

THE TENEBRIONIDAE OF SOUTHERN AFRICA (COL.)
 PART LIII: *CARDIOSIS HAMILTONULI*
 A NEW ULTRA-PSAMMOPHILOUS SPECIES
 FROM THE DUNES IN THE NAMIB DESERT

by

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(With 4 figures)

INTRODUCTION

The present introduction of a striking new species of *Cardiosis* into the systematics of Tenebrionidae is based on the original specimens which have been obtained by Prof. William J. Hamilton III (University of California) in the course of his ecological field research carried out at the Namib Desert Research Station Gobabeb in 1967/68.

The species concerned represents a new component of the ultra-psammophilous ecosystem (Fig. 4). This discovery of a second, sympatrically occurring species of *Cardiosis* in the dune area of Gobabeb has been quite unexpected, since the very same dunes were believed to be occupied by *Cardiosis fairmairei* only, on the assumption also that evolutionary tendencies within the genus point towards the development of only one species in each of the faunistically differentiated dune systems.

The reasons accounting for the absence of the new *Cardiosis hamiltonuli* in collections made to date, and the overlooking of its presence almost in sight of the Research Station, may possibly be found in its amazing camouflage closely matching the colour and structural pattern of the sand it inhabits, its rather cryptic diurnal rhythm characterized by only limited intervals of surfacing, and by its adaptation to a quite specialized ecological niche in the dune system, which has so far not yet been recognized as such. This particular habitat — being a part of the dune itself — refers to the wind-rippled foredune tongues at the foot of the dune, formed

by pure active sand grains, and extend onto the terrace surfaces of the inter-dune valleys. *Cardiosis fairmairei* living on the identical dune but mostly in the zones of the crest and slipface of dune, does not seem to enter this particular niche which is occupied by *Cardiosis hamiltonuli*. Both *Cardiosis*, however, are 'diving' species and as such strictly confined to the loose but non-tunnellable sand of the dune, avoiding the soil of the terrace surfaces which, on account of the consolidation of the sand through the admixture of gypsum, calcareous and other components, houses a quite different fauna of 'tunnelling' and 'digging' species.

Concluding this introductory note, I wish to express my thanks: First of all to young John, Prof. Hamilton's son, to whom the credit for the actual discovery of the new species is due, to Prof. Hamilton and Mr. E. Holm jr. for the communication of their observations, and to Mr. K. Schaer for the execution of the magnificent paintings which illustrate the present article.

CARDIOSIS HAMILTONULI sp. nov.

(Figures 1 and 2)

DIAGNOSIS

On account of its general appearance and built of body belonging clearly to the Zophosini-genus *Cardiosis*. From the five hitherto known congeneric species, distinguished by some striking features such

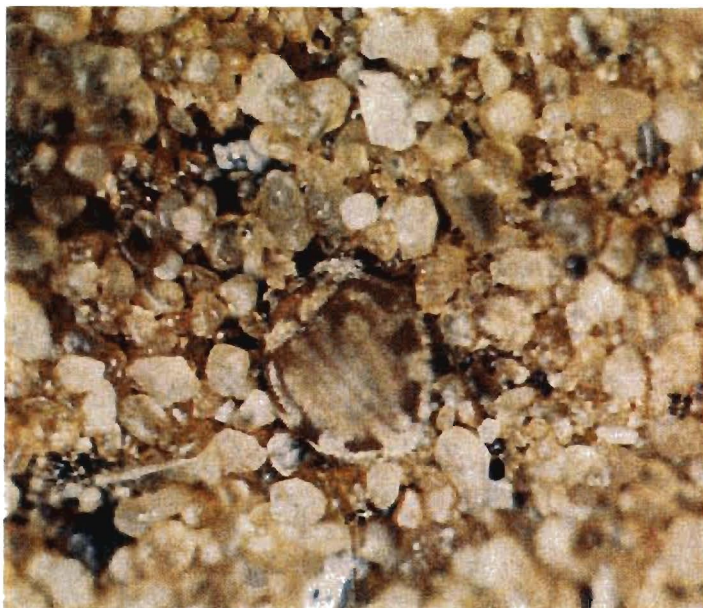


Figure 1: *Cardiosis hamiltonuli* sp. nov. — Specimen photographed *in situ*, to show the high degree of camouflage matching perfectly the colour and structural pattern of the sand which it inhabits. Note also the large size of the grains of sand, in comparison to the body size. x7. Prof. Hamilton phot.

as the depigmented testaceous cuticle, the contrasting red and silverish vestiture on pronotum and elytra being combined with a similarly bicolorous pulverulescence of a chalky-white and brick-red tint, the coronoid ciliation of the prothoracic and elytral sides, the specifically characteristic elytral sculpture consisting of an ornamental relief of deepened, setiferous and pulverulescent elements alternating with raised, bare and shiny parts, the total absence of both the lateral sulci on the metasternum and the pseudopleural crests on elytra, the deviating development of the armatures on the legs particularly those on the basal segment of the hind tarsi, etc.

The sympatric *Cardiosis fairmairei* (Figure 3) is distinguished from the new *Cardiosis hamiltonuli* (Figs. 1, 2) at a first glance by the bright brimstone colour of the dorsal pulverulescence, the large size of body*, the much longer legs*, large eyes with auriculate supra-orbital ridge, the much more produced medial section of the clypeus, and in particular the typically cordiform shape of, and the different ornamental relief of sculpture on, the elytra.

While *C.hamiltonuli* appears to be thoroughly camouflaged and hardly detectable on the sand, *C.fairmairei*, on the contrary, is highly conspicuous, with the bright design on elytra to some extent recalling a warning device.

DESCRIPTION

Body varying in length from 2.7 to 4.6 mm, in width from 2.1 to 3.4 mm (index: 0.78/0.74), wingless, thinly sclerotized, depigmented, roundish, convex, generally opaque above but with shiny portions below. Of a pale reddish-brown to testaceous colouration, except for the black eyes, the blackish tips of the mandibles and antennae, the blackish spines on the legs, the darkened apical margin of the tarsal segments, and the tibial spurs and tarsal claws which are very pale and of a transparent, slightly stramineous tint. The dorsal surface in parts with a sessile vestiture of brick-red and silverish bristles, the sides with a dense silverish ciliation, with the background of the cuticle between the red bristles partially covered by a brick-red pulverulescence and that between the silverish cilia with a continuous layer of a chalky-white pulverulescence.

* Measurements (*Cardiosis fairmairei*):—

Body	— Length 3.8 — 7.0 mm, width 3.3 — 6.0 mm.
Prothorax.	— Length 0.7 — 1.3 mm, width 2.6 — 4.3 mm.
Elytra.	— Length 2.7 — 4.2 mm, width 3.3 — 6.0 mm.
Posterior tibia.	— Length 1.2 — 1.8 mm (calcaria excluded).
Posterior tarsus.	— Length 2.0 — 3.7 mm (claws excluded).



Figure 2: *Cardiosis hamiltonuli* sp. nov. — Male holotype. x20. After a painting by Klaus Schaer.

Cranium hypognathous, with the head-capsule globular, its swollen posterior portion amplexed in the prothorax, with only the flattened anterior portion exposed. — In dorsal aspect approximately hexagonal, flat, broadest across the preocular portion of the genae, there about two-thirds to three-quarters broader than long and scarcely longer but of less than half the width of the pronotum, with opaque, densely micro-granulate cuticle bearing aggregate, sessile, red bristles on the vertex. Epistoma large, concealing the basal portion of the antennal scape and leaving exposed the prominent labrum and the proximal part of the mandibles. Medial section of the clypeus briefly produced, distinctly demarcated from the lateral portions, with truncate apical margin; genoclypeal sutures indicated, converging backwards in straight oblique lines and obliterated in front of the anterior demarcation of the pilose zone on vertex; no frontoclypeal sutures. Preocular outlines of genae subangular, slightly projecting beyond the lateral contours of the eyes. Eyes black, rather small, of reniform shape, lateral in position; in dorsal aspect convex along the inner margin and there with a fine supra-ocular margination, elongate, not quite twice as long as broad, about the length of the preocular portion of genae, with the outer margins not coinciding with the body outlines but remaining within the outer contours of the strongly convex lateral portions of postgenae which bulge from underneath beyond the outer margins of the eyes. Tempora long but amplexed in the prothorax. Labrum large, produced, flat, about twice as broad as long, with the straight sides gradually diverging basad and the apical margin shallowly emarginate; the cuticle uniformly micro-sculptured, moderately shining. — Of the ventral part only the mouth with its organs exposed, while the large postgenal-gular surface amplexed in and concealed by the prothorax. The concealed section bare, microscopically granular, and formed by the globularly convex postgenae (which conceal the eyes completely) and the large, triangular gular plate; the latter exhibits straight gular sutures converging from the transverse gular edge towards the pointed tip of the triangle which is separated from the submental section by one or two obsolete transverse impressions; the position of the eyes is halfway the length of the head-capsule and indicates roughly the dividing level between the oral and the postgenal-gular sections. The submentum is badly defined as a short, transversely rectangular surface, with an obsolescent, small, subtubercular convexity on each side. The margin of the oral cavity truncate behind mentum, forming at each side a minutely triangular dilation inwards from the mandibular fossa. Mentum large, concealing the greater part of the ligula, the labial palpi and the basal segments of the maxillary palpi; flat, subrugosely sculptured, almost three times as broad as long, appearing as if bipartite,

with rounded sides and a deep, triangular incision at the middle of the apical margin. Only the three distal segments of the maxillary palpi exposed; these are very slender, almost filiform, with the terminal segment the longest. Mandibles stout, with well-developed apical teeth. Antennae thin, extending to beyond the base of the pronotum, the proximal segments filiform and elongately ciliate, the three terminal segments dilated, bare and together forming some kind of clava; segment 3 slightly longer than 2 but as long as the apical segment, segment 4 about the length of 2, segments 5 and 6 subequal and distinctly shorter than 4, segment 7 slightly shorter than 6 or 5, segment 8 elongately triangular, shorter than 7 and broader than the preceding segments, segment 9 equilaterally triangular, segment 10 transversely triangular, short and closely joining the apical segment, the latter large, oval, about the width of 10, scarcely shorter than 9 and 10 combined, composed of a very short, sclerotized, subannular basal part and the large, velvety, porous and evenly granulate sensorium.

Prothorax varying in length from 0.6 to 0.9 mm, in width from 1.8 to 2.7 mm. In dorsal aspect the pronotum short, very transverse, exactly three times as broad as long, about seven-eighths to eight-ninths the width of the elytra, somewhat crescent-shaped, convex in the latitudinal sense, with the sides gradually sloping towards the lateral margin, plane in the longitudinal sense. Anterior border deeply and subrectangularly emarginate behind the cranium, the lateral corners strongly produced, broadly rounded and embracing the ocular portion of cranium, with an extremely fine margination; the latter obsolescent on middle section but reinforced on lateral sections, minutely projecting subangularly on the extreme anterior corners. Sides rather abruptly narrowed and strongly rounded anteriorly, very little so on posterior half, with a very fine, sharp and complete margination flanked by a narrow juxtamarginal depression. Base much broader than the anterior border, arcuately curved to the rear medially, shallowly sinuate on sides, immarginate; the lateral corners rounded to indistinctly subangular, projecting beyond the re-entrant basilar contraction of the elytra. Dorsum behind cranium with a large, bare patch of a triangular to subcordiform shape, pointing backwards and ending at some distance from base; the remaining posterior portion of disc covered with short, brick-red sessile bristles which are arranged transversely but gradually change into a longitudinal and backwardly directed position towards midline; on the depressed sides of the lateral portions covered with a furry coronula of elongate silverish cilia projecting outwards beyond lateral margin. The background of the cuticle is concealed by a layer of an opaque, bicolorous pulverulescence on the sloping lateral sections; this pulverulescence



Figure 3: *Cardiosis fairmairei* PERINGUEY. — Male specimen from the dune system of Gobabeb (where also *Cardiosis hamiltonuli* occurs). x15. After a painting by Klaus Schaer.

is of a contrasting colouration, bright cinnamon to brick-red between the red bristles and of a chalky-white tint between the silverish cilia. — Ventrally the prothorax practically bare, opaque and evenly micro-granulate. The pseudopleura of pronotum large, excavate laterally and there with weakly indicated longitudinal wrinkles; tergo-sternal sutures complete, strongly oblique; prosternum small, in front of the coxal cavities about the longitudinal diameter of cavity; intercoxal sternellum extremely constricted, at the narrowest point narrower than any of the protarsal segments, with carinate margins, the apex moderately dilated, produced backwards beyond the coxal contours and gradually sloping towards foramen.

Elytra varying in length from 1.9 to 3.2 mm, in width from 2.1 to 3.4 mm, convex, roundish, broadest in front of middle, there slightly broader than long and broader than the prothorax, shoulderless, with regularly rounded and anteriorly constricted sides, narrower across the base than the pronotal base is wide. Integument with a characteristic, symmetrically arranged ornamental relief consisting of raised sculptural elements with a bare, more or less shiny and micro-granular cuticle alternating with deepened and opaque portions which are covered either with brick-red, short sessile bristles or elongate, silverish cilia. There is on each elytron a narrow, straight juxtasutural ridge running parallel to the suture and bent outwards at both ends of which the anterior end coalesces with a longitudinally impressed, smooth patch at about midline of the basilar portion of elytron, while the posterior end forms a somewhat transversely-crescent, swollen, smooth patch on the apical portion; these raised and bare elements of sculpture embrace a longitudinally oval discoidal section filled with a covering of brick-red sessile bristles appearing as if parted along midline, with the bristles pointing obliquely to the left and to the right respectively; this hairy section is bordered on the sloping lateral portion by two additional fenestrate patches, viz. an elongate humeral patch and a subsquare median patch; the hairy covering of the disc merges, on the transverse intervals between these bare lateral patches, with the broad zone of silverish cilia on the latero-ventral surface of elytron, with the red colour of bristles gradually changing to silverish on the sides and apical declivity; the narrow interval between the suture and the juxtasutural ridge likewise covered with red bristles. Apical declivity evenly sloping caudad. The surface of the cuticle partially or wholly concealed by a dense layer of pulverescence which corresponds in colour to that of the respective bristles. — The ventral surface embracing the afterbody, at the broadest point occupying about one-half of its width; swollen and broadly rounded with the dorsal surface on anterior half, concave

and bluntly edged laterally on posterior half; the cuticle granular, densely ciliate and clothed with a dense layer of a chalky-white pulverescence. Neither pseudopleural nor epipleural structures of delimitation, except for an extremely fine epipleural crest on the extreme apex bordering the anal sternite of abdomen.

Mesothorax and metathorax enlarged, with striking sculptural contrasts in sterna and pleura, the former being densely sculptured and almost opaque, while the latter are smooth and polished. All pleura well demarcated by complete and deep sutures including those delimiting the juxtabasilar preëpisternum of mesosternum; the metepisternum the largest, highly polished, with only single, irregularly set and widely spaced setiferous punctures. Mesosternum in size equalling the mesepisternum, convex but with a small median groove basally for the reception of the apex of prosternellum; the cuticle micro-granular and covered with fine, recumbent, yellowish setae; intercoxal sternellum very elongate, slightly narrowed posteriorly, truncate apically and there narrower than the apex of prosternellum. Metasternum very large, about one- to two-thirds longer than the abdomen, forming a horizontally plane plate which is densely covered with a coarse but shallow, partly scabrous and confluent punctation; median sulcus varying from weakly indicated to sharply impressed linearly, in the latter case sometimes extending forwards to about middle of sternum; no oblique sulci on preapical surface; the apical intercoxal incision sharply triangular.

Abdomen reduced in size, only about one-fifth of the total length of the afterbody, bilevelled because of the intercoxal position of the basal sternite; the latter raised to level with the metasternal plate basally but, together with the telescoped rudimentary second and third sternites, abruptly dropping to the much lower level of the distal two sternites apically; these are perfectly horizontal in position, shiny. Anal sternite large, rounded, with a few fine punctures, longer than the basal sternite and about two-and-a-half times as long as the fourth sternite.

Legs elongate, testaceous, smooth, armatus with blackish spines, the tibial spurs and claws transparent and practically colourless, the tibiae shorter than the tarsi or the femora, the two spurs of claws unequal in length. Femora with small trochanter, compressed, the front and middle ones with a row of pectinate long and sharply pointed spines on underside; in the hind femora these spines reduced in length, triangular, with similar additional spines irregularly and sparsely set also on the upper surface, plus a fringe of fine silky hairs on inner surface.

Anterior tibiae short, the outer contours sinuate in front of the apical dilation, with a few short spines on upper and lower surfaces; there are two

very elongate, black spines of the apical corona, inserted on the outer apical angle opposite to the calcarial spurs, attaining in length almost that of the basal segment of the anterior tarsus; calcaria much enlarged, of somewhat foliaceous shape, with the longer of the two spurs about the length of the two proximal segments of the anterior tarsus combined or that of the entire anterior tibia. Intermediate and posterior tibiae straight, more densely spinose than the anterior tibiae, the coronal spines elongate in the intermediate tibiae but short in the posterior ones, the calcaria comparatively short, not foliaceous, with the longer of the two spurs decidedly shorter than the respective tibia, attaining about two-thirds of the length of the basal segment of the intermediate tarsus in the intermediate tibiae but only one-third of this in the posterior tibiae. Tarsi of unequal proportions, the anterior ones the shortest, about one-and-a-third times the length of tibia, the intermediate ones the longest, almost two-and-a-half times the length of tibia, the posterior tarsi also very elongate, about one-and-two-thirds times the length of tibia. The tarsal segments very elongate in the intermediate and posterior tarsi, with extremely prolonged basal segment which practically attains the length of the tibia; all segments armatus with blackish spines on the apical margin, the basal segment of the posterior tarsus with some stout additional spines on middle section; the claws of the anterior tarsi with equilong spurs, very short, not longer than the unguis segment, those of the intermediate and posterior tarsi with the respective spurs strikingly unequal in length, very elongate, the longer of both spurs more than twice the length of the unguis segment, of distinctly foliaceous shape in the posterior tarsus. Length of posterior tibia: 0.7 — 1.1 mm; length of posterior tarsus: 1.3 — 1.9 mm (not including calcaria and claws respectively).

LOCALITY

South West Africa, northern part of the Southern Namib Desert: On the southern side of the Kuiseb Riverbed and opposite the Research Station Gobabeb (23° 34' S. 15° 03' E). Cf. Fig. 4.

DEDICATION

Named in honour of the discoverer, young John. Prof. William J. Hamilton's son.

MATERIAL

The description is based on a collection of altogether 73 specimens. Comparatively few specimens were taken when freely moving on the sand during the apparently brief intervals of surfacing in the afternoon, while the greater part were trapped in open pit-jars sunk into the sand. Since the discovery of the first known specimens in December, 1967, the new species was being collected and recorded regularly up to date of the writing of the present article, viz. June, 1968. It therefore appears that its occurrence may be rather independent of the seasonal changes in the environmental climate*).

Typoids are designated and deposited as follows. Male holotype and female allotype with the Transvaal Museum, Pretoria. Paratypes with the Namib Desert Research Station, Gobabeb; the Department of Zoology of the University of California, Davis; the Science Museum of the California Academy of Sciences, San Francisco; the British Museum (Natural History), London; and the Museum G. Frey, Tutzing bei München.

* The climate at Gobabeb during the period of the above cited occurrence of *Cardiosis hamiltoni* (December, 1967, to July, 1968) follows from the following table.

TABLE: Data recorded and condensed by Mr. K. Schaer, Namib Desert Research Station

	high- est Tx °C	Number of days with Tx				low- est Tn °C	Number of days with Tn				Ux %	Un %	days with fog	total pre- cipit. fog mm	total pre- cipit. rain mm
		>35.0	>30.0	<17.5	<10.0		<-2.5	<0.0	<5.0	>20.0					
December 1967	37.8	3	20	0	0	10.0	0	0	0	2	99	19	4	0.5	2.4
January 1968	39.0	1	18	0	0	10.5	0	0	0	0	99	10	3	1.7	0.0
February ..	35.6	3	21	0	0	10.7	0	0	0	2	100	11	7	5.0	0.0
March ..	39.7	6	22	0	0	12.6	0	0	0	5	100	10	5	2.0	0.0
April ..	36.1	2	11	0	0	7.6	0	0	0	0	100	14	5	4.4	0.0
May ..	33.8	0	8	0	0	5.2	0	0	0	0	100	4	5	5.9	0.0
June ..	30.8	0	4	3	0	2.1	0	0	1	0	100	2	6	2.4	0.8
July ..	33.8	0	5	0	0	1.8	0	0	7	0	100	5	7	8.5	0.0

HABITAT

Occurring in the loose sand of the active dune system but confined to the lower foredune tongues at the foot of the high dunes extending onto the terrace surfaces of the inter-dune valleys. These also form zones of accumulated pure sand on the gravelly terrace-plain between the dune system and the river-bed, including the sandy slopes of the southern river-bank. The center of the local dispersal was found to be a gentle slope at the foot of the large dunes extending north — south, characterized by giant wind-ripples of very coarse sand of about 1 mm in diameter. Indicative of this special habitat appeared to be also the small *Monsonia ignorata* Merxmüller & Schreiber (Geraniaceae), one of the few desert plants growing in active sand. Reference to the same ecological niche was first made by Koch (1962b) in connection with the nocturnal Tenebrionid *Lepidochora portii* Koch which likewise prefers the wind-rippled slopes of the foredune area. Cf. Fig. 4.

From observations so far carried out, it seems that the range in the occurrence of the new *Cardiosis hamiltonuli* does not interfere with that of *Cardiosis fairmairei* which, though living within the identical dune system, populates the finer sand of the dune itself, especially the zones of the crest of the dune and the slipfaces within the crescent-shaped leeward slopes. It was never seen on the sand of the foredune ripples nor on the patches of accumulated dune-sand covering the compact surface soil of the gravelly plain.

Two dead specimens of the new species were found by Mr. E. Holm in the empty body-shell of a cadaver of *Eustolopus octoseriatus* Gebien (Tenebrionidae, Adesmiini), at about 16 miles south of the local center of occurrence. Here the inter-dune valleys are filled completely with dune-sand, widening to extensive foredune plains with hillock formation initiated by single plants. This configuration is typical for the dune system of the southern part of the *Southern Namib*, particularly the territory between north of Luderitz and south of Gobabeb.

SYSTEMATIC POSITION

The genus *Cardiosis* represents a highly distinctive and specialized group of the xerophilous Afro-Asiatic Zophosini. It is endemic to the dune systems of the *True Namib* in South West Africa and Angola, but does not occur in the dunes of the *Transitional Namib* south of the Orange River nor in those of Kalahari origin. In accordance with this stenecological specialization, most of the diagnostic morphological characters are associated with locomotion between and on the moving grains of sand. Such adaptive modifications refer to the striking

prolongation of the middle and hind tarsi, the special developments in the unguis, calcarial and antennal structures and their armatures, the displacement in the position of the metacoxae towards the center of body which is correlated with a telescopic contraction of the abdomen but hypertrophic enlargement of the metasternum, the formation of complex cuticular derivatives, subglobular body shape, etc.

The definition of the genus *Cardiosis* within the Zophosini is reflected by the following combination of morphological features (as tabulated by Koch, 1958):—

Lateral sulci on metasternum well developed, as is the case in all Zophosina of Zophosini, except for *Cerosis*, *Dignathosis*, *Microsis* and *Hesseosis*.

Sides of elytra without lateral carina above pseudopleural crest.

Pseudopleural crest of elytra rudimentary, reduced to basal and apical portions.

Metasternum considerably larger than abdomen.

Abdomen reduced and telescoped proximally in both sexes, with perpendicularly declivous basal sternite.

Claws of intermediate and posterior tarsi distinctly more elongate than the respective tibial calcaria.

All previously described species of *Cardiosis* are well characterized by this combination of structures, but not the new *Cardiosis hamiltonuli*. In this species both the lateral sulci on the metasternum as well as the pseudopleural crest of the elytra are entirely lacking. In particular the absence of the lateral sulci on the metasternum may be considered a striking deviation, since their development is found to be of extreme constancy, and occurs, without any exception in all the several hundred known species of the genus *Zophosis*, but also in *Calosis*, *Heliophosis*, *Tarsosis*, *Anisosis*, *Ophthalmosis*, *Onychosis*, *Hologenosis*, *Myrmecophosis* and *Gyrosis*.

Moreover the decidedly isolated systematic position of *Cardiosis hamiltonuli* follows clearly from the following scheme of intrageneric grouping:—

1. Group of *C. mouffleti*, with the species *mouffleti* Deyrolle and *carpi* Koch, ranging in the *Northern Namib* from the Unjab River northwards to the Porto Alexandre area in Angola:— Lateral sulci on the metasternum developed. Discoidal portion of the elytra shiny and bare, with plane sutural zone. Shoulders rounded, not projecting beyond the posterior angles of the pronotum. Claws of the anterior tarsus about the length of the unguis segment. Deepened portions on elytra with unicolorous yellowish bristles, without any pulverescence. Ciliation of pronotal and elytral sides inconspicuous.



phot. Marais Malan

Figure 4: Northern marginal area of the dune system of the *Southern Namib*, near Gobabeb (with isolated old hillock formed by *Aristida sabulicola* in the foreground).

Among the vegetationless dune systems of the world, the dunes of the Namib Desert are distinguished by harbouring a fauna of greatly specialized Arthropoda, which is endemic to the vegetationless sand of dune and does not depend on active vegetation anymore. For this unique biotype the term of "ultra-psammophilous" was introduced into ecology (Koch, 1931).

About the biogeographical terms relating to a subdivision of the Namib Desert and used in the present paper (such as *Southern Namib*, etc.) see Koch, 1962a.

2. Group of *C. fairmairei*, with the species *fairmairei* Péringuey, *triangulifera* Gebien and *eremita* Koch, occurring in the *Southern Namib* from Luderitz northwards as far as Walvis Bay, but *C. triangulifera* in the isolated dune system between the Kuiseb and the Swakop Rivers (which faunistically may be assigned to the *Northern Namib*): — Lateral sulci on metasternum developed. Discoidal portion of elytra entirely or partially sculptured, dull and pilose, with raised sutural zone. Shoulders subangular, projecting beyond the posterior angles of pronotum. Claws of the anterior tarsus considerably longer than the unguis segment. Deepened portions on elytra with unicolorous yellowish bristles, only in *C. fairmairei* with (unicolorous brimstone-coloured) pulverescence. Ciliation of pronotal and elytral sides moderately developed, not coronoid.
3. Group of *C. hamiltonuli* nov., monotypical, northern part of the *Southern Namib*: — No lateral sulci on the metasternum. Discoidal portion of elytra similar in sculpture to that of the *fairmairei*-group. Shoulders rounded and non-prominent, as in the *mouffleti*-group. Claws of the anterior tarsus short, as in the *mouffleti*-group. Deepened portions on elytra with bicolorous, brick-red and whitish bristles, plus a bicolorous pulverescence of brick-red and chalky-white tints. Ciliation of pronotal and elytral sides very conspicuous, dense, elongate, coronoid and of silverish colour.

Contrary to the phylogenetic tendencies inherent in *Cardiosis*, *C. hamiltonuli* has evolved to a sympatric but allo-ecological species distinguished by a high degree of camouflage. Some of its morphological characteristics may indicate the initiation of evolutionary tendencies relating to a change in life habits from the diurnal Zophosina, through cryptic, to the nocturnal Dactylocalcarina. These criteria refer to the depigmented and weakly sclerotized composition of the body-cuticle, the reduction in the size of the eyes, the poorly developed supra-orbital structures, the stronger spinose armatures on legs, etc. All the other *Cardiosis* are allopatric and vicariant species tending to split into

geographical and ecological subtle forms; they are very conspicuous in the field (as the diurnal Tenebrionidae generally are) and of decidedly diurnal and heliophilous life habits (with the body heavily sclerotized, the cuticle pigmented, the eyes large and protected by an auriculate supra-orbital ridge, the armatures on legs less strongly developed, etc.).

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