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ANNALS OF THE TRANSVAAL MUSEUM  
ANNALE VAN DIE TRANSVAAL-MUSEUM

Vol. 30

30 June 1976

No. 5

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THE BURROWING GECKOS OF  
SOUTHERN AFRICA, 4  
(REPTILIA: GEKKONIDAE)

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(With five Plates and one Text-figure)

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ABSTRACT

This study deals with the entirely terrestrial genera of southern African geckos and is published in five parts in this journal. In this part the monotypic large ground gecko *Chondrodactylus* is discussed and a new subspecies from the Namib Desert is described.

E. Genus *CHONDRODACTYLUS* Peters

*Chondrodactylus* Peters, 1870, *Mber. Akad. Wiss. Berl.* 1870: 110.

Type species: *Chondrodactylus angulifer* Peters.

A stout, large, terrestrial, nocturnal gecko.

Digits short, cylindrical, with slightly flattened edges and rounded tips; fingers clawless in both males and females; phalangeal formula: manus 3,3,4,5,3, pes 3,3,4,5,4; terminal two phalanges greatly reduced in size, recurved and embedded in tissue, terminal phalanges minute and granular in fingers, slightly pointed in toes of males but thin and elongate in toes of females, bearing a claw which points vertically upwards; last phalanges of toe five in males less recurved than in females. Hands and feet covered dorsally with imbricate scales, ventrally with minute, spinose, close-fitting scales with three-pointed bases consisting of six alternating convex and concave sides. Tips of fingers covered with blunt, enlarged, callous scales of similar pattern to those on palm. Palmar surface and underside of digital articulations pad-like. Body stout, cylindrical, not depressed,

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covered above with irregular granules intermixed with enlarged tubercles, below with smooth, flattened, imbricate scales. Pupil vertical, closing down to four pinholes (*Gekko*-type; Underwood, 1954). Postanal sacs present, preanal and femoral pores absent.

Endemic to southern Africa and represented by a single species.

**DISTRIBUTION:** The sandy areas of the Cape Province, southwestern Botswana, Great Namaqualand, the southwestern parts of Damaraland and the western Kaokoveld. All known records are from an area with an average annual rainfall of less than 300mm.

7(a) *Chondrodactylus angulifer angulifer* Peters, text-fig. 1, plates 4, 5 (top), 6 (right), 7 (left), and 8 (bottom).

**Chondrodactylus angulifer** Peters, 1870, *Mber. Akad. Wiss. Berl.* 1870: 111, plate, fig. 1; FitzSimons, 1943: 10; Loveridge, 1947: 28; Underwood, 1954: 477; Mertens, 1955: 43; FitzSimons, 1957: 392; FitzSimons and Brain, 1958: 99; Wermuth, 1965: 11; Kluge, 1967: 26; Mertens, 1971: 34 (Farm Plateau, Bethany); Pianka, 1971: 1025.

Type locality: Hantam, Oorlogsrivier, C.P.

**DIAGNOSIS:** A large, robust, nocturnal, terrestrial gecko. Marked sexual dichromatism; ventral scales increase in size towards sides of body.

**DESCRIPTION:** Head large and swollen, subtriangular and about as long as wide; snout short in adults slightly longer than distance from eye to ear, about 1,5 times diameter of eye, but considerably longer in juveniles. Interorbital area concave and narrow, edged with a row of enlarged scales, often keeled and separated by two to three rows of smaller, more irregular scales. Scales of supraorbital area distinct from other head scales by being fairly regular, smooth and non-imbricate. Extrabrillar fringe well developed, extending from lower anterior to upper posterior corner of eye. Supraorbital part flattened, brim-like and formed by a row of elongate scales overlying another slightly shorter row. This lid-like structure can be slightly lowered. At posterior edge it ends rather abruptly, but anteriorly continues into a slight preorbital swelling. Eye large and bulging, average diameter equal to 7,4 perca (N = 19, range 6,6 - 8,9), about two-thirds length of snout; pupil a vertical slit with lobed edges, closing down to four pinholes as in *Gekko*-type (Underwood, 1954). Ear-opening, which is oblique, oval and slightly longer than the diameter of eye, can be closed down voluntarily to a narrow slit. Rostral subpentagonal, slightly larger than first upper labials and about as broad as deep; 8-12 upper and 10-14 lower labials (occasional higher or lower counts may occur, due to splitting or fusion). Mental narrow with more or less parallel sides and rounded posterior edge, subequal in width, but usually longer than adjacent lower labials. Nostril small and oval, usually partly blocked by an interior projection of posterior nasal, surrounded by three (occasionally two or four) swollen nasals, of which anterior one is largest and in good contact with its fellow mesially, as well as rostral and first upper labial. A small granule may separate anterior nasals behind rostral. Posterior nasal in good contact with first upper labial and occasionally in short contact with second. Snout in interorbital area covered with large, irregularly-shaped, polygonal, swollen scales, largest anterior to orbit.

In post-orbital, temporal and occipital areas enlarged head scales become intermixed with smaller, irregular granules; a row of enlarged, pointed tubercles borders anterior edge of ear opening. Neck and body covered with small, irregular, flat scales, intermixed with irregular rows of enlarged, more or less keeled tubercles, largest dorsally, decreasing in size laterally. Lower labials bordered by enlarged scales which merge with minute sublingual and gular granules, then become enlarged and imbricate on throat, covering whole ventrum, and largest on posterior third of abdomen next to umbilical slit, in pubic area and on underside of femurs. Umbilical slit remains clearly visible in adult specimens. Laterally ventral imbricate scales increase still further, largest in middle of sides, where they meet and are equal in size to dorsal enlarged tubercles (pl. 5). Body stout, short and cylindrical, legs relatively long and slender; adpressed hindlimbs reaching to or just beyond elbow. Dorsal side of upper and anterior edge of lower part of forelegs covered with imbricate, flattened scales, while dorsal side is covered with irregular, smooth granules intermixed with enlarged, smooth to slightly keeled tubercles; underside of forelegs covered with minute granules, becoming subimbricate on lower parts. Fingers short, sub-equal in length, with parallel sides, slightly webbed at base, edges slightly flattened and tips rounded. Dorsally hand and fingers are covered with flat, imbricate scales, while palmar surface is covered with minute scales, each with a three-pointed base, consisting of six alternating convex and concave sides, fitting tightly into sides of adjacent scales. Each of these scales bears a sharp median spine, which causes finely serrated appearance of edges of fingers. When sloughing, the glove tears along edges of fingers where spinose ventral scales and imbricate dorsals meet and dorsal and ventral surfaces are thus sloughed individually. Tips of fingers covered with enlarged, blunt, callous scales of the same basic shape as those on palm. These continue to a point between one and two millimetres from tip, where they meet dorsal imbricate scales. Dorsally hindlimb is covered with minute granules intermixed with enlarged, smooth and subconical tubercles, faintly keeled on femur but strongly so on lower part of limb. Underside and anterior edge of hindleg covered with imbricate scales, posterior side of femur is covered with minute granules. Toes cylindrical, with slightly flattened edges, and faintly webbed at base between toes one to four while toe five is free, and, in life, stands at nearly right angles to toe four. Length increases from toe one to four with five again shorter and subequal to three. Feet and toes covered with imbricate scales above but ventrally with same type of pointed scales as described for palms of hands. Although these scales also form a protective cover over tips of toes and are blunt as on fingers, they are not markedly enlarged and continue onto dorsal surface of toes to a point from 1 to 2mm from tip, where in females a fine claw erupts, pointing vertically upwards. Preanal and femoral pores absent, postanal sacs present. Postanal area swollen and covered with smooth, imbricate scales and usually two (1-3) enlarged, pointed scales on either side. Tail segmented, swollen, round, tapering, average length equal to 71,7 perca ( $N = 22$ , range 63,2-80,5). Each segment covered above with small, irregular, imbricate, smooth scales, intermixed with a transverse row of evenly spaced, enlarged, pointed, smooth to keeled tubercles. In basal part

about 8–10 enlarged tubercles per segment, decreasing in number and size towards tip of tail. Underside of tail covered with three to four rows of smooth, usually enlarged, imbricate scales, in size equal to or larger than those on belly. Regenerated tails covered above and below by smooth, irregular, subimbricate scales.

Sexual dimorphism: Postanal region of males strongly swollen, more so than in females, protruding on either side of tail. Enlarged scallop-like scales borne on either side of swelling better developed in males, where slightly hooked and upward-curving. In females, although occurring in same position as in males, they are flattened and therefore less prominent. Only hind feet of females clawed. Claws minute and apparently, at least to some extent, retractile and emerge from a little cluster of scales on dorsal surface of all toes 1 to 2mm from tip, where dorsal, flat, imbricate scales meet peculiarly shaped scales of ventral side (pl. 4).

A remarkably clear sexual dichromatism exists, which hitherto has not been recognized as such. In the generally fairly variable pattern the angular, dark brown, often black-lined shoulder band is usually very clear in females and is followed by similar dark, angular bands, alternating with light bands, which may be interrupted (pls. 6 and 8). In adult males the dorsal brown colour is more continuous and on the light crossbars one to four pairs of prominent dorso-lateral white spots occur (pl. 7). This applies to all the specimens examined from central and eastern Great Namaqualand, Botswana and most of the Cape Province. However, in Little Namaqualand, the Namib Desert south of Lüderitz and probably along the South West African escarpment in the transitional area between this and the Namib subspecies, male specimens in a population may or may not show these spots, as no dichromatism occurs in the Namib form.

Colour: The colour is fairly variable and to some extent depends on the general ground colour of the environment, e.g. specimens collected on red Kalahari sand usually have a reddish brown appearance. Like most geckos *Chondrodactylus* can change its colour intensity from dark to lighter, although only to a limited extent. Preserved specimens lose all the colour quite soon but unless exposed to strong light for prolonged periods, which results in complete bleaching, the original pattern remains recognizable and is as follows (pls. 6–8): A dark streak extends from the second upper labial to the anterior corner of the eye, continuing from behind the eye as a wide band curving over the temporal area, and ending on the occiput without meeting its fellow. A dark band originating on the rostral forks posterior to the nasals, its arms passing over the supra-orbital to rejoin in the parietal area, and continues as a thin median streak down the neck, terminating in the neckband or continuing to the shoulder saddle. A thin median dark line occurs in the light interorbital area and joins the dark parietal spot. A dark band may occur across the neck. A prominent dark angular band with the apex pointing backwards occurs over the shoulder area. It is often very dark brown or even black-edged and always the most prominent crossband on females. Two further more or less straight to slightly angular, often darker-edged bands occur across the back and one across the sacral area. These bands are separated by lighter bands. The tail is marked with alternating light and dark bands in young, but they become less distinct to uniform reddish brown, with

scattered dark brown specks, in adults. The legs are brownish above with the lighter enlarged tubercles appearing as spots. The underside of the head, body, extremities and tail is white to pinkish. In juveniles the colour pattern is very clear, but becomes less so in older specimens. In juvenile males the shoulder saddle and dorsal bands are very clear and each of the lighter intermediate bands bears a pair of dorso-lateral white spots. In old adult males both the dark and the light bands become less distinct and merge into a generally uniformly mottled dorsal colouring. However, the dorso-lateral white spots remain and may in fact become more distinct. Occasionally these spots are broken up into a cluster of smaller spots. These spots occur on the base of the neck, just behind the shoulder saddle, about halfway between the fore and hind limbs and just anterior to the hind limbs. Quite often the anterior and posterior pair are only faintly developed or may be completely absent. The spots behind the shoulder saddle are usually the most prominent. The iris is light golden-brown with dark brown reticulations.

Size: Largest complete specimen and largest male TM 15631 172,0 (101,0 + 71,0) mm, between Nochaben and Kanus. Largest female TM 31609 155,5 (92,0 + 63,5) mm, Farm De Waal.

Population Variation: As mentioned previously in the discussion of sexual dichromatism a transitional zone between the typical form and the subspecies described in this paper appears to exist in the southern Namib as far south as the Richtersveld. The most obvious differences are in the colour pattern, presence or absence of sexual dichromatism and the size of the lateral scales. In general the enlarged dorsal tubercles are white tipped on all the specimens from the southern Namib and therefore they are much more obvious than in the typical form, causing a more speckled impression which is characteristic for the new subspecies. Although a fair number of records exist from this area many of them are unfortunately juveniles and/or females. In the case of doubtful samples males would indicate the affinity. The samples from Tsondabvlei and Awasib contain both sexes while the two specimens from the Tsauchab valley (TM 24974, 42358) are females, all belonging to the typical form. In these localities *C.a. angulifer* invades the desert along the wide erosion valleys of the Tsondab and Tsauchab rivers and the gravel flats around Awasib which form deep indentations into the southern Namib sand sea. Apart from the typical white spotted males from Rosh Pinah (TM 37616) and 23 km E. of Oranjemund most of the other samples from Aus to Port Nolloth consist of females or juveniles with white tipped tubercles but otherwise normal scale pattern. The samples from Brandkaross and Lekkersing are true intergrades, illustrating the heterogeneity of the transitional area. Two females (TM 22264, 22657) from the first mentioned locality have a pattern without a very well accentuated shoulder saddle and with unclear scalation. The juvenile male (TM 22658) has a clear Kalahari scale pattern, but no white spots, while the adult male (TM 33769) has a clear Kalahari scale pattern with white spots. At Lekkersing all three adult males have a Kalahari scale pattern, but while TM 27905 has white spots and is thus a typical *C.a. angulifer*, the other two specimens (PEM 1489/65 and 66) have a female pattern, i.e. no white spots. The male TM 28066, from 8km southwest of Annisfontein, has a typical scale pattern but only

two minute spots behind the vague shoulder saddle, which is sufficient to consider it a specimen of the typical form. Mertens (1955: 43) mentions his surprise at the absence of white dorsolateral spots in specimen SMF 45677, from between Rehoboth and Mariental. As it is a male, this is surprising, assuming that the locality is correct. A special problem is posed by specimens CR 1030 and CR 1031 in the State Museum, from the lower course of the Kuiseb River. These are a juvenile from between Unarus and Walvisbaai and an adult male from Rooibank. Their scalation and markings are clearly of the typical form but they occur in the area where the Namib form would be expected and a specimen has been collected about 32 km from Walvisbaai on the road to Rooibank. Although this specimen was lost photographs of it exist. A similar problem was encountered and is mentioned in the discussion of *Ptenopus garrulus*. No conclusion can be reached on the lower Kuiseb area material until more thorough sampling has been carried out.

ECOLOGICAL AND FIELD NOTES: A terrestrial, nocturnal inhabitant of Great Namaqualand, south-western Botswana and the northern, north-western, western and central Cape Province, an area coinciding very closely with the below 300mm average annual rainfall zone.

*Chondrodactylus* prefers flat, sandy areas with a substratum suitable for burrow construction. In hilly or mountainous areas the distribution appears restricted to sandy river courses and alluvial deposits in the valleys. In the dunefields of the southern Namib and south-western Kalahari this gecko prefers the harder interdune spaces to the actual dunes. The distribution coincides remarkably well with the area with less than 300mm average annual rainfall and since no obvious reason was noted why the more eastern parts of the Kalahari have not been invaded the situation suggests that rainfall may be a limiting factor.

The day is spent in some retreat which appears to be selected anew each night, as one may find specimens hiding under camping equipment after spending a night in an area. Furthermore they can be found under stones and the statement by Methuen and Hewitt (1914) that they occasionally occur in old houses must be taken as reflecting a similar situation, namely that specimens shelter under debris of a ruin. The same authors, who were very successful collectors of this gecko in the Karasberg area, dug them up from holes about one metre long. These appeared in many cases to be scorpion holes, which had been enlarged by their new occupants. A single specimen was found per hole and the holes were without side tunnels. The following observations concerning their day retreats were made in January 1967 at the new Nossob Camp in the Kalahari Gemsbok National Park. Bushmen tracked the geckos to where they had disappeared into holes, which were then excavated. The following were found: (a) Adult female in branching mouse warren, 25cm below surface in area without shade. (b) Adult female in hole 25cm long, and 5cm below surface in scant shade of "driedoring" bush (*Rhigozum trichotomum*). The entrance was old and apparently started by mice, but may have been cleaned out by the gecko. (c) Adult female in mouse hole 50cm from entrance, less than 15cm below unshaded surface. (d) Subadult male, collected by native women and said to have been close to surface, about 50cm from the entrance and in an unshaded area. These findings con-

firm the statement above that *Chondrodactylus* will make use of any suitable retreat during the day and also change it periodically.

*Chondrodactylus* has never been observed abroad during the day by the author but Broadley (pers. comm.) during February 1967 saw a specimen walking under the shelter of a thorn bush at the edge of the Nossob River near Vloorskop at about 16h00. Normally they emerge from their retreats after sunset and wander about in search of food. Methuen and Hewitt's (1914) report that they squat near the entrance of their holes and chirp through the night must be attributed to a confusion with *Ptenopus*, as already pointed out by Loveridge (1947: 30). The only sounds produced which have been noticed are squeaks uttered in distress while being handled or during threat display. Hissing, emitted during threat display, appears to be caused by forcing air through the nostrils. According to sonagrams this is a "white" sound indicating that no true sound production is involved.

Their normal gait is slow and deliberate and they pause frequently to survey their surroundings. While walking, their bodies and tails are raised well off the ground. When alarmed the tail is raised over the back giving the animal the appearance of a scorpion (FitzSimons and Brain, 1958), but no proof of effective mimicry exists. When molested and cornered an aggressive attitude is often assumed. The body becomes inflated to the accompaniment of a wheezing, continuous hiss, and sways from side to side. If agitation continues, the gecko will lunge at the offender, jumping into the air while uttering a squeaking hiss and giving a powerful bite which can draw blood from a finger. Although in fact quite harmless, these geckos are considered deadly poisonous in areas where they occur (FitzSimons, 1943).

Their activity rhythm and the factors controlling it are still completely unknown and are probably linked with prevailing weather conditions, which also control the activity of prey. Night collecting may produce nothing one night, while during the following night, without noticeable changes in the weather, this gecko can be encountered in fair numbers.

Finding specimens close to the surface in unshaded areas or in only very scant shade under a *Rhigozum* bush, when investigating their day retreats at the Nossob camp, was surprising. Although it was fairly cool at that time, the surface temperature in January can climb well above the lethal limit of any reptile and even 15cm below the surface the temperature may still approach the critical maximum. In captivity these geckos sometimes emerge from their retreats during the day to lie on the sand and bask near a heat bulb and body temperatures of 28,5° to 34,4°C have been measured. When offered a temperature range of 28° to 50°C in a box with a sand-covered floor of 25×70cm five specimens, from the Nossob Camp and Twee Rivieren, settled down in the section with the surface temperature ranging from 32° to 37°C. These observations indicated that the temperature requirements of this gecko are quite high and that for this reason the critical maximum may be higher than for other diurnal geckos. This is not confirmed by Stebbins' (1961) experiments, which established the mean critical maximum tolerance for four specimens as 42,9°C. An attempt was made to check this result in Pretoria with an artificial heat source as described by Brain (1962). Schultheis quick-

registering thermometers, as utilized by Stebbins in 1958, were used with the five geckos from the Gemsbok Park, which by then had been in captivity for four months. The results showed a range varying from 40,5° to 42,2°C with a mean of 41,3°C, which is considerably lower than Stebbins' results and much lower than the results obtained by Brain (1962) for other gecko species in the Namib. Although in excellent physical condition at the time of the experiment the physiology of these geckos might have been affected during their captivity, or otherwise the experimental technique was unsatisfactory and caused the difference found in the results.

Little is known about the reproduction of this genus. Gravid females bearing two eggs at a time have been collected from September to January and a female from the Gemsbok Park laid two eggs on January 19th, 1967 of which one measured 18 × 15,5mm. TM 33340, collected at the Nossob Camp on 6.I.1967 with a total length of 66,5 (39,0 + 27,5)mm is the smallest juvenile measured. Other juveniles with head-body lengths of 45mm or less were collected in December 1912 at Wasserfall, March 1916 at Keetmanshoop, February 1949 at Maltahöhe and another specimen was collected at Nossob Camp on the same date as the one mentioned above. From these scant observations it appears that eggs are laid from early to middle summer and young hatch after about three months, from middle to late summer. Although hard when laid, the shell of the egg is very thin and brittle. The surface is sticky at first and becomes encrusted with sand. It is not known where the eggs are laid in nature.

From observations in captivity it appears that males establish territories, which they defend against intruders. A male and two females from the Nossob Camp, which had lived together harmoniously for ten months, were used for experiments during which the following observations were made: Male and female specimens of *C.a. namibensis* were introduced into the terrarium individually and at intervals. The new specimen immediately attracted the attention of the male *angulifer*, while the females did not show any interest. Stealthily stalking with horizontally outstretched tail the male approached the intruder. The male *namibensis* then stood up high facing the aggressor broadside, while the females did not react to the approach. Then, either without further preliminaries or only after identifying the intruder by touching him with the tongue, the *angulifer* male attacked by biting and shaking vigorously while holding on to the intruder. The favourite site of attack was the side of the neck just behind the ear opening, but the side of the body, the base of the tail and the legs were also bitten. The victims reacted by hissing loudly, while struggling violently to wrench themselves free, usually successfully. The winner then pursued the fleeing victim, which continued hissing. Usually no further attacks were made and the dominant male then resorted to threat display. After rushing up to the cornered intruder he swung broadside to him, while raising himself up on outstretched legs with the tail stretched out horizontally. By flattening the body laterally and inflating the throat the body was enlarged. In this position the dorso-lateral white spots are prominently displayed. At this stage a soft threatening sound was also uttered. It started with a purring which ebbed to a monotonous sound, a similar pitch being maintained throughout. This sound was uttered



repeatedly until the other specimen was removed, after which the male *angulifer* calmed down.

Females were treated in a similar way to males although their reactions were not quite the same. When approached they did not attempt threat display but usually allowed the male *angulifer* to inspect them. When bitten on the side of the neck they hissed loudly but did not struggle as violently as when bitten on other parts of the body, in which case they sometimes even returned the bite. However, while holding on to the side of the neck of the female *namibensis* the male *angulifer* would try to hold on to her back with his forelegs. In this case there appeared to be a confusion between aggression and mating behaviour.

It was interesting to note that the *angulifer* recognized the *namibensis*, which has a different colour pattern, as belonging to its own species, as other lizards in the terrarium, unless of edible size, were ignored. During fighting the tail was never attacked and it can therefore be assumed that regenerated tails were lost during attacks by predators.

The skin is shed in pieces and is eaten. It comes off at the lips first and is peeled back over the head by rubbing against the roof of the burrow or some suitable object. When it has been pushed back to the shoulders the gecko starts kicking and scratching the loose skin with its hind feet. Thereby the skin is peeled off the forelegs. This is the only time when the claws of the female might still come into action, although this is no functional explanation for their existence as they occur in one of the sexes only. As soon as the slough can be reached, the gecko takes hold of it with its mouth and pulls it off piece by piece. Any part that tears loose is swallowed. The gloves of the hands and feet tear along the edge of the palm and digits where the dorsal imbricate and the ventral spinose scales meet. The dorsal side tears off first. Because of the protective cap formed by the ventral scales over the tips of the digits, the skin comes off with great difficulty at these points. Usually the gecko only manages to remove the skin from those parts after the skin from all other parts of the body has been shed.

Food consists mainly of a variety of arthropods, and FitzSimons (1943) listed termites of the grass-cutting variety and small ground-living beetles as the main components of their diet. Loveridge (1947: 338) mentioned in addition *Orthoptera* and a gecko (*Colopus wahlbergii*). The observation that small geckos are taken is confirmed by Brain (1962: 9), who states that *C. angulifer* will eat a variety of insects in captivity, but never shows the same enthusiasm as when offered a barking gecko (*Ptenopus*), which it will grasp, shake vigorously and swallow whole. He concludes that *Chondrodactylus* may be the main predator of *Ptenopus* in the south-western Kalahari. However, the examination of the stomach contents of more than 25 specimens from various localities revealed no remains of vertebrates, for which reason its role as a predator of *Ptenopus* does not seem as important as suggested by Brain. Remains belonging to the following arthropod groups were found: harvesting termites, curculionid and tenebrionid beetles, tenebrionid larvae, moths, pentatomid bugs, the gryllacrid *Comicus* from various localities, solifugids, spiders and scorpions. A certain amount of sand was usually present as well as surprisingly large stones, up to the size of  $9 \times 7,5$ mm. An interesting find was the

presence of "hairballs" in the stomach of some specimens. They were of irregular shape with a fairly smooth surface and up to about 9mm in diameter, which is obviously too large to pass through the small intestine. They consisted of a conglomerate of sand, hairs, bristles, small pieces of chitin, vegetable matter (?) and other unidentifiable material. In captivity mealworms and locusts are readily taken.

Round worms are found in the stomach and a tapeworm was found in the coelom and not in the intestine. The mite *Gecckobia transvaalensis* is known as an external parasite. The remains of *Chondrodactylus* are common in owl-pellets (Nel & Nolte, 1965) and it has been found in the stomach contents of the Bat-eared Fox (*Otocyon megalotis*) (TM 33369) and the sand-snake *Psammophis leightoni trinasalis* (Broadley, 1967). This last observation is particularly interesting as the snake in question is diurnal. All small carnivores and owls occurring in the same area as this gecko, as well as the adders *Bitis arietans*, *B. caudalis* and *B. cornuta*, must be considered its natural enemies.

**RANGE:** The distribution coincides closely with those parts of southern South West Africa (Great Namaqualand), south-western Botswana and the Cape Province which have an average annual rainfall of less than 300mm (Fig. 1). The record from Malmesbury is extremely doubtful as no subsequent specimens have been collected there since Boettger (1887) reported it. On ecological grounds it is also unlikely as it is the only record from an area with Cape Macchia flora, with an average annual rainfall of more than 300mm. In contrast the record from Touwsrivier is acceptable, as this locality has a low average rainfall with karrooid vegetation.

**RECORDED LOCALITIES** (Gazetteer in Part 1): Abbabis (TN); Abrahamskraal (TO); Alt Wasserfall (F,M,L,PE,TO,SW,MCZ); Annisfontein, 8km S.W. of Annisfontein, Asab Station (TN); Askham (F,L,TO); Aughrabies Falls, Aus (S); btwn Aus and Bethany (F,M,L); Awasib (SW, TN); Beaufort West (L,S); Bethany (M,M1,A); Blaauwbosch (K,L); 8km N.E. of Bokspits (UM); Brukkaros (TN); Büllsport (F,M,L); Buschpanne (TN); Carnarvon (F,L,A); Dassiefontein-Noakabib (TO); Davignab (UM); De Waal (TN,SW,UM); 10km S. of Gakhibane (UM); Gembokberg (TN); Gezelskap (P); Great Fish River nr Berseba (F,M,L,TO); Great Karas Mountains (F,M,L,A,PE,TO,SW,MCZ); Groot Aarpan (TN,P); Groot Brak, Groot Kolk (TN); Hanaus (M,SW); Hantam (F,L); Henkries (L,S); Inkboschpan (P); Jakhalswater (S); Kakamas (A); Kalkfontein South (M,S); Kalksloot Station (TN); Kameelsleep (P); Karoedap (TN); Keetmanshoop (M,TO); Kenhardt (F,L,PE); Kenhardt - Pofadder (TN); Khuis (UM); Konkiep (F,M,L,TO); Kraikluft - Alt Wasserfall (TO); Krantzkop (S); 18km S.W. of Kuboos (TN); Kubub (F,M,L,TN); Kulsberg (TN); Leeudril, Mahlzeit (TN,P); Malmesbury (F,L); Maltahöhe (M,L,TN); Mata Mata (TN); Miershoopholte (P); Naramoep, Naroep (S); Nasukkel - Uhlenhorst (SW); Naukluft Mountains (M); Niekerkshoop (B,TN); nr Noachabeb (= Noakabib) (TO); Nochaben - Kanus (F,M,L,TO); Nossob Camp (TN); Obib, Oranjemund, 23km E. of Oranjemund (TN); Perdepán (SW); Plateau (M1); Pofadder, Port Nolloth (S); Port Nolloth - Oograbies (TN); Rehoboth - Mariental (M); Rosh Pinah, Sesriem (TN);

Sinclair Mine (F,M,L); 30km E. of Sossusvlei (TN); Stoepjes (Swedish SA. Exp.); Swartmodder (S); Swemkuil (TN); Touwsrivier (S); Tsabong (UM,P); Tsondabvlei, Twee Rivieren (TN); Uhlenhorst (SW); Upington, Verloor (= Velloor) (S); Victoria West (K); Vloorskop (UM); Voegelfontein (S); Vrederus, Voorloper (P); Warmbad (F,M,L).

Localities with intergrade populations between *C.a.angulifer* and *C.a.namibensis*: Brandkaross (TN); Lekkersing (PE,TN).

MATERIAL EXAMINED: One hundred and sixty-eight specimens.

TRANSVAAL MUSEUM: TM 3002 nr Noakabib; TM 3004-8, 3011, 3013-5, 3017, 3019, 3021, 3023 Alt Wasserfall; TM 3010 btwn Dassiefontein and Noakabib; TM 3018 btwn Kraikluft and Alt Wasserfall; TM 3454 Keetmanshoop; TM 15596 Askham; TM 15597 Konkiep; TM 15631-2 btwn Nochaben and Kanus; TM 15633 Verloor (Velloor); TM 17824 Gt Fish River Valley 23km from Berseba; TM 21043 Oranjemund; TM 22104 Maltahöhe; TM 22264, 22657-8, 33769, 35251, 35258 Brandkaross; TM 22273 btwn Oograbies and Port Nolloth; TM 22676, 22678-9 Obib; TM 22677 Kubub; TM 22975 btwn Kenhardt and Pofadder; TM 22976 Niekerkshoop; TM 24641, 25232 Mata Mata; TM 26852, 28155-60, 31605-11, 32027, 41395, 41701-3 De Waal; TM 24974 30km E. of Sossusvlei; TM 27797 23km E. of Oranjemund; TM 27869 Groenkloof River 18km S.W. of Kuboos; TM 27905 Lekkersing; TM 28058 Swemkuil; TM 28066 8km S.W. of Annisfontein; TM 28500-1 Kalksloot Station; TM 32627-8, 32660, 32668, 32684, 33382-3, 41532 Twee Rivieren; TM 32665-7 Leudril; TM 33284 Brukkaros Mtn; TM 33339 Groot Kolk; TM 33340-6, 33800, 34910, 34950 Nossob Camp; TM 33369 Groot Brak; TM 35277 Annisfontein; TM 35474-6, 36344 Karoedap; TM 36330 Kulsberg; TM 36962-4 Tsondabvlei; TM 36965-7 Abbabis; TM 37101-3 Awasisb; TM 37616 Rosh Pinah; TM 37969 Mahlzeit; TM 37970-1 Buschpfanne; TM 38024 Groot Aarpan; TM 41802-7 Asab Station; TM 41892-3 Gemsbokberg; TM 42358 Sesriem.

STATE MUSEUM: CR 1030 btwn Unarus (= Ururus?) and Walvisbaai. CR 1031 Rooibank; CR 2195 Uhlenhorst; CR 2534 a + b Perdepan; CR 3317 Hanaus; CR 3456 Awasisb; CR 3891 a - c De Waal; CR 3915 Nasukkel - Uhlenhorst.

SOUTH AFRICAN MUSEUM: SAM 1070 Touwsrivier; SAM 1131-2, 2530-1, 2540-4 Namaqualand; SAM 1137 Cape Town (?); SAM 2786-7 Naramoep; SAM 2834 Pofadder; SAM 2932-3 Swartmodder; SAM 9176 Beaufort West; SAM 11364 Port Nolloth; SAM 13644 Lüderitz; SAM 14182 (2) Voigtsgrund; SAM 15841 Upington; SAM 17015 Kalkfontein South; SAM 17322 Krantzskop, N. bank of Orange River; SAM 17329 (3) Aughrabies Falls; SAM 17725 Aus; SAM 18021 (2) Voegelfontein.

ALBANY MUSEUM: AM 369 (2) Carnarvon; AM 2210 (2) Kakamas; AM 3020 Alt Wasserfall; No number Bethany.

PORT ELIZABETH MUSEUM: PEM 390 Great Karas Mountains; PEM 1489/9 Kenhardt; PEM 1489/65 + 66 Lekkersing.

MCGREGOR MUSEUM: No numbers. Blaauwbosch; Victoria West.

UMTALI MUSEUM: UM 9925-6 De Waal; UM 10959, 10961 Farm Davignab; UM 15228-33, 15288 Vloorskop; UM 15466 8km N.E. of Bokspits; UM 15820 Khuis; UM 16009, 20209 Tshabong; UM 22697 10km S. of Gakhibane.

7(b) *Chondrodactylus angulifer namibensis* ssp. nov., text-fig. 1, plates 5 (bottom), 6 (left), 7 (right) and 8 (top)

*Chondrodactylus angulifer* part. FitzSimons, 1943: 10 (Btwn Omaruru River and Otavi; Lüderitzbucht); Loveridge, 1947: 28 (Lüderitz Bay = Angra Pequena); Mertens, 1955: 43 (Lüderitzbucht); Koch, 1962, Photo; Giess, 1965: 16; Mertens, 1971: 34 (32km E. of Swakopmund).

Type locality: Amichab (= Anigab) Mountain, Namib Park, central Namib Desert, South West Africa ( $\pm 23^{\circ}11'S.$ ,  $15^{\circ}30'E.$  Altitude about 1000m.). The specimens were collected at the foot of the mountain which lies about eight kilometres west of the Amichab (= Anigab) waterhole which is indicated on most of the large-scale maps of that area.

Type series: Nineteen specimens: 11 males, six females, two juveniles.

Holotype: TM 32632, adult male from Amichab Mountain, Namib Park, W.D. Haacke, 27.IV.1966; allotype: TM 31267, adult female from 5km N.N.W. of Gorob Mine, Namib Park, C.G. Coetzee, 23.IX.1965; paratypes: TM 31266 5km N.N.W. of Gorob Mine, TM 32118-21 Amichab Mountain, TM 32158-60 Ubib, TM 32185-7, 32796 Hotsas, W.D. Haacke; TM 32714 5km N.N.W. of Gorob Mine, C.G. Coetzee; TM 32249 Langer Heinrich, H.D. Brown; TM 32250-1 Gross Tinkas, W.D. Haacke; TM 32661 Gobabeb, O.P.M. Prozesky.

DIAGNOSIS: A desert form, occupying north-western parts of distribution area of genus, i.e. central Namib Desert, from the western Kaokoveld to the Kuiseb River and then along a narrow coastal strip to Lüderitz (text-fig. 1). Differs from the typical form in absence of sexual dichromatism, different colour pattern (pls. 6-8), decrease of size of ventral scales towards sides of body (pl. 5) and more slender extremities.

DESCRIPTION: Holotype TM 32632, adult male, 178,5 (107,5 + 71,0)mm (pl. 6, left). Head from tip of snout to right ear opening 28,7mm long, 19,3mm thick and 29,0mm wide; horizontal diameter of right eye 8mm; snout from rostral to anterior edge of right eye 12,5mm; distance from eye to ear on right side 11,7mm; length of right foreleg from armpit to palm of hand 34,0mm; right hand from wrist to tip of 3rd finger 11,0mm; right hind leg from groin to palm of foot 37,0mm; right foot from heel to tip of fourth toe 14,0mm.

Unless otherwise stated, general shape and scalation similar to typical form. Head large and swollen, subtriangular, about as long as wide; snout short and curved, subequal to distance from eye to ear and one and a-half times length of horizontal diameter of eye; eyes large and bulging equal to 7,4 perca; pupil vertical with lobed sides; ear opening nearly vertical, elongate, oval and 5mm long; rostral pentagonal, subequal to first upper labials; 12, 12 upper and 11, 12 lower labials; mental elongate, about twice as long as broad, slightly longer than elongate first lower labials; anterior nasal in good contact with its fellow mesially, as well as rostral and first upper labial, lateral nasal also in contact with first upper labial; neck and back covered with small, irregular, flat granules, intermixed with enlarged, round, smooth to faintly keeled tubercles, forming about 18 irregular rows on back. Enlarged tubercles largest dorsally, decreasing in size on sides of body. Laterally ventral scales decrease in size and merge with small dorsal granules in between enlarged tubercles of

mid-lateral area (pl. 5). On remaining parts of body, scalation is similar to typical form. Body stout and cylindrical, legs thin, adpressed hindlimbs reaching to just beyond elbow. Preanal pores absent, postanal sacs present. Postanal area strongly swollen and covered with smooth, imbricate scales and a pair of enlarged, pointed scales on either side. Tail segmented, round, tapering, in length equal to 62,2 perca, covered dorsally with about seven irregular, transverse rows of small, subequal flat, imbricate scales per segment. A transverse row of about 10 enlarged, pointed, smooth to faintly keeled scales on each of basal tail segments, decreasing in size and number per segment towards tip. Tail ventrally covered with fairly irregular, but mostly large, flat, imbricate scales.

Colour (in life, from colour slide): The general impression is orange-brown, with a number of darker brown crossbands over the back and tail. The whole of the dorsal surface is speckled white. All the dark pigment is present in the form of fine dusting and the colour pattern is formed by a concentration of these fine specks in bands or blotches. The basic dorsal colour a reddish to orange-brown, while some dark brown infusions occur on the lips, above the orbits, on the occiput and on the limbs. The neck is without a crossband. A thin line starts just anterior to the front leg on the side of the body, passes backwards and up at an angle to behind the legs, where it widens out to form a crossband reminiscent of the angular black saddle of females of the typical form. On the back there are three more wide crossbands, of which the posterior one is in the sacral area between the hindlegs. A faint vertebral line incompletely links these bands. Five similar, ill-defined, brown crossbands occur on the tail. All the enlarged tubercles on the back, tail, limbs, neck and most of those on the head are white or white-tipped, which causes a speckled appearance, which is characteristic of this subspecies. The underside is white. The reddish-brown colour faded in the preservative, but the dorsal bands and brown infusions remain clear. The iris is silvery-white, with red to black dendritic infusions around the edge.

Allotype: TM 31267, adult female, 154,5 (98,0 + 56,5)mm; right hand 11mm from wrist to tip of third finger; right front limb from armpit to palm of hand 29mm; right hind foot from heel to tip of fourth toe 13,5mm; right hind limb from groin to palm of foot 33,5mm; head from tip of snout to right ear opening 24,2mm, width of head 25mm, thickness 14,5mm; horizontal diameter of right eye 7,4mm; snout from rostral to anterior edge of right eye 10,8mm; distance from eye to ear on right side 8,5mm.

Scalation very similar to that of holotype, but differing as follows: left posterior nasal in contact with first and second upper labials; upper labials 10, 10; lower labials 11, 11; postanal swelling less developed and not extending back as far as in male; enlarged scales (only one on right side) on either side of base of tail smaller. Toes each with a minute claw erupting dorsally at point where peculiar ventral scales, which also cap tips of toes, meet dorsal flat imbricate scales. This point is closest to tip on toe five, where claw protrudes more or less horizontally from dorsal edge of toe, while on all other toes the claw erupts about 2mm from tip and stands up vertically. The allotype is a gravid female bearing two nearly spherical ova of 13mm and 12mm diameter.

The colour pattern is very similar to that of the holotype, with a very faint neckband, four bands across the body and five on the tail. The head and the limbs have a brown dusting, but are white underneath. All the enlarged tubercles are very conspicuous, as they are white-tipped, even in the dark bands.

Paratypes: Scallation in general similar to that of holo- and allotype, with slight individual variations. Upper labials 10–13; 10(10), 18(11), 5(12), 1(13). Lower labials 10–14; 1(10), 15(11), 9(12), 6(13), 3(14). A pair of enlarged, scallop-like scales on either side of base of tail, occasionally only one per side in females. Belly covered with flat, imbricate scales, decreasing in size towards sides of body, where they merge into the small irregular dorsal granules. Enlarged dorsal tubercles also decrease in size on side of body but do not merge with ventral scales, as in typical form. Extremities thinner and longer, with longer fingers and toes, than in typical form. In comparison the average percra ratios of 15 of the types differ from those of 16 specimens from De Waal as follows:

	front leg	hand	hind leg	foot
	32,7	11,2	36,4	14,9
<i>namibensis</i> . . . . .	(28,9–36,2)	(9,4–12,3)	(31,5–40,1)	(11,9–17,6)
<i>angulifer</i> . . . . .	28,9	10,0	33,7	13,3
	(26,8–31,6)	(8,7–11,5)	(32,2–35,5)	(12,5–14,7)

. Of 38 specimens of this subspecies 71,1 % still had the original tail, 10,5 % had the tail regenerated from the base, 15,8 % had the tail regenerated from a point distally to the base, a single (2,6 %) specimen had its tail missing from the base while none had only part of the tail missing. These ratios are very similar to those of a series of 84 specimens of the typical form which are in the same sequence 72,6 %, 9,5 %, 13,1 %, 1,2 % and 3,6 % had part of the tail missing. The juvenile specimen TM 32661 lost and regrew its tail in captivity.

Sexual dimorphism: Neither postanal swellings nor enlarged pair of scallop-like scales on sides of these swellings are markedly larger in males than in females and unless comparative material is available, are unreliable characters for sexing. Toes of females have minute claws on dorsal side between one and two millimeters from tip. Apart from inspection of gonads this is the best character for sex determination. Sexual dichromatism not normally present (pls. 6–8), however TM 39020 a large male from 30km S.W. of Orupembe, the most northern record for this subspecies as well as the genus, has small white specks in the dorso-lateral position of the white spots of males of typical *angulifer*, and another male with similar markings was photographed at Klein Spitzkoppe. Otherwise his colour pattern is characteristic for *namibensis* as described below.

Colour: In general, preserved specimens are very light in colour due to fading. The pattern remains darkest in specimens which died after being kept in captivity for some time. All specimens have five bands on the back, of which the first is on the neck, the second on the shoulders and the fifth in the sacral area and five to seven bands on original tails. The shoulder saddle is as dark as the remaining dorsal bands, which differs from the typical form, in which it is usually darker than the rest and accentuated with black. Head either very pale, with a few darker marks

or occasionally quite dark without a pattern. The basic dorsal colour is pale buff while the transverse bars and other markings are reddish to greyish brown. Ventrums immaculately white. The enlarged dorsal tubercles on the whole body, or at least their tips, are white or very pale grey. This causes an overall speckled appearance, which is particularly noticeable on the darker markings, which is characteristic of this subspecies.

Size: Largest specimen and largest male TM 34960 snout/vent length = 113mm (tail damaged) from Gobabeb. Largest complete male TM 32632 (holotype) 178,5 (107,5 + 71,0)mm, Amichab Mountain. Largest female TM 31267 (allotype) 154,5 (98,0 + 56,5)mm, 5km N.N.W. of Gorob Mine.

REMARKS: Mertens (1955 and 1971) had a sample consisting of both the subspecies. He noticed the absence of the dorsolateral white spots in several of the specimens and the presence of enlarged tubercles, more obvious because of their white pigmentation. The poor representation of the typical form in his sample did not demonstrate the clear sexual dichromatism which exists in that form. His three specimens (SMF 22101–3) from Lüderitz, two males and one female, do not show this colour difference and have the white enlarged tubercles thereby indicating their affinity with this new subspecies. In the 1971 publication the lack of white spots of SMF 56639 from the Namib in comparison to a similar sized specimen of the typical form from Bethany (SMF 56642) is noticed and suspicion is expressed that two sympatric species might exist, i.e. one with white dorsolateral spots and one without them but with more obvious white enlarged tubercles. In the discussion Mertens points out that Peters in the original description mentions white dorsolateral spots but illustrates a specimen without, which is regarded as holotype. This indicates that both male and female were available to Peters. Mertens further mentions *Chondrodactylus weiri*, which Boulenger described on a specimen from the Kalahari, and suggests that this name is available for the spotted form. However, *weiri* is a typical *angulifer* for which reason this name is not available for this new subspecies. A particularly difficult problem is SMF 45677, a male without dorsolateral white spots, from between Rehoboth and Mariental. Apart from the possibility of an aberrant specimen, I am suspicious of the validity of its claimed origin, as the collector of this specimen is known to me to be notoriously vague. This specimen, supposedly originating from within the range of the typical form, further complicated the picture for Mertens.

The problem of specimens CR 1030 and CR 1031 in the Windhoek Museum has been mentioned when discussing transitional populations in the chapter on the typical form. The specimens belong to the typical form but are supposedly from the lower Kuseb River in the Namib. Since five specimens of *Ptenopus garrulus* supposedly collected near Walvisbaai at the same time and by the same collector, also appear to be of more eastern origin (cf. Part 1 on *Ptenopus*, Fig. 1.) these specimens are suspect as being wrongly labelled, unless further sampling proves that rather unusual conditions prevail along the lower Kuseb River.

ECOLOGICAL AND FIELD NOTES: A terrestrial, nocturnal inhabitant of the true Namib and pro-Namib. In the east the escarpment of South West Africa appears to be the ecological boundary between this and the typical

subspecies. In the south a transitional zone exists in those parts of the Namib which fall within the northern limits of the winter rainfall area. Intergrades are known from various localities in this area, while none have yet been recorded from along the escarpment. Except for the records from Lüderitz this subspecies has not been collected along the coast. It is known from the undulating gravel plains of the central Namib and pro-Namib as far north as the Sechomib River, and from the interdune spaces of the southern Namib as far south as Lüderitz. The distribution lies within those parts of the summer rainfall area which have an average annual precipitation of less than five inches ( $\pm 125\text{mm}$ ) according to Wellington (1955), while Zelle's (1956/7) map indicates an average of less than 50mm.

Daylight retreats are unknown. The specimens collected in the central Namib were walking about at night. In most cases, when approached with a lamp, the specimens would "freeze" in a standing position or crouch on the ground. In captivity they often sit on rocks, from whence they survey the area for prey. Captive specimens, especially males, are at first very aggressive when molested and defend themselves in the way described for the typical form. The general behaviour and biology appear to be similar to what is known of the typical form.

Females collected during September and October contained two eggs and some captive specimens from Gobabeb laid eggs during the first two weeks of October. The shell is hard when laid and is brittle and fragile. The white shell is sticky at first and becomes encrusted with sand. The dimensions of one egg were  $21,7 \times 15,0\text{mm}$ .

As most specimens collected were kept alive for some time, hardly any records of stomach contents are available. The gryllacrid *Comicus* and termites are important food items. "Hairballs", as described for the typical form, were also found in this subspecies. If small geckos are preyed upon, *Ptenopus garrulus maculatus*, *P. carpi*, *Pachydactylus kochi*, *P. punctatus amoenoides* and *Kaokogecko vanzyli* are possible prey of this large ground gecko.

It can be assumed that the Horned Adder, *Bitis caudalis* is one of the most important predators, while *B. arietans* and possible *B. cornuta* in the southern parts are of lesser importance. In the vicinity of rocky outcrops and along rivers predation by owls is heavy, and by jackals very likely.

The activity rhythm and population dynamics are very obscure. Since 1959 intensive herpetological collecting has been carried out at Gobabeb but this gecko was not recorded from there for a number of years. A photograph taken by Mr E. von Koenen (Kock, 1963) was the first indication of the presence of this gecko at that locality. In February 1966 the first specimen, a juvenile, was collected accidentally in a solar still. Until then night collecting had produced no specimens. Suddenly in September 1967 Mr O.P.M. Prozesky, during two successive nights, managed to collect a dozen adult specimens in the immediate vicinity of the station. This apparent sudden increase in the population density is rather surprising and cannot be explained at present.

**RANGE:** The gravel plains and interdune spaces of the Namib and pro-Namib mainly north of the Kuiseb River to about Orupembe in the



western Kaokoveld, and apparently along a narrow coastal strip to Lüderitz in the south.

RECORDED LOCALITIES (Gazetteer in Part 1): Amichab Mountain, N.E. corner of Brandberg, Gobabeb, 5km N.N.W. of Gorob Mine, Cross Tinkas, Hotsas, Klein Spitzkoppe, Langer Heinrich (TN); Lüderitzbucht (= Angra Pequena) F,M,L,S); between Omaruru River and Otavi (D); 32km E of Swakopmund (M1); Ubib (TN); 50km N.W. of Uis (TN). Also collected at Husab and 32 km E. of Walvisbaai on Gobabeb road but specimens lost, however the latter was photographed.

Doubtful records: *C.a. angulifer* from between Unarus (= Uaras?) and Walvisbaai (CR 1030) and from Rooibank (CR 1031).

Additional material: DURBAN MUSEUM: DM 27 Between Omaruru and Otavi (exact locality unknown).

SOUTH AFRICAN MUSEUM: SAM 13644 Lüderitz.

TRANSSVAAL MUSEUM: TM 27213 N.E. foot of Brandberg; TM 33796-9, 34922, 34924, 34960, 34975, 37181 Gobabeb; TM 34897 Ganab; TM 35745 50km N.W. of Uis; TM 39019-21 30km S.W. of Orupembe in Sechomib River; TM 42289 Klein Spitzkoppe.

SENCKENBERG MUSEUM: SMF 22101-3 Lüderitz; SMF 56639 32km E. of Swakopmund.

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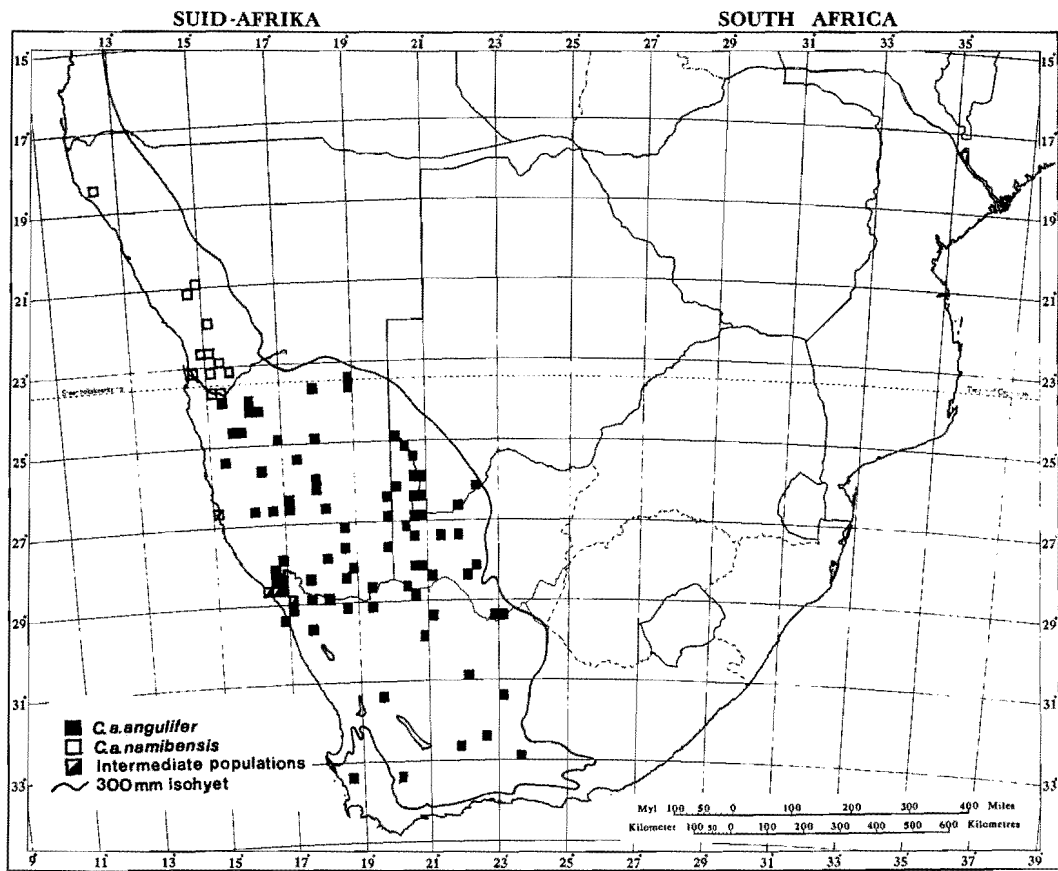


Fig. 1. Distribution of *Chondrodactylus anguilifer*.

PLATE 4

Tip of fourth toe of female *Chondrodactylus a. angulifer* showing claw protruding dorsally  
(Photo: L. Prozesky-Schulze).

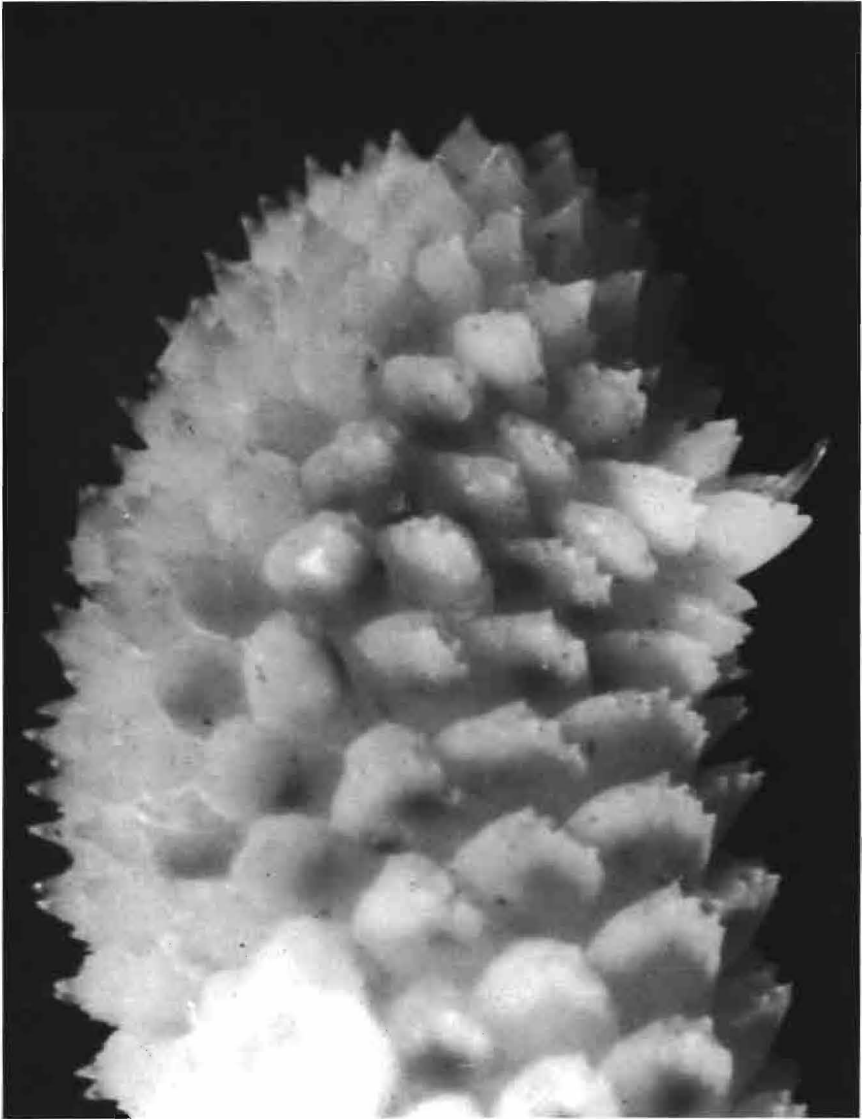


PLATE 5

Top: Lateral view of body of *C.a. angulifer*, TM 41801, Asab, showing enlarged ventrals merging with enlarged dorsal tubercles.

Bottom: Lateral view of body of *C.a. namibensis*, Holotype TM 32632, Amichab Mtn., showing decreasing ventrals merging into small scales between enlarged dorsal tubercles.

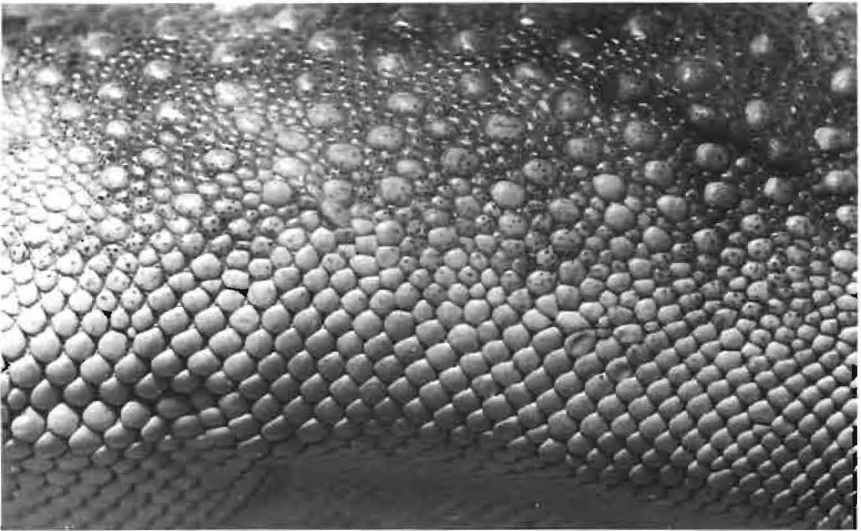
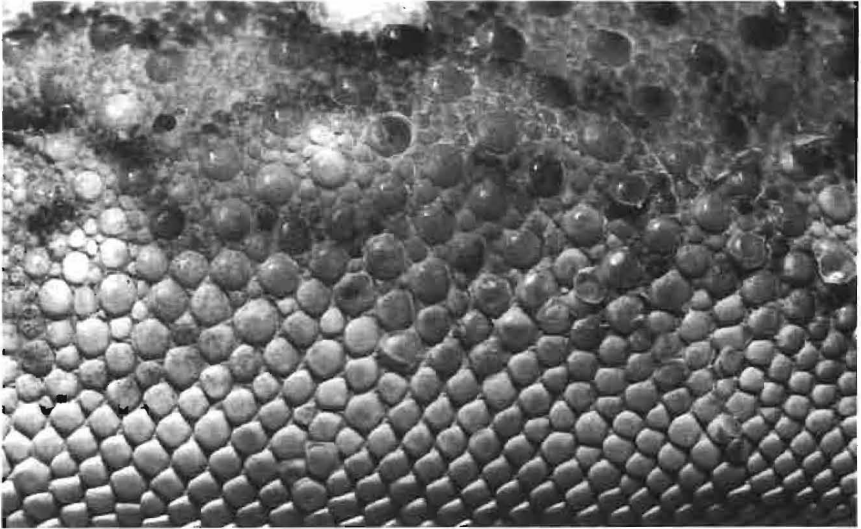


PLATE 6

Adult males of *Chondrodactylus angulifer*:

Left: *C.a. namibensis*, Holotype TM 32632, Amichab Mountain, Central Namib Desert. Speckled pattern due to white tipped tubercles.

Right: *C.a. angulifer* from Kalahari Gemsbok National Park showing dorso-lateral white spots characteristic of typical males.





PLATE 7

Adult females of *Chondrodactylus angulifer*:

Left: *C.a. angulifer* from Kalahari Gemsbok National Park.

Right: *C.a. namibensis*, Central Namib Desert.



PLATE 8

Juveniles of *Chondrodactylus angulifer* in alert position:

Top: *C.a. namibensis*, male, Gobabeb, Central Namib Desert.

Bottom: *C.a. angulifer*, female, Kalahari Gemsbok National Park.

