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Résumé en français (150 mots maximum)

Un genre nouveau, *Cyclaulacidea* gen. n. (espèce-type *C. bruchivorus* sp. n.) est décrit du Pérou et illustré. Il s'agit d'un parasitoïde des stades préimaginaux de la bruche *Caryoborus serripes*, qui attaque les fruits comestibles de plusieurs palmiers appartenant au genre *Astrocaryum*. Des données biologiques concernant les palmiers, la bruche et le parasitoïde sont fournies.

Résumé en Anglais

Cyclaulacidea gen. n. (type species *C. bruchivorus* sp. n.) from Peru is described and illustrated. It is a parasite of the immature stages of the bruchis beetle, *Caryoborus serripes*, which attacks the edible fruits of various palms of the genus *Astrocaryum*. Biological notes on the palms, the pest bruchid and the parasitoid are given

A NEW NEOTROPICAL BRACONINE (HYM., BRACONIDAE) PARASITIC ON BRUCHIDAE (COL.)

BY DONALD L.J. QUICKE & ALEX DELOBEL

ABSTRACT

Cyclaulacidea gen. n. (type species *C. bruchivorus* sp. n.) from Peru is described and illustrated. It is a parasite of the immature stages of the bruchid beetle, *Caryoborus serripes,* which attacks the edible fruits of various palms of the genus *Astrocaryum.* Biological notes on the palms, the pest bruchid and the parasitoid are given.

INTRODUCTION

Whilst preparing a key to the New World genera of braconine wasps as part of a larger project to produce an identification guide to the New World genera of Braconidae (Wharton & Marsh, in prep.), the senior author discovered a number of new genera (Quicke, in press, in prep.). One of the genera discovered, whilst being well represented in collections, has recently also come to light in a study by AD of South American palms of the genus *Astrocaryum* whose fruits produce a potable endosperm which is drunk by the indigenous peoples. The new genus and species are being described here to make names available for future work. Biological details presented are from the observations of AD whilst the generic and species descriptions are by DLJQ.

Terminology follows that of van Achterberg (1979). Wing veins are measured from the middles of their junctions except for forewing vein r. Museums are abbreviated as follows: Museum National d'Histoire Naturelle, Paris (MNHNP); Natural History Museum, London (BMNH); Nationaal Natuurhistorisch Museum, Leiden (NNML).

BIOLOGICAL OBSERVATIONS

Host plants

The new genus and species was reared from fallen fruits of three species of *Astrocaryum,* a palm belonging to the subfamily Arecoideae (Uhl & Dransfield, 1987), namely *A. chonta* Martins, *A. javarense* Trail ex Drude and *A. macrocalyx* Burret. *A. chonta* fruits were collected in Genaro Herrera (Ucayali river valley), *A. javarense* fruits came from Santa Cecelia (Maniti river valley), and *A. macrocalyx* fruits were collected in Quisto Cocha near Iquitos. Identification of the palms was made by F. Kahn following Kahn & Millán (1992). *A. chonta* is widespread in the south-western part of the Amazonian basin (in Peru and Bolivia); it grows in periodically flooded soils. *A. javarense* is distributed in the lower valley of the river Jauari in Brazil, and also in the lower Ucayali and Maniti valleys in Peru, on soils which are not subject to flooding. *A. macrocalyx* grows in the western part of the Amazonian basin, in Peru, Colombia and Brazil, on clayey to sandy

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soils (Kahn & Millán, 1992). The immature endosperm of the fruits is drunk by the natives, and occasionally sold on the Iquitos markets (Mejia, 1992). The vernacular name for the three species is 'huicongo' in Peru, and 'murumuru' in Brazil. Fruits of the three species measured approximately 3.5 to 5.5 cm in length and 2 to 3.5 cm maximum width. The endocarp was stony, 3 to 5 mm thick in *A. javarense,* and 1.5 to 2.5 mm in *A. chonta* and *A. macrocalyx.*

When fruits fall to the ground, the mesocarp, fleshy at maturity (in the case of *A. macrocalyx*) or dry (in the case of *A. chonta* and *A. javarense*) is still present. At this stage, the endosperm is still partly liquid, but deposition of nuclear endosperm rapidly takes place. The spiny epicarp is gradually broken down, and the mesocarp disintegrates, leaving the endocarp bare.

Bruchid hosts

All three species of *Astrocaryum* harboured a single species of bruchid: *Caryoborus serripes* Sturm (Bruchidae: Pachymerinae). The same species has also been reared by the junior author from *Astrocaryum huicongo* Dammer ex Burret in Moyobamba (Department of San Martin, Peru) and *Astrocaryum chambira* Burret in Iquitos, though extensive sampling of these two species did not yield any parasites. *C. serripes* has also been bred on one occasion from a nut of the oil palm *Elaeis guineensis* Jacq. in Iquitos, and Bridwell (1929) reported the same species from an unidentified species of *Astrocaryum,* probably from Brazil, and very doubtfully from *Maximiliana.* The beetle has also been reported to infest *Astrocaryum sciophilum* (Miq.) Pulle in French Guyana (Sist, 1989). The link between *C. serripes* and the palm genus *Astrocaryum* therefore seems obvious. Egg-laying by the bruchid takes place on the ground soon after fruits have fallen. However, most eggs were laid once the epicarp and mesocarp had been broken down and the endocarp was visible.

Sex-ratio

The total numbers of males and females reared were 33 and 13 respectively suggesting a sex ratio of approximately 2.5 : 1.0.

Oviposition

Egg-laying was not observed. No natural entry hole exists in the fruit of *Astrocaryum.* Emergence of *Caryoborus* first instar larvae and their penetration into the fruit occurs through the chorion wall which is glued to the endocarp, so that entry holes normally remain protected by the egg shell.

The endocarp of one fruit of *Astrocaryum chonta* which had yielded several adults of *Cyclaulacidea* gen. n. showed a very distinctive hole in the immediate vicinity of the parasite exit hole. It was 0.15 mm in

diameter, as compared with 0.45 to 0.50 mm for the entry hole of newly hatched *Caryoborus* larvae. (The maximum diameter of the ovipositor is slightly less than 0.10 mm). It may be assumed that *Cyclaulacidea* females were attracted to infested fruits by vibrations produced by final instar *Caryoborus* larvae chewing through the endocarp in the process of cocoon building prior to pupation (these vibrations can be distinctly perceived by the human ear). Oviposition apparently took place through the part of the endocarp just above the bruchid cocoon, which was reduced to a thin layer (less than 1 mm). Once the fruit wall was pierced, probably by the teeth at the apical part of the ovipositor, the ovipositor's length enables the female to reach virtually any part of the fruit.

Parasitoid larvae were found feeding on a bruchid pupa, indicating that *Cyclaulacidea* gen. n. is ectoparasitic in common with virtually all other Braconinae. Examination of host remains associated with parasite cocoons indicated that prepupae and pupae, and possibly also late and final instars, were suitable for parasitization.

When a single fruit was infested by several bruchid larvae, their different cocoons were often located in the same part of the fruit. This could explain the highly aggregated distribution of parasitized larvae among infested fruits, which suggests the possibility that several bruchid larvae were probably parasitized by the same female. Of 88 infested fruits of *A. chonta,* (by 275 bruchid larvae), only 8 fruits contained parasitized larvae. In 5 of them, all larvae were parasitized; in the three other cases, 1 larva out of 2, 1 out of 3, and 3 out of 5 were parasitized.

Gregarism

Gregarism was estimated by dissection of *Astrocaryum* fruits after emergence of both *Caryoborus* and *Cyclaulacidea* gen. n. adults: in *A. macrocalyx,* 13 bruchid larvae were found to be parasitized by 47 *Cyclaulacidea* gen. n. In *A. javarense,* 4 bruchids were parasitized by 10 braconids. In *A. chonta,* 11 bruchids were parasitized by 36 braconids. From 1 to 6 parasites were found in a single bruchid cocoon (mean number: 3.32).

Rate of parasitism

106 fruits of *A. chonta* were collected; 88 of them were infested by a total of 275 bruchid larvae, among which 15 were parasitized. The rate of parasitism was 5.4%. In *A. javarense,* 55 fruits were collected; 11 of them were infested by 25 bruchid larvae, among which 4 were parasitized (rate: 16%). In *A. macrocalyx,* 168 fruits were collected under three different trees; 41 were infested by 123 larvae, among which 13 were parasitized (rate: 10.5%, ranging from 9 to 20% in the different samples).

Development of the parasite

The number of larval instars was not determined, though in all other Braconinae for which data are available, there are 5 larval instars. Before pupation, cocoons were spun inside the host cocoon which was brown and thick (made up of material taken from the endocarp). They were made of strong whitish silk produced by the larvae. When several larvae were present on the same host, cocoons were not attached together, but rather wrapped in a light common spinning.

In a single sample of fruits, emergence of the parasites usually occurred before that of the bruchids. This was explained by the fact that bruchids normally experience a period of quiescence in the adult stage before cutting an exit hole and emerging. Such a quiescent state apparently did not exist in *Cyclaulacidea bruchivorus.*

Emergence of the parasite

Emerging adults chew their way first through the pupal cocoon, then through the thinned-down wall of the fruit. In one instance, the parasites used the exit hole of a neighbouring adult *Caryoborus serripes* after leaving its cocoon. In a cocoon, all pupae were orientated the same way, with heads towards the exit hole. These were distinct from *C. serripes* holes, both in size and shape: *Caryoborus* exit holes were almost perfectly circular, with regular edges, and a diameter of 4.3 to 6.5 mm. *Cyclaulacidea* gen. n. exit holes were irregular in shape, with jagged edges, and had an approximate diameter of 2.5 mm only.

TAXONOMIC TREATMENT

Cyclaulacidea Quicke & Delobel gen. n.

Antenna slightly shorter than forewing. Terminal flagellomere acuminate. Median flagellomeres approximately as long as wide. Scapus cylindrical, longer ventrally than dorsally; not emarginate apico-medially and without a false margin. Hypoclypeal depression separated from upper part of clypeus by a well-developed lamelliform carina. Clypeus separated from the face dorsally by thick carina. Face with a parallel pair of sublateral carinae, the area between these with a tear-drop shaped raised, coriaceous area surrounded by strong rugose sculpture. Eyes glabrous, not emarginate. Frons medially impressed with a mid-longitudinal sulcus; glabrous.

Mesosoma smooth and shiny. Notauli smooth, moderately impressed on anterior half of mesoscutum. Scutellar sulcus narrow, smooth or very finely punctate. precoxal suture absent. Pleural suture smooth. Median area of metanotum not formed into carinae anteriorly. Propodeum smooth, without carinae. Propodeal spiracle approximately 2 times taller than wide, situated slightly behind the middle.

Forewing vein SR1 reaching the wing margin 0.9 of the distance between the apex of the pterostigma and the wingtip. 2nd submarginal cell parallel-sided. Forewing vein 1r-m tubular, with two bulli. Forewing vein 1-SR+M strongly and more or less evenly curved. Forewing veins 1-SR and C+SC+R forming an angle of approximately 80°. Forewing vein cu-a interstitial. Forewing vein 3-CU1 not expanded posteriorly.

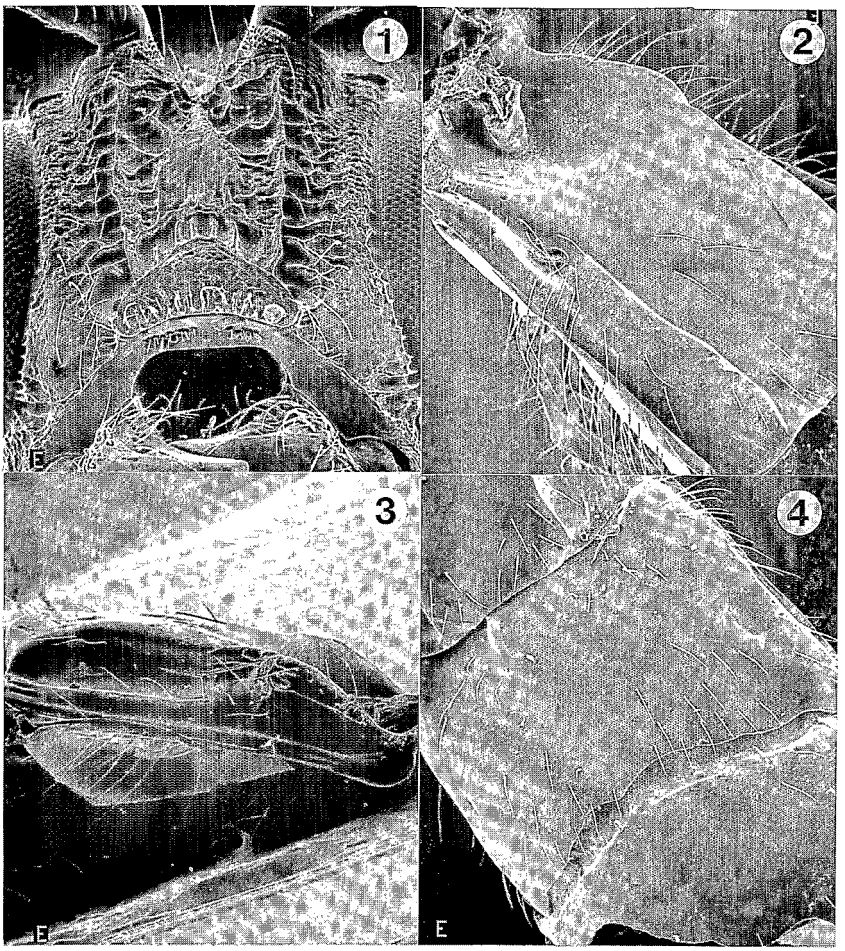
Hindwing vein 2-SC+R interstitial to short longitudinal. Hindwing vein 1r-m shorter than SC+R1. Apex of vein C+SC+R with 1 especially thickened setum (catch bristles). Without vein 2-1A.

Claws with small rounded basal lobes. Apex of fore tibia without a transverse row of pegs. Fore basitarsus not compressed. Hind tibia with a weak longitudinal lateral groove.

Metasoma smooth and shiny. Raised median area of 1st tergite strongly raised, dorsally rather flat with vertical or concave sides; dorso-lateral carinae obsolescent. Second tergite without a posteriorly-narrowing, mid-basal triangular area. Second suture smooth or weakly punctate. Third and subsequent tergites without transverse sub-posterior grooves. Ovipositor with a preapical dorsal nodus and apico-ventral serrations; approximately 1.2 × longer than forewing.

Internal anatomy. With a gland-like pouch in the membrane between the 2nd and 3rd metasomal sternites of males and females. Rectum with four rectal pads each of which is approximately 1.5 times longer than wide.

Type-species: *Cyclaulacidea bruchivorus* Quicke sp. n.



Figs 1–4. — *Cyclaulacidea bruchivorus* gen. et sp. n. Scanning electron photomicrographs: 1, face, frontal view; 2, 1st metasomal tergite dorso-lateral aspect; 3, 1st metasomal tergite lateral aspect; 4, 2nd metasomal tergite, dorsal aspect.

Cyclaulacidea bruchivorus Quicke sp. n.
(Figs 1–4)

Female

Antennae with approximately 57 flagellomeres. Terminal flagellomere 2 times longer than wide. First flagellomere 1.7 and 1.5 times longer than the 2nd and 3rd respectively, the latter being 1.1 times longer than wide. Scapus tapering from apex to base, 1.7 times longer than maximally deep. Malar suture distinct, bordered laterally by several fine parallel carinae. Height of clypeus : inter-tentorial distance : tenorio-ocular distance = 1.0 : 1.8 : 1.0. Clypeus finely coriaceous. Height of eye : width of face : width of head = 1.18 : 1.0 : 2.2. Length of face (from dorsal margin of clypeus to anterior edge of antennal socket) 0.66 times width of face. Horizontal length of eye (measured perpendicular to face) : horizontal length of head behind eye = 1.2 : 1.0. Post-ocellar length : transverse diameter of posterior ocellus : shortest distance between posterior ocellus and eye = 1.0 : 1.5 : 5.5.

Mesosoma smooth and shiny; 1.5 times longer than high. Median area of metanotum not produced into a carina anteriorly.

Forewing. Lengths of veins SR1 : 3-SR : r = 6.0 : 5.6 : 1.0. Lengths of veins 2-SR : 3-SR : r-m = 1.0 : 2.9 : 1.0. Vein m-cu 1.1 times length of r; more than twice as thick as vein 1-SR+M. Veins C+SC+R and 1-SR forming an angle of 80°.

Hindwing. Lengths of veins 1-r-m : SC+R1 = 1.0 : 1.25. Base of wing with small area of reduced setosity distal to vein cu-a.

Length of fore femur (excluding trochantellus) : tibia : tarsus = 1.0 : 1.1 : 1.5. Fore basitarsus 5.4 times longer than maximally deep. Fore tibia anteriorly with broad band of robust setae. Lengths of hind femur (excluding trochantellus) : tibia : basitarsus = 1.8 : 2.7 : 1.0. Outer and inner hind tibial spurs 0.3 and 0.57 times length of basitarsus respectively. Hind basitarsus 5.6 times longer than sub-posteriorly wide.

Second tergite 1.6 times wider than maximally (submedially) long. 2nd suture smoothly bisinuate, medio-anteriorly sharply defined, laterally shallowed and weakly defined.

Black except for the following which are brownish orange: anterior of notauli, edge of mesoscutum, posterior margin of scutellum, metanotum, central part of propodeum (broadly), metasomal tergites 1–4 and anterior of 5th; the following are brownish yellow: fore and mid-legs, basal half of hind femur (including trochantellus), apex of hind femur (narrowly) and base of hind tibia. Wings yellow with dark grey apex and a transverse band below the black pterostigma.

Length of body 11–12 mm, of forewing 10.8–12.0 mm, and of ovipositor (part exserted beyond apex of metasomal tergites) 14–15 mm.

Male. As for female except slightly smaller and with 2nd metasomal suture more sharply defined laterally.

Holotype ♀, (MNHNP) PERU, with the following labels: "PEROU – Loreto, Quisto Cocha – Fundo Ogalia (6 km d'Iquitos) 7 août 1993 A. DELOBEL coll.", "Ex noix de Palmier au sol: *Astrocaryum macrocalyx* N24", "Ex *Caryoborus serripes* Sturm (Bruchidae, Pachymerinae)".

Paratypes 10 ♂♂, 2 ♀♀, PERU, same data as holotype: 8 ♂♂, 1 ♀ deposited in MNHNP, 1 ♂, 1 ♀ in BMNH, 1 ♂ in NNML.

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REVIEW

'IDENTIFICATION GUIDE TO THE ANT GENERA OF THE WORLD' By Barry Bolton; Harvard University Press; 10″ x 12″, hard cover; 224 pp; 531 half-tone plates; 2 tables; 9 line figs; 1994. Price £51.95.

By the end of the first paragraph, the reader of this book is left in no doubt that it was written by someone enthralled by his subject. Barry Bolton expounds with a passion the wealth of variety to be found in this most fascinating and ubiquitous group of insects. The ants have a justifiable ability to attract and hold the attention of an increasing number of scientists from various disciplines; however many find identifying their material problematic. Previously there has only been a disparate collection of keys to different taxa and regions with few serious attempts to update this knowledge in one volume; this guide aims to fill that gap. Bolton's refreshingly global and 'holistic' view of ant taxonomy, allied to his exhaustive study of the most comprehensive collections, have placed him in an eminent position to attempt such an ambitious work. My comments on this book relate mainly to its ease of use, particularly for those new to the subject, rather than its scientific accuracy.

Little biological or ecological information is provided in the book; it is instead a functional tool admirably designed to fulfil its role as an identification guide to all of the world's ant genera. The introductory chapter steers the reader through the preliminaries required to start identifying ants, such as the classification of the 16 currently recognised subfamilies within the Formicidae, the preparation of specimens and the correct use of a dichotomous key. It has been necessary in a book of this scale to group the genera not only by subfamily but also according to geographical region; an outline of the zoogeography of ants is therefore also included. Those interested in identifying pest or tramp species should be aware that genera are only recorded from their region of *origin* and keys to a number of regions might need to be consulted until a good match is found. It should also be noted that the keys are only for the worker caste; males and gynes are not catered for, an understandable limitation given the scope of the book.

There are two keys to subfamilies, the first is largely based on fairly well established features of external morphology and is quite simple to use. The second involves more detailed examination of the structure and occasionally the internal morphology of specimens. This may entail dissecting specimens and so it is wise to take a few examples of each type when collecting. The second key is also experimental but with practice may

prove the quicker and easier of the two, Bolton is hoping that those who try it will comment upon its usefulness. Once the subfamily is established the next stage is to identify the genus within that subfamily, often based upon geographical region. It is, however, necessary to go back to the contents page or flick through the book to find where each subfamily starts, this could have been avoided by giving the appropriate page number for each subfamily where it keys out.

Bolton's keys are not entirely free of subjective and comparative terminology but he uses a combination of characters at each couplet to reduce the chances of error. Where comparisons are made there is usually also reference to the appropriate electron micrographs so that users can see for themselves just what a given character actually looks like. There is trend in many keys to make extensive use of character counts and measurements followed by the calculation of indices. Although measurements do need to be made at certain junctures within the keys, Bolton makes relatively little use of such techniques, instead relying heavily upon the micrographs from which the eye can take in information more quickly. Although not mentioned in the book, a binocular microscope with at least ×60 magnification is essential for use with it, ×100 or more may help with some specimens. The morphological terminology used for ants may be quite unfamiliar to many entomologists and the extensive glossary at the end of the book is a welcome feature which also helps rationalise the variety of terms used.

The 531 excellent plates used in this book are admirably clear, with good contrast and very little of the flaring which often spoils such work; the photographer perhaps deserves fuller credit for her contribution. Although the relevant features used in the keys are always clear, if I have one criticism of the plates, it is that they are occasionally rather tightly cropped. There may be good reasons for this given the magnifications used and space restrictions but the feeling remains that occipital margins, antennae and the tips of gasters and mandibles were unfairly sacrificed in certain plates. The reader also needs to look back to the beginning of each section to check which genera are portrayed in the plates and no scales or species names are given. This may be intentional so that readers do not just flick through the plates and jump to wrong conclusions without running specimens through the keys properly – an easy temptation with some other keys.

The keys to genera are as clear as those to subfamilies and I could not fault any resulting determinations. The lack of numbers for preceding couplets does not make backtracking through the keys that easy but the frequent use of more than one character at each stage should make mistakes and the need to backtrack a rare occurrence. Repeated references to figures during use of the keys necessitates frequent flicking through pages to find the appropriate plates; regular users might wish to stick bookmarks at frequently used figures to help locate them and protect their book. At the end of each key to genera there is a very useful synoptic classification with the genera grouped at tribe level and all redundant synonymous taxa listed. Extinct taxa known from the Fossil Record are also incorporated into this classification. A thorough taxonomic reference list is also provided to help the reader determine specimens to species level.

Earlier versions of the keys have previously appeared in Hölldobler & Wilson's *The Ants* (1990), which for an extra £20 also covers ant biology and ecology in some detail. However, Bolton's latest keys do contain a lot more extensive, reworked and updated material and from a purely functional viewpoint, anyone likely to make regular use of the keys and who requires the quickest, easiest and most accurate results will need this volume. From an aesthetic point of view I would buy the new book for the plates alone and it also forms a natural companion to *The Ants*.

By the author's own admission this book represents a snapshot in time as the classifications used are based very much on current taxonomic knowledge. This knowledge is dynamic and constantly evolving as new species and associations between species are discovered. It is, however, as close a representation of the true state of affairs as anyone is likely to find at present. Bolton recognises the guide's inherent limitations due to this dynamic quality and indeed hopes that through use of his keys others will be encouraged to contribute to the development of ant taxonomy. This book is ideally suited to that purpose. — SIMON HOY.