>
<td>Heliocopris bucephalus</td>
</tr>
<tr>
<td>magna</td>
<td><em>Heliocopris haroldi</em></td>
</tr>
<tr>
<td></td>
<td><em>Heliocopris sp.</em></td>
</tr>
<tr>
<td></td>
<td><em>Onitis artuosus</em></td>
</tr>
<tr>
<td></td>
<td><em>Onitis monstrosus</em></td>
</tr>
<tr>
<td>maius</td>
<td>Heliocopris sp.</td>
</tr>
<tr>
<td>meridionalis</td>
<td>Geotrupes silvaticus</td>
</tr>
<tr>
<td>setosum</td>
<td><em>Catharsius capucinus</em></td>
</tr>
<tr>
<td></td>
<td><em>Catharsius pithecus</em></td>
</tr>
<tr>
<td>spinirostris</td>
<td>Copris sp.</td>
</tr>
<tr>
<td>tshambi</td>
<td>Scarabaenus gangeticus</td>
</tr>
<tr>
<td>vanstraeleni</td>
<td>?</td>
</tr>
<tr>
<td>verschureni</td>
<td>&quot;avec coprophage&quot;</td>
</tr>
<tr>
<td>wenzeli</td>
<td>Homalocopris tmolus</td>
</tr>
</tbody>
</table>
BIBLIOGRAPHY