

NOTES ON THE DISTRIBUTION OF MILLIPEDS IN SOUTHERN TEXAS, WITH DESCRIPTIONS OF NEW GENERA AND SPECIES FROM TEXAS, ARIZONA, MEXICO, AND COSTA RICA.

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DISTRIBUTION OF MILLIPEDS IN SOUTH TEXAS.

The millipeds and other primitive types of humus-inhabiting arthropoda constitute a living summary of the biological conditions and history of the soil. The environmental limitations of the millipeds render this group of animals especially interesting from the standpoint of geographical distribution. It is impossible for these creatures to exist or to extend their distribution over areas where there are no accumulations of humus or other vegetable débris that can retain a permanent supply of moisture. As these animals are unable to fly, or even to run with rapidity, and can not endure exposure to extremes of light, heat, or drought, they afford unusually direct evidence regarding the earlier extension of forests or other conditions that would determine their geographical distribution.

Attention has been called in a previous publication to the persistence of tropical types of humus-inhabiting organisms in certain localities in south Texas, as an evidence of permanent moisture in the soil. The existence of such oases of permanently moist humus in regions where desert conditions otherwise appear so nearly universal has been taken to indicate a much greater extension of forest growth in south Texas in former times. Without assuming a previous extension of forest conditions it is difficult to imagine how animals that require permanently moist humus could have reached the isolated localities where they now exist.¹

Reference was made in a previous paper to a spot a little to the northeast of the town of Falfurrias, Texas, as one of these oases where the existence of permanent moisture had made possible the survival of

¹Change of Vegetation on the South Texas Prairies, Circular No. 14, Bureau of Plant Industry, U. S. Department of Agriculture, 1908.

several very small and delicate humus-inhabiting creatures, such as *Scolopendrella*, *Pauropus*, *Japyx*, and *Campodea*. The finding of a relatively large tropical milliped (*Eurelus*, new genus, order Anocheta) in the same locality, may be taken to indicate that permanent moisture has not been confined to the lower layers of the soil, but has existed practically on the surface. Though these larger millipeds are undoubtedly able to endure much more exposure to dry air than the smaller and more delicate types mentioned above, they can hardly be expected to survive any such complete exposure as would follow the destruction of all the forest growth. The more minute animals are able to crawl into small cracks and interstices, and thus take advantage of any moisture that exists, even at considerable depths. The evidence of continuous humidity is strengthened by the finding of relatively large species of millipeds that remain nearer to the surface.

These facts indicate that some of the present forest growth in the vicinity of Falfurrias is not of recent origin, but may represent a remnant of earlier and more continuous forests. There is a rather densely wooded area to the northeast of Falfurrias, consisting of a slight depression where the water collects after rains and stands in small pools long enough apparently to prevent the growth of grasses, and thus to give protection against the prairie fires that might otherwise have destroyed the woody growth and obliterated the last traces of the millipeds and other humus-inhabiting types of animal life.

The existence of any form of arthropod life in the soils of south Texas is in striking contrast with the black-land prairies farther north, those that form the so-called "hog wallows." The soil of the black-land prairies is remarkably devoid of life of any sort; even the agricultural ants are unable to occupy the typical black-land prairie. The soil cracks during drought to the depth of several feet, and then dissolves into a very adhesive, pasty mud when the rain comes. Delicate animals would find no protection in drought, and the more hardy would be drowned or smothered in their burrows in times of floods. One group of large heavily armored millipeds of the order Diplocheta is able to live in deserts of west Texas and Arizona by virtue of their habit of burrowing, taking advantage also of the deep excavations of the burrowing rodents that are so abundant in the deserts.

The preservation of even a remnant of permanent forest in such a place as Falfurrias under present climatic conditions might not strike the observer as being at all probable, were it not for the concrete evidence afforded by the existence of these animals. Local opinion declares that this district has become distinctly drier in the last twenty years. Surface wells and pools that were formerly relied upon to furnish permanent supplies of water for stock have completely dried out, in the last decade, over a considerable section. This has

been ascribed, of course, to a deficiency of rainfall, though there are no records to establish the fact, and other factors may be responsible.

The extension of grazing and the limitations of forest fires has allowed woody vegetation to spread in recent years over large tracts of land that were formerly covered with heavy growths of grass. It is known that little water, relatively speaking, enters the naked surfaces of the soil when the land is occupied by the usual sparse growth of mesquite, prickly pear, and other desert vegetation. The formerly more heavy and general growth of grass may have afforded more favorable conditions for holding water on the surface and allowing it to soak gradually into the soil. With ordinary gentle rains the effect of grass is, of course, to keep the soil dry, but with the very heavy rains that come occasionally in south Texas, nearly level grass-covered areas might be expected to hold the water longer than denuded surfaces, and give it a better opportunity to penetrate to the lower layers of the soil.

The recent open growth of mesquite probably represents the most unfavorable condition for the retention of water in the soil. With sufficiently old and abundant forest growth to accumulate fallen timber and other débris, obstacles to drainage would be formed and the earth would be shaded from the sun. Conditions would again become more favorable to the retention of permanent moisture, and many areas would eventually change from naked deserts into humid forests or swamps. Tendencies in this direction begin to appear in the region of Brownsville. The finding of another new genus of tropical millipeds near Brownsville serves as an additional indication that present tendencies are only a return toward a former condition of much more abundant forest growth in south Texas.

The rapidity with which these prairies are now being covered with woody vegetation is a further indication that the previous treeless condition did not represent the natural state of the country, but might be ascribed to the same agencies that have exterminated forests in many parts of Mexico and Central America. Lands that have been cleared by the natives for agricultural purposes eventually become occupied by perennial grasses that put an end to agriculture, as practiced by primitive Indian methods. The burning of accumulations of dead grass kills young trees and thus hinders or prevents the extension of forests. Large areas that are naturally well adapted to forests have been gradually denuded into artificial deserts or grassy fire-swept tracts, now quite unoccupied by human inhabitants, and more or less completely devoid of millipeds and other humus-inhabiting types of arthropoda.

On the other hand, many areas now covered with heavy growth do not represent truly virgin or primeval forests. The absence or scarce representation of the humus-inhabiting animals shows that many

forests are of relatively recent growth. Such indications can be supported by evidence drawn from other groups of biological facts.¹

DESCRIPTIONS OF NEW GENERA AND SPECIES.

The two new millipeds that are to be described from south Texas belong to the order Anocheta, but are only remotely related to the other members of this group previously known from more northern and eastern localities as species of the old cosmopolitan genus *Spirobolus*. Texas is not lacking in native species of *Spirobolus* or *Arctobolus*, as the dominant eastern genus of this group has now been named, but these belong to the temperate fauna and are not to be considered in this paper.

With a single exception of the genus *Onychelus*, described a few years ago from the Colorado desert, the relatives of the new types are found only in Mexico and Central America, whence three additional new genera are recognized. Study of some further material of the previously established genus *Onychelus* has also resulted in the description of three more species from Arizona.

ANALYTICAL KEY TO GENERA TREATED IN THIS PAPER.

- First segment not emarginate behind the antennæ.....Genus *Anelus*, new, p. 160.
 First segment broadly emarginate on each side, behind the antennæ.....
 Anal valves with prominent compressed, elevated margins. Genus *Glosselus*, new, p. 163.
 Anal valves with depressed beveled margins, meeting in a groove.....
 First segment not margined with raised ridges..Genus *Cyclothrophorus* Pocock, p. 160.
 First segment with a distinct raised ridge bordering the lateral corners and emarginations.....
 Striations of posterior segments few, produced obliquely upward into sharp spines.....Genus *Centrelus*, new, p. 154.
 Striations numerous, not produced into spines.....
 Coxæ of third legs of male with a long, retrorse process....Genus *Eurelus*, new, p. 151.
 Coxæ of third legs of male unarmed.....Genus *Onychelus* Cook, p. 157.

The last four genera, characterized by the depressed margins of the anal valves, undoubtedly constitute a natural group, but the affinities of *Anelus* and *Glosselus* are still uncertain. They are not closely related to the other American genera, unless it be with the widespread tropical genus *Trigoniulus* Pocock. Nor can it be insisted that *Anelus* and *Glosselus* have any very close affinity with each other, though *Glosselus* seemed to be the nearest relative of *Anelus* available for comparison at the time the description was drawn.

¹Vegetation Affected by Agriculture in Central America, Bulletin 145, Bureau of Plant Industry, U. S. Department of Agriculture, 1909.

EURELUS, new genus.

Type.—*Eurelus soleatus*, a new species from south Texas.

Diagnosis.—More nearly related to *Onychelus* than to any other recognized genus. Differs in the much greater size and more fusiform shape of the body, in having the anterior legs of the males armed with large coxal processes, but without enlarged claws, and in the very different structure of the copulatory legs.

Description.—Body rather large and robust, about nine times as long as broad, subfusiform in outline, gradually narrowed in front and more abruptly behind, especially the last five segments.

Antennæ moderately robust, not clavate; second joint longest; joints 3-5 subequal; joint 6 somewhat shorter and narrower than joint 5. Antennæ not inserted under the first segment, but accommodated by a large lateral depression of the head and the mandibular stipe. In comparison with *Onychelus* the antennæ appear more slender, and the sixth joint does not appear to be reduced in that genus. Olfactory cones four in both genera.

Eyes of over 40 closely clustered, flattened ocelli, arranged in seven or eight rows.

First segment rather strongly emarginate on each side behind the antennæ and the somewhat prominent posterior corner of the mandibular stipe. Lateral angle acute, with a prominent, thickened anterior margin. The groove that bounds the margin remains very distinct as far up as the middle of the eye and then suddenly disappears. Second segment not produced below the somewhat projecting angle of the first segment.

Segments of middle of body with only a slight and rather indistinct constriction between the midbelt and the hindbelt. Forebelt with very fine and somewhat broken striations extending slightly beyond the very indistinct anterior suture. Midbelt and hindbelt marked on the surface with the same minute punctations, but somewhat more numerous on the midbelt. Posterior suture usually indicated by a fine superficial striation. Median suture indicated by a very fine and indistinct striation, not grooved on the hindbelt as in *Onychelus*. Ventral striations beginning well below the pores, especially on posterior segments; extending farther up on the midbelt than on the hindbelt, but more irregular and passing below into a fine reticulation; all these ventral markings much more distinct than in *Onychelus*.

Repugnatorial pores inconspicuous, located above the middle of the segments, though hardly as far above as in *Onychelus*; on or in contact with posterior suture, usually below the lateral suture, but in contact with it or nearly so, the suture being sometimes slightly sinuate above the pore. The pores of the sixth segment are distinctly lower

down than those of the seventh and subsequent segments and are distinctly separated from the lateral suture. The aperture of the pore is not surrounded by a raised rim, and the lateral suture is not marked by a distinct groove behind the pore as in *Onychelus*. In *Onychelus* the pore is set in a distinct depression and there often appears to be a rim or a minute papilla in the depression.

Supplementary margin shorter than in *Onychelus* and the surface apparently plain, instead of longitudinally grooved or fluted. With sufficient magnification very fine longitudinal striations appear, and a fringe of minute needle-like teeth.

Pleural sutures indistinct, indicated only by a slight interruption or greater irregularity of the reticular striations.

Sterna subquadrate, but distinctly broader in front; surface with distinct close striations, not reaching the ventral sutures. The striations are much more distinct and more numerous than in *Onychelus*, and the sutures are not so nearly parallel as in that genus. Spiracles set in distinct excavations.

Last segment very short, with a short broadly rounded apex, slightly exceeded by the anal valves.

Anal valves strongly and evenly convex, not thickened nor prominent along the margins which meet in a broad groove. Surface rather coarsely wrinkled, instead of smooth and shining, as in *Onychelus*. Preanal scale very broadly and evenly rounded, as in *Onychelus*, the surface rugose like the valves.

Males with claws of anterior legs not specially enlarged as in *Onychelus*, except the first three pairs. The next four pairs have the claws reduced, smaller than those of the segments behind the gonopods.

Coxæ of third pair of legs of male produced into very long flattened appendages with a sharp double curve near the middle, ending in heavily chitinized shoe-shaped process.

Coxæ of fourth, fifth, and sixth pairs of legs of male produced into much shorter, flattened, thin-edged processes, bent backward and covered by the long process of the third legs.

Coxæ of sixth pair of legs of male with broad, thick subquadrate straight processes which project behind the ends of the long processes of the third legs.

Coleopods with ventral plate produced in the middle into a very broadly triangular-quadrate process with a very short, broadly angular apex greatly exceeded by the abruptly produced median corners of the strongly transverse anterior lobes, which completely conceal the posterior lobes, as well as the gonopods, both of which are distinctly exposed from in front in *Onychelus*.

Gonopods ending in a short, expanded, concave, somewhat hand-shaped process, not in a recurved bidentate spine as in *Onychelus*.

Coalesced pleuræ of seventh segment of male crossed by a relatively slight, straight ridge, not carried up into a fold-like, arcuate crest, as in *Onychelus*.

The narrowing of the first segment at the sides in *Eurelus* and *Onychelus* does not result from a change in the anterior margin, which is much the same as in *Arctobolus*. The principal difference lies in the much straighter posterior margin of *Eurelus* which does not curve back from the lateral angle of the segment, as in *Arctobolus*, but passes directly upward.

EURELUS SOLEATUS, new species.

Type.—Cat. No. 801, U. S. National Museum. Collected at Falfurrias, Starr County, Texas, August, 1906, by O. F. Cook.

Length of male about 65 mm., width nearly 8 mm. Number of segments 48.

Color in life, dull olive brown with somewhat grayish posterior margins, not at all reddish or yellowish, as in *Arctobolus*. On being placed in alcohol the dark bands appear darker and the light bands lighter, and the contrast accordingly much greater, as though black and pale yellow.

With age the alcoholic specimens become very dark, blackish-green, with the margins of the segments paler, and appearing yellowish or brownish if the specimens begin to dry out. The first segment and the dorsal part of the last segment appear distinctly paler than the others, both in the fluid and out.

Clypeal foveolæ five on each side, sometimes only four; surface of clypeus and vertex with rather remote, irregularly scattered wrinkles, otherwise smooth and shining.

Eyes rounded-polygonal, 43 or 44 ocelli, arranged in nearly vertical, somewhat curved rows, counted as follows, beginning at the back: 6, 7, 8, 7, 6, 6, 4. In the other eye of the same specimen the arrangement of the ocelli seemed to be 5, 6, 7, 7, 7, 6, 4, 1. In an eye of *Onychelus obustus* the ocelli were counted in rows of 5, 5, 6, 6, 5, 3.

First segment with three or four short irregular striations above the lateral angle, not present in *Onychelus obustus*. The angle is more pointed than in *Onychelus*, and the anterior thickened margin is broader and more prominent and also more distinctly sinuate because of the deeper emargination.

Second segment with a distinct raised flange along the anterior ventral margin, but not nearly so prominent as in *Onychelus*.

Surface of segments with a rather dull luster, minutely punctate over all the exposed surface, but somewhat more on the midbelt than on the hindbelt, which becomes slightly more prominent on the sides and below, and may then have the surface roughened by indistinct granules or by irregular shallow, seal-like depressions, above the regular ventral striations.

Last segment punctate like the others except along the margins, where it tends to become rugulose like the anal valves. The very much shortened and narrowed segments at the end of the body are also more minutely and indistinctly punctate.

The anal valves are both punctate and rugose, the prominent wrinkles being marked very often with distinct punctations.

The same number of the segments, 48, was counted in four normal individuals. A fifth specimen had only 47 segments and one of these, the ninth, was distinctly shorter than its neighbors and was fused with the tenth for a short distance; near the middle of the back.

The repugnatorial secretion appeared unusually abundant and was exuded very promptly, as soon as the animals were caught. Numerous specimens were found crawling about on damp ground in a field of sorghum a short distance to the northeast of the village of Falfurrias, Starr County, Texas. The species is evidently rare, or at least not generally distributed, even in the immediate vicinity, for no more specimens have been found in many subsequent visits that have been made to the same neighborhood.

Single individuals of *Eurelus* have been found in two other localities in south Texas, one collected near San Antonio by Mr. W. P. Carr and another at Moore, Frio County, about 40 miles southwest of San Antonio, by Mr. F. L. Lewton.

A NEW GENUS FROM MEXICO, RELATED TO EURELUS.

The U. S. National Museum contains four specimens of a small milliped labeled as *Spiroboldus nietanus*, Guanajuato, Mexico, probably identified by Bollman.

These specimens are of interest as very near relatives of *Eurelus*. Though hardly to be reckoned as members of the same genus, the agreement is more complete than with any other type thus far known. The form of the copulatory apparatus is much the same and the third legs of the male are provided with coxal processes. The following diagnosis and description refer mostly to the features in which this Mexican type appears to diverge from *Eurelus*.

CENTRELUS, new genus.

Type.—*Centrelus falcatus*, a new species from Guanajuato, Mexico.

Diagnosis.—Closely related to *Eurelus*. Differs in having the body smaller, more slender and more cylindrical, the sterna narrower, and the ventral striations very few and subtended by large curved spines, especially on the posterior half of the body.

Description.—Body rather small and slender, ten or twelve times as long as broad, cylindrical, slightly wider in front, narrowed rather gradually behind.

First segment with the thickened anterior edge slightly emarginate near the somewhat rounded lateral angle, and limited by a deep, slightly sinuate groove. Posterior edge not emarginate, marked with three or four short strictions like those of the other segments.

Segments of middle of body with no distinct constriction. Forebelt with very fine, indistinct striations not extending beyond the anterior suture except below. Midbelt and hindbelt nearly smooth, the hindbelt not thickened nor convex. Posterior and median sutures indicated by very fine superficial striations, especially the median. Ventral striations very few and remote, not ascending more than half way to the pores, even on posterior segments. The surface is very prominent below each of the first four or five striations and the angle of the prominence is produced into a sharp upcurved spine, especially on the segments behind the middle of the body. The spined striations are interrupted at the posterior suture instead of passing over to join a reticular ornamentation of the midbelt as in *Eurelus*. Only the pleuræ have the fine close longitudinal striations of the usual sort.

Repugnatorial pores very minute, set in distinct depressions above the middle of the segments, distinctly behind the posterior suture, and unusually close to the margin of the segment. Lateral suture usually indicated by a very fine groove behind the pore; seldom indicated on midbelt but very distinct on forebelt and interrupting the concentric striations.

Supplementary margin short, minutely pectinate along the edge.

Pleural suture very distinct along the forebelt and midbelt, not indicated on the hindbelt; surface of pleuræ with very obscure, transverse striæ and reticulations in front, longitudinally striate behind.

Sterna quadrate, scarcely broader than long, but the sutures distinctly excurved near the anterior corners; rather closely covered with obscure striations. Spiracles situated in front of a small depression.

Last segment very short, the broadly rounded apex distinctly exceeded by the very convex anal valves.

Males with claws of the anterior legs distinctly reduced, but the first two pairs with strong claws.

Coxæ of third pair of legs of male with large strongly chitinized processes abruptly geniculate near the base and then prolonged into a recurved falcate armature.

Coxæ of legs 4, 5, and 6 with large flattened obliquely truncate processes, the outer corner slightly produced and the inner provided with a small narrow, abruptly incurved branch. The same legs have the second and especially the third joints swollen into conical prominences on the lower side.

Coxæ of seventh pair of legs with a simple triangular-conic process, longer and thicker than those of the preceding legs.

Coleopods with ventral plate very large, subquadrate, occupying more than half of the anterior surface, but rather poorly chitinized; margin nearly transverse, slightly angled in the middle, but not produced. Anterior lobes broadly and deeply emarginate, the mesial corners produced, much as in *Eurelus*, but broader and distinctly curved outward. Posterior lobes also somewhat broader and stronger than in *Eurelus*.

Gonopods very small and deeply retracted.

Coalesced pleuræ of the seventh segment of male forming a very deep sinus behind and with the anterior face carried up into a narrow transverse ridge much more prominent than in *Eurelus*.

CENTRELUS FALCATUS, new species.

Type.—Cat. No. 800, U. S. National Museum, Guanajuato, Mexico.

Length of male about 38 mm., width about 3 mm.; female about 42 mm. by 4.5 mm.

Color in alcohol dull olive or grayish green, the segments with a pale posterior margin behind an equally short black band. Antennæ and legs of the same color as the segments, but the head and last segment somewhat paler.

Clypeal foveolæ 4 on each side, at nearly equal distances; outer pair located on the lower margin of the clypeus. Surface of clypeus and vertex smooth, except for slight depressions and a few fine irregular striations.

Eyes somewhat oval or trapezoidal, of over 40 ocelli counted in eight nearly vertical rows from the back toward the antennæ, 4, 5, 6, 6, 6, 5, 3, or in 7 obliquely transverse rows from above downward 3, 5, 7, 8, 7, 6, 5.

First segment with the anterior emargination not so broad and deep as in *Eurelus soleatus*, the marginal ridge broader and the lateral angle more rounded, not projecting below the second segment as in *Eurelus*.

Second segment with the anterior margin decurved, much as in *Eurelus*.

Surface of segments nearly smooth, shining with a dull luster, very finely and indistinctly punctate and longitudinally striate above; lateral and ventral striations very short, confined to the hindbelt; surface convex below each striation. Segments behind the middle of the body have the striations remote, only three or four on each side, and produced into distinct sharp spines, curving obliquely upward. Several of the posterior segments have the spines reduced.

Last segment smooth, the apex very broadly triangular-rounded, distinctly exceeded by the strongly convex smooth anal valves. Preanal scale very broadly rounded.

Four specimens were examined, a male being selected as type. All four were in a broken condition, so that the proportions of the body and the numbers of segments could not be stated with certainty, though the matching of the pieces allowed the same number of segments to be counted in all four cases.

This species is evidently very distinct from *Spirobolus nictanus* Saussure, which Pocock has recently transferred to his genus *Cylothrophorus*.

Genus ONYCHELUS Cook.

Onychelus Cook, Myriapoda of Northwestern America, Harriman Expedition, p. 67.

The type of this genus, *O. obustus*, was from the Colorado desert of California. Specimens now in the National Museum seem to represent three additional species of *Onychelus* from the deserts of Arizona. When the original description was drawn *Onychelus* appeared to have no close relatives in the North American fauna. Several points of difference between *Onychelus* and its undiscovered relatives were not anticipated in the original description. Several additional peculiarities of *Onychelus* have been noted in comparing it with *Eurelus*, as the description of that genus will show.

ONYCHELUS HOSPES, new species.

Type.—Cat. No. 803, U. S. National Museum, collected at Tucson, Arizona, December 23, 1896, by H. G. Hubbard, in the nest of a rat (*Neotoma albigula*).

Diagnosis.—Distinct from *Onychelus obustus* in the smaller size of the body and in the position of the transverse constriction of the segments.

Description.—Body about 25 mm. long by 2.5 mm. in diameter, probably composed of 41 or 42 segments. All the specimens are broken and may not be fully mature.

Color nearly black, with pale posterior margins.

Clypeal foveolæ four on each side.

Eyes composed of about 33 ocelli arranged in an oval cluster of seven rows: 3, 6, 6, 6, 5, 4, 3.

First segment with two or three very short rudimentary striations above the lateral angle. The segment is somewhat less strongly emarginate in front and with a somewhat broader and less prominent raised margin. The posterior margin is not so straight as in *O. obustus*, but is distinctly curved forward above the angle.

Segments very minutely punctate-striate, much more distinctly than in *O. obustus*. The striæ of the forebelt and ventral surfaces are slight and indistinct, much as in *O. obustus*. The transverse constriction is in the midbelt of the segment, instead of following the posterior suture as in *O. obustus*. This brings the repugnatorial pores

behind the constriction instead of in front as in *O. obustus*. The hindbelt is also somewhat shorter than in *O. obustus*, so that the repugnatorial pores are brought closer to the posterior margin of the segment. The lateral suture is indicated by a fine groove behind the pore, but not so pronounced as in *O. obustus*.

Last segment somewhat less produced than in *O. obustus* but the apex distinctly angular, instead of being completely rounded off as in *O. obustus*. Penultimate segment very short, the margin scarcely exposed.

Anal valves somewhat more convex and prominent than in *O. obustus*, and with a less distinct row of fine hairs along the margin. Preanal scale thinner and somewhat angular like the apex of the segment.

Five specimens, three evidently immature and the others possibly so. The only complete specimen is a male with 38 segments, but only about 12 mm. long.

ONYCHELUS DENTATUS, new species.

Type.—Cat. No. 804, U. S. National Museum, collected at Fort Huachuca, Arizona, by T. E. Wilcox. Accession No. 26403.

Diagnosis.—Similar in size and shape to *Onychelus obustus*, but having the lateral angles of the first segment acute and striate, the transverse constriction very shallow and indistinct, the pores closer to the posterior margin, and the lateral suture not marked by a distinct groove.

Description.—Body about 40 mm. long with a diameter of 4.5 mm., composed of 48 segments.

Color of alcoholic specimen very deep olive green, nearly black; legs and antennæ also dark, with a bluish tinge.

Clypeal foveolæ five on each side, the outer pair close to the margin and smaller than the others. Surface of clypeus with a few irregular impressed lines; otherwise evenly convex but scarcely shining.

Eyes composed of nearly 40 ocelli, arranged in seven rows, counted as follows: 4, 6, 6, 7, 7, 4, 2, and 5, 6, 7, 7, 6, 5, 3.

First segment with the lateral corner acute, more produced than in *O. obustus* or *O. hospes*, the anterior raised margin more pronounced and the posterior margin striate or grooved near the angle like the sides of the other segments. The raised margin is carried farther back around the corner than in *O. obustus* and even projects very slightly, so that the posterior margin appears slightly emarginate just above the corner.

Segments very minutely and indistinctly punctate-coriaceous on the surface, the punctations more distinct than in *O. obustus*, but less distinct and less numerous than in *O. hospes*. The transverse constriction is very slight, but follows the posterior suture, so that the pores are in the line of the constriction. The lateral suture is

not indicated by a groove behind the pore as in *O. obustus*. The suture crosses the midbelt in an oblique direction, being turned or bent downward to meet the pore, which appears to be set exactly at the junction of the sutures. The ventral striations are much more pronounced than in *O. obustus*, with the ridges running out into distinct teeth along the posterior margin.

Last segment more produced and more angular at apex than in *O. obustus*, and the surface rugulose-punctate, more distinctly than the preceding segments.

Anal valves somewhat more prominent than in *O. obustus*, distinctly exceeding the apex of the last segment. Surface distinctly rugulose-punctate, especially on the sides; margin fringed with a row of short hairs.

Preanal scale broadly rounded, but not thickened as in *O. obustus*.

The more angular first segment and the indistinct transverse constrictions are similar to those of the related Texan genus *Eurelus*.

ONYCHELUS SUTURATUS, new species.

Type.—Cat. No. 805, U. S. National Museum, collected at Fort Huachuca, Arizona, by T. E. Wilcox. Accession No. 27626.

Diagnosis.—Similar in size and general appearance to *O. dentatus*, but with the sculpture of the ventral surfaces coarser and more pronounced and all the sutures marked by superficial grooves.

Description.—Body about 43 mm. long, 4.6 mm. in transverse diameter, and 4.2 mm. in vertical diameter, the segments being appreciably depressed.

Color, very dark green, nearly black.

Clypeal foveolæ four on each side, the inner pair very small and crowded into the median suture, the next two pairs large and also crowded toward the middle. Outer pair very small, near the margin, remote from the others.

Eyes composed of over 40 ocelli arranged in seven rows, 6, 7, 8, 7, 7, 5, 3, to form nearly circular clusters.

First segment much as in *O. dentatus*, but the lateral angles somewhat more produced and the anterior raised margin distinctly narrower. Posterior margin distinctly striate on the sides and also distinctly notched just above the corner.

Segments nearly as smooth as in *O. obustus*, very finely and irregularly punctate-coriaceous, but somewhat less than in *O. dentatus*. Transverse constriction very slight, appearing to follow the suture on the sides, passing a little in front of the suture above. All the sutures, anterior and posterior, median, lateral, pleural and ventral, are marked by distinct superficial grooves. The reticulate sculpture of the ventral surfaces is coarser and more pronounced than in *O. dentatus*, although the longitudinal striations are rather less

accentuated. The anterior transverse and pleural sutures are especially well marked and completely interrupt the patterns of the superficial network. The pleuræ are distinctly wider in front, the forebelt being narrowed and shortened below.

Last segment of much the same shape as in *O. dentatus*; surface of the segment and the valves less rugulose and more distinctly punctate.

Morphological interest warrants the description of the peculiarities of this animal, though more abundant material must determine whether they have taxonomic importance or not.

Genus CYCLOTHYRAPHORUS Pocock.

Cyclothyraptor Pocock, *Biologia Centr.-Amer.*, 1908, p. 83.

The Mexican genus *Cyclothyraptor*, established by Pocock on *C. salvini* from the Mexican State of Guerrero, may belong to the same general group as *Onychelus* and *Eurelus*. The anal valves have the same peculiarity of meeting in a reentering angle or groove, and the anterior corners of the first segment are cut away so as to expose the sides of the mandibular stipes. Nevertheless, if the characteristics of the type species are taken into account, the genus *Cyclothyraptor* appears to be quite distinct from the more northern types.

The body of *C. salvini* is described as slender, less than 3 mm. wide and over 12 times as long. The antennæ are crassate, with the second and third joints about equal in length. The first segment is "without trace of a sulcus" to define an anterior margin. Second segment "projecting below the level of the first." The coxæ of the third pair of legs of males are without processes, and the ventral plate of the gonopods is not produced, fully exposing the oblong anterior lobes.

The form of the body, the absence of processes from the third pair of legs of the males, and the form of the coleopods seem to ally *Cyclothyraptor* with *Onychelus* rather than with *Eurelus*.

ANELUS, new genus.

Type.—*Anelus reduncus*, a new species from south Texas.

Diagnosis.—Remotely related to *Onychelus* and *Eurelus*, but readily distinguished by having the first segment very broad, with two nearly square lateral corners, the body segments with densely reticulate forebelt and coarsely punctate hindbelt, the last segment with a produced triangular apex, the anterior male legs without coxal processes, and the ventral plate of the copulatory legs rudimentary.

Description.—Body rather small and robust, nine or ten times as long as broad, cylindrical, slightly thicker in front, rather abruptly tapered behind, coiling into a close spiral.

Antennæ short, subclavate, joint 2 distinctly the longest, joint 1 next, joints 3-5 subequal, slightly exceeded by 6, about half as long as joint 2. Antennæ accommodated by a lateral depression of the head and mandibulary stipe and partly covered by the wide anterior corner of the first segment. Olfactory cones 4.

Eyes of less than 20 rather prominent ocelli arranged in five rows.

First segment very broad, not emarginate below the eyes and with broad anterior and posterior lateral angles, the latter more rounded, the former somewhat produced and with a very broad raised margin. Second segment not produced below the first, but crossed by an obliquely longitudinal crest parallel with the lower edge of the first segment.

Segments of middle of body with no distinct constriction, the hindbelt scarcely more convex than the midbelt. Anterior suture usually distinct, the posterior often perceptible as a fine superficial striation; median suture often marked by a distinct groove of the hindbelt. Forebelt and covered parts of midbelt with very fine indistinct irregular striations along the anterior margin, passing into a more distinct, very fine reticulation. Exposed parts of midbelt beset with deep, coarse punctations, irregular in size and arrangement. Hindbelt nearly smooth, with a few minute punctations and fine longitudinal striæ. The more distinct lateral and ventral striations are confined to the hindbelt. They begin well below the pores on anterior segments, but on posterior segments come up nearly to the pores.

Repugnatorial pores, with slightly raised margins set in distinct depressions, slightly below the middle of the segment, on or in front of the posterior suture. Lateral suture not indicated on the midbelt, but marked by a distinct straight groove crossing the hindbelt and sloping slightly upward from the pore, instead of downward like the other lateral striations.

Supplementary margin short, with fine longitudinal striations; minutely pectinate with extremely fine-pointed teeth, visible with a quarter-inch objective.

Sterna quadrate, less than twice as broad as long; the lateral margins parallel, the anterior distinctly convex; surface with fine transverse striations, somewhat irregular and broken. Pleural sutures indistinct, indicated by interruption of the surface reticulation of the midbelt.

Legs of anterior segments of males not crassate, the claws not enlarged. Basal joints rather prominent below, but not distinctly produced.

Posterior segments somewhat abruptly narrowed and shortened, especially the two penultimate. Last segment with a thickened,

triangular apex projecting for about half its length beyond the closed anal valves.

Anal valves moderately convex, not thickened nor prominent, the edges meeting in a slight groove. Surface nearly smooth. Preanal scale short, broadly rounded.

Coleopods with ventral plate rudimentary, not produced in the middle, exposing the whole of the long, subquadrate anterior lobes, which are closely approximate along the median line.

Gonopods rather straight, the projecting apex consisting of two parts, the mesial a simple oblong transverse blade, the lateral shorter and ending in two incurved prongs that partially embrace the middle of the mesial blade.

Sixth and seventh segments of males not notably enlarged nor prominent below; coalesced pleuræ of seventh segment crossed by a broad flattened elevation, not projecting as a crest, the median suture distinct.

The very broadly rounded lateral margins of the first segment and the projecting apex of the last segment would at once distinguish this genus from all members of the order Anocheta previously known in the United States without taking the other peculiar characters into account. The affinity with *Eurelus* and *Onychelus* is certainly very slight, but there is still less with the more northern genera *Arctobolus* and *Tylobolus*.

The absence of scobinæ and of a median process from the ventral plate of the coleopods distinguish *Anelus* from the Mexican and Central American forms that have the last segment produced. The broadly rounded first segment might be supposed to ally this genus with *Rhinoericus* as well as the produced last segment, but it does not appear that there is any real affinity with the scobinate forms.

ANELUS REDUNCUS, new species.

Type.—Cat. No. 798, U. S. National Museum, collected near Brownsville, Texas, January, 1905, by O. F. Cook.

Length of male about 30 mm., width about 3 mm. Number of segments, 44. The largest female specimens are nearly 4 mm. in diameter.

Color in life slate gray, the dark background modified by pale bluish punctations not large enough to be distinguished by the naked eye. Alcoholic specimens change to a moderately dark grayish brown, but distinctly banded. The midbelt still appears gray and the anterior part of the hindbelt dark brown. Posterior part of hindbelt and exposed parts of forebelt light brown.

Clypeal foveolæ three on each side, the two upper close together, the lower much more widely separated; surface of clypeus and vertex smooth and shining.

Eyes rounded, of 17 ocelli, arranged in five rows—3, 4, 4, 4, 2.

First segment with surface smooth, not punctate nor striate like the others. Lateral margin nearly straight or slightly emarginate in the middle, the strongly thickened raised margin broadened and slightly produced to a broadly angled corner.

Surface of segments divided into three bands, the forebelt reticulate, the midbelt coarsely punctate and the hindbelt smooth, except for a few minute punctations along the midbelt, and a few fine longitudinal wrinkles or grooves. Reticulations limited to forebelt on the dorsal surface, but covering about half of midbelt lower down.

Penultimate segments distinctly narrowed and shortened, and the punctations less pronounced.

Last segment nearly smooth with a distinctly triangular produced apex, slightly decurved. Anal valves and preanal scale also smooth.

Several specimens were collected in a small forest of the Texan palmetto (*Inodes texana*) not far from the north bank of the Rio Grande, a few miles east of Brownsville. They showed no tendency to congregate in rotten wood, as *Arctobolus* usually does, but were scattered about in the humus layer, an inch or two below the surface. No other millipeds were found in the same place.

It is possible, of course, that the Brownsville locality represents the most northern distribution of a species otherwise limited to Mexico, but this is not to be taken for granted. The Texas palmetto appears to have ranged formerly as far north as Jackson County

ANELUS RICHARDSONI (Pocock).

Spirobolellus richardsoni Pocock, *Biologia Centr.-Amer.*, 1908, p. 87.

A Mexican milliped from Tampico, larger than *A. reduncus*, but having the last segment shorter and the outer ramus of the gonopod with the terminal prongs very unequal. The females attain, according to Pocock, a length of 56 mm. and a diameter of about 5.5 mm. The projecting apex of the last segment of *A. richardsoni* is "a rather wide and flat, apically rounded, caudal process which surpasses the summit of the valves," while the corresponding part of the Texan animal is rather acutely triangular, about as long as wide. The anterior portion of the surface of the segments is not described as reticulate, but "only very finely striolate," and there is said to be a distinct transverse sulcus or constriction of the segments, which is not true of *A. reduncus*. Pocock recognizes the improbability of any close alliance between the Mexican species and the genus *Spirobolellus*, the type of which came from Sumatra. The sexual characters of the original East Indian species of *Spirobolellus* have not been described.

GLOSSELUS, new genus.

Type.—*Glosselus musarum*, a new species from Costa Rica.

Diagnosis.—Apparently related to *Anelus*, but with the first segment strongly emarginate behind the antennæ, the last segment scarcely

produced, the anal valves with prominent margins, the coxæ of the fifth pair of legs of males armed with processes, the ventral plate of the coleopods large, and the anterior lobes widely separated.

Description.—Body rather small and slender, over ten times as long as broad, cylindrical, slightly thicker in front, the sixth and seventh segments of the male distinctly wider.

Antennæ rather short, subclavate, joint 6 the longest, slightly exceeding joint 2; joints 3–5 subequal, distinctly shorter than joint 6. Antennæ accommodated by a large lateral depression of the head and mandibular stipe, but the cardo with a prominent raised rim fitting against the emargination of the first segment, so that the antennæ are excluded. Olfactory cones four.

Eyes of more than 40 flattened ocelli arranged in six or seven vertical curved rows.

First segment much longer in the middle than in *Anelus*, much shorter on the sides; distinctly broader than the second segment, distinctly narrowed by a broad emargination below the level of the eyes, but with rounded lateral angles, both the emargination and the angle bordered by a very distinct, rather narrow ridge. Second segment slightly exposed below the first when viewed from the side, but without a crest as in *Anelus*.

Segments of middle of body with a slight constriction a little in front of the posterior suture, the hindbelt and midbelt about equally convex. Sutures not indicated by superficial striations, but becoming distinct as white lines as the animals dry out, except the median. Forebelt nearly smooth, the striations extremely fine and indistinct. Midbelt rather sparsely covered with short curved striæ deepening to a row of distinct punctations in the constriction.

Hindbelt above smooth and shining, the lateral and ventral striations rather few and weak, and confined to the hindbelt, but the constriction with more numerous short striations below, replacing of the dorsal punctures.

Repugnatorial pores nearly on the middle line of side, inserted in a distinct circular depression slightly separated from the posterior suture that bends slightly away from the pore. Lateral suture sometimes indicated by a slight groove behind the pore.

Supplementary margin rather thick and firm, the edge irregularly erose-dentate with short, broad, square or rounded teeth, not regularly pectinate with fine teeth as in *Anelus*.

Pleural sutures very faintly indicated on the smooth surface, but often marked by a whiter line, especially along the forebelt and midbelt.

Sterna quadrate, a little broader than long, the surface covered with close regular transverse striations.

Posterior segments but little shorter than the others, gradually narrowed and somewhat compressed; constriction and punctations slight.

Last segment abruptly narrowed and distinctly angled at the apex, equaling the anal valves or very slightly produced.

Anal valves strongly convex, with rather thin, distinctly compressed slightly prominent margins, bordered by shallow grooves.

Preanal scale small, the posterior margin nearly transverse.

Males with anterior legs rather strongly crassate, all of the joints but the last swollen on the under side into rounded prominences. Claws not enlarged.

Coxæ of third and fourth pairs of legs of male produced into very small papilliform processes, turned obliquely forward.

Coxæ of fifth pair of male legs with processes four or five times as long as the others and thick in proportion, about twice as long as broad, subcylindric, slightly tapering, with the ends abruptly hooked forward.

Coxæ of sixth and seventh pairs without processes, merely rounded like the other joints.

Coleopods with ventral plate forming a large, oblong-ligulate median process nearly twice as long as broad, emarginate at apex. Anterior lobes widely separated, stout columnar, the outer margins nearly straight, the rounded apex slightly incurbed. Posterior lobes small, with simple incurved apices only slightly exceeding the corners of the ventral plate.

Gonopods not exposed; doubtless retracted into the unusually thick bulbous bases of the coleopods.

Sixth and seventh segments of males notably broader, the seventh inflated and prominent below; coalesced pleuræ of seventh segment with a very broad transversely striate anterior slope, the median suture obsolete. The dorsal part of the seventh segment very short, that of the sixth segment unusually long.

The affinity of this genus with *Anebus* is certainly not close, and may prove to be very remote, but the external similarities are at least interesting. The transverse row of punctations renders the segments much alike, and the apex of the last segment shows a slight projection, giving at least an external appearance more similar to *Anebus* than any other Mexican or Central American type available for comparison. Both genera may prove to be relatives of *Trigoniulus*, and may assist in determining whether that cosmopolitan genus is of American or Old World origin.

GLOSSELUS MUSARUM, new species.

Type.—Cat. No. 799, U. S. National Museum, collected in a banana plantation at La Colombiana, Costa Rica, April, 1903, by O. F. Cook.

Length of male about 33 mm., width 2.8 mm.; female about 35 mm. by 3.2 mm. Number of segments 47 in a male, 49 in a female. Males have the sixth and seventh segments broader than the others; females distinctly constricted behind the head.

Color in alcohol very dark brown, nearly black; legs and antennæ slightly paler and more reddish.

Clypeal foveolæ two on each side, one near the median sulcus, and one widely removed, near the inferior margin. Vertex with sulcus distinct, and with a band of fine vertical wrinkles under the margin of the first segment; surface elsewhere smooth and shining.

Eyes rounded triangular, of about 42 ocelli arranged in 7 vertical curved rows, counted from behind toward the antennæ, 9, 9, 8, 7, 5, 3, 1, and 8, 9, 8, 7, 6, 3, 1.

First segment with the surface smooth, the emarginations very broad and shallow and the raised margin narrow but very distinct from the rounded lateral corner to behind the middle of the eye.

Surface of segments smooth on the forebelt, sparingly punctate on the midbelt, distinctly punctate along the shallow constriction, smooth or very finely striolate longitudinally on the hind belt. Lateral striations numerous below the pores, but not strongly developed. Surface nowhere distinctly reticulate as in *Anebus*. Posterior segments smoother than the others, the transverse constrictions and punctations becoming obsolete.

Last segment, anal valves and preanal scale with surfaces smooth and shining.

Nineteen specimens, mostly adults, were collected about banana stumps; some of the male specimens are smaller than the others, but do not appear to differ in any other respect except that the sixth and seventh segments are only very slightly enlarged. They seem to have as many segments as the others, and all the segments are provided with legs except the last two, as in the adults. The copulatory apparatus appears to be partially developed.

GLOSSELUS NARESII (Pocock).

Spirobolus naresii Pocock, Ann. and Mag. Nat. Hist., ser. 6, vol. 11, p. 252, pl. 16, fig. 4.

The copulatory apparatus of *G. musarum* shows such a marked resemblance to that of *Spirobolus naresii* Pocock that the existence of generic differences between the two species seem very improbable. The ventral plate, as well as the anterior and posterior lobes, are of the same general form, the most notable difference being that the ventral plate of *naresii* is shown with a somewhat triangular rounded apex, instead of emarginate.

The color seems to be quite distinct, that of *naresii* being described as slate-gray, with the posterior borders of the segments ochraceous and the legs and antennæ flavous. The segments are also described as marked "with a transverse row of ring-shaped or crescentic impressions just in front of the sulcus." The drawings of the anterior and posterior parts of the body also indicate an essential agreement in the characters of the first and last segments, so that a reference to the same genus seems justified, in spite of the fact that the locality given for *naresii* is "Mahé Island, Seychelles."