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MEXICAN MOLLUSKS COLLECTED FOR DR. BRYANT WALKER IN 1926
XI. *DRYMAEUS*

BY ALAN SOLEM

INTRODUCTION

THIS is the eleventh report in a series on southeastern Mexican mollusks collected by Dr. H. B. Baker in 1926.[1] These anatomical studies on *Drymaeus* were started under Dr. Baker's direction at Haverford College in 1951–52; they were finished at the University of Michigan in 1952–53. Detailed accounts of the collecting sites and the general ecology of the area are found in Baker (1928), but a key to the symbols used by him has been included here for clarity.

For access to material in collections under their charge, I wish to thank Dr. Henry A. Pilsbry, Dr. Harald A. Rehder, Dr. Fritz Haas, and Dr. Henry van der Schalie. A special note of thanks is due Miss Marie Bourgeois of Mexico City, Mexico, for the loan of several specimens. My deep gratitude goes to Dr. Baker for permission to publish this material and for much valuable aid during the preparation of the manuscript; to Dr. Henry van der Schalie for reading the manuscript and for making many helpful suggestions. Mr. William Brudon made the drawings for Plate V; his assistance with the other plates is gratefully acknowledged.

TAXONOMY OF *Drymaeus*

Albers, in 1850, established the genus *Drymaeus* for two Bolivian bulimulid snails. About 400 named entities are now at least provisionally included in this genus, which ranges from Argentina to northern Mexico, Florida, and the West Indies. As now understood, the genus *Drymaeus* includes all bulimulid snails with pitted embryonic

[1] The previous ten reports are by H. Burrington Baker and appeared as follows: Parts I and II are Nos. 193 and 220 of this series; Parts III through X appeared in the *Nautilus* (Vols. 52–58) from 1939 to 1945.

sculpture and, in the few species in which the radulae have been examined, normally tricuspid centrifugal teeth. Within this group shell form is quite diverse. Consequently, several names based on the shape of the shell are available for biological subgroupings. Since no one source lists these names, it has been thought worth while to give them in chronological order with their nomenclature type and, when possible, an indication as to their historical usage. In no sense should this list be taken as an indication of subgeneric designations, but rather as an enumeration of names available for use in future revisionary work. Unless otherwise indicated, types are by original designation.

Drymaeus Albers, 1850, p. 155. Type: *D. hygrohylaeus* (Orbigny). Pilsbry (1898, *Manual Conch.* (2) 11, p. 182). Usually applied to South American forms with fully expanded lip.

Mesembrinus Albers, 1850, p. 157. Type: *B. virgulatus* Ferussac. von Martens (1860, p. 214). Species with simple, unexpanded lip; central and eastern South America.

Semiclausaria Pfeiffer, *Malak. Blätt.,* 1855, p. 162. Type: *B. semiclausus* Pfeiffer. A group of Columbian and Ecuadorian species.

Mormus von Martens, 1860, p. 216. Type: *B. papyraceus* Mawe. Species from southern and eastern Brazil with thin, slightly expanded lips.

Goniognathmus Fisher and Crosse, 1875, p. 473. Type: *D. lattrei* Pfeiffer. Mexican forms with expanded lip.

Stenostylus Pilsbry, 1898, p. 184. Type: *D. nigrolimbatus* (Pfeiffer). Thin-shelled, obese montane forms with simple lip; Peru to Colombia.

Antidrymaeus Germain, 1910, p. C43. Type: *D. inusitatus* Fulton. Pilsbry (1926, p. 87). All sinistral species of *Drymaeus (s. l.).*

Metadrymaeus Pilsbry, 1926, p. 87. Type: *D. josephus* Angas. Erected for type and *D. zhorquinensis* (Angas) from Panama and Costa Rica. They have expanded lips, but the whorls and apertures are shorter than in *Goniognathmus.*

Orodrymaeus Pilsbry, 1926, p. 87. Type: *D. farrissi* Pfeiffer. Elongate, variegated shells with simple lip; Peru and Ecuador.

Leptodrymaeus Pilsbry, 1946, p. 23. Type: *D. dominicus* (Reeve). Erected for *D. dormani* and type, from Florida and West Indies.

As originally proposed and subsequently used, most of the groups listed above are obviously artificial and seem to have no objective reality. Although Pilsbry (1902: xxxix–xl) indicated several possibilities for morphological studies of *Drymaeus,* little work has been done since that time. Both Pilsbry and I indicate that there are criteria on which

supraspecific categories could be based, but since very few of the species of *Drymaeus* have been examined and only one of the type species is known anatomically, it is at present impossible to assign any supraspecific categories. If historical usage were followed, the species described below with expanded lip would be placed in *Goniognathmus* and those with simple lip in *Mesembrinus*. This division has not been followed here, however, because of conflicting anatomical data.

ANATOMY OF *Drymaeus*

The pallial complex, the muscular system, and the gross morphology of the genitalia are very similar throughout the family Bulimulidae. The structure of the radula and jaw usually forms generic characters, and in some cases they serve for specific differentiation. The finer anatomy of the genital system also offers some possibilities for use in classification. Each of the three main differentiating systems are discussed generally and in the form of short notes under each species.

Radula

As pointed out by Pilsbry, there are four types of structural modifications known in the radula of *Drymaeus*. Principally, they affect the rachidian tooth, and, to a lesser extent, the contour of the transverse rows of teeth. The four types are:

1. Rachidian tooth tricuspid, cusps subequal; rows running backwards from middle, then forwards.
2. Rachidian tooth with a single broad cusp, notched in the middle. Reported only in West Indian forms.
3. Rachidian tooth with elongate mesocone, 0, 1, or 2 small ectocones.
4. Rachidian tooth tricuspid, mesocone much longer than the large blunt ectocones.

Three of the four groups are represented in the Baker material. *D. aurifluus, D. emeus,* and *D. sulphureus* belong to the first group; *D. droueti, D. necaxanus, D. serperastrus and D. attenuatus* to the third group; and *D. rudis* and *D. sulcosus* to the fourth group. As far as is known, the four groups do not intergrade, despite extensive intragroup variability.

Asymmetrical variations seem common in the members of the first group. This occurrence is shown most strikingly in the rachidian teeth of *D. sulphureus* (Pl. II, Figs. 9, 12), which were found in four consecutive rows on a single radula. The acute angle at which the rows of

teeth slant backward has caused crowding of the rachidian tooth by the lateromarginals. In *D. aurifluus* this condition has resulted in the loss of an ectocone (Pl. II, Fig. 5); in *D. attenuatus* the endocone of the first lateromarginal has been lost or greatly reduced. Not enough material of *D. emeus* or *D. aurifluus* was available for a study of individual variation in these species.

Variation within the third group is based on length of mesocone and presence or absence of ectocones. Occasionally, the mesocones become as short as in the fourth group, but the two types can always be distinguished by the greater ectoconal prominence of the *rudis–sulcosus* series. Complete loss of ectocones appears to be an individual variation within the third group, since often the same radula shows a row with ectocones on the rachidian tooth although adjacent rows lack them.

The extreme wear shown by the teeth of *D. rudis* would be puzzling had not the collecting notes indicated that it is found on cactus. Only the earliest rows on the radula adequately show the shape characteristic of the fourth group. Radulae of *D. sulcosus* indicate very little wear and less variation than is observed among specimens of any other species.

In contrast with the variations observed in the rachidian teeth, the formation of the lateromarginal teeth is quite regular throughout the entire series examined. There is no sharp distinction between lateral and marginal teeth, as there is in many pulmonate snails, but rather such a gradual transition that it is impossible to separate the two groups. In each radula there are two trends which can be discerned. First, there is a progressive increase in size from the first lateromarginal to a point about one-third of the way from the center, followed by a gradual decrease in size. Throughout the last ten to twenty denticles the decrease in size is accelerated. Second, from the midpoint of each row to the edge there is a tendency for the ectocone to split into two, three, four, or five cusps. No absolute progression takes place as teeth with one, two, or three ectoconal cusps occur next to one another. Nevertheless, in the outer third of the row there are usually at least two cusps and frequently three or four on the ectocone.

In the half century from Sterki (1894) to Carriker (1943) several people have made observations on the mechanism of radular growth and the changes which occur in the size, shape, and number of teeth during ontogeny. Changes in tooth form can be easily observed in a single radula, since worn rows are being constantly sloughed off anteriorly and new ones developed posteriorly. On the older parts of the

radula the cusps are usually much blunted, and the characteristic shape is obscured. Embryonic teeth, such as those of *D. sulphureus* (Pl. II, Fig. 8), present accentuated group characteristics and form the easiest guide for group determination of individual radulae.

Within limits the number of teeth per row varies directly with the age of the animal, as has been pointed out by Carriker (1943) and others. The figures given here for the number of rows per radula and the number of teeth per row are based upon radulae extracted from adult animals. A few radulae taken from juvenile specimens have 20–30 rows less and possess 10–20 fewer teeth per row. Venmans and Verdcourt (1950) found an interesting deformity in the radula of *Drymaeus virgulatus*. The normal W-shaped row was suddenly succeeded by a straight-line contour with only a two-row transition. Examination of the Gwatkin collection of radulae in the British Museum demonstrated this deformity in a number of species of *Drymaeus* and *Bulimulus*. None of the fifty or more radulae of *Drymaeus* examined by me showed this change, and none gave evidence to indicate they had experienced the deformation.

Ordinarily, among pulmonates the rachidian tooth is considered the most stable element in the radula. The fact that this particular tooth diverged into four well-marked categories within this genus would indicate that there are four phyletic groups present. Many more species must be examined, however, before this can be claimed to be anything more than a hypothesis.

Jaw

The jaw of Drymaeus is composed of a number of horny, partly overlapping plates attached to a basal membrane. The entire structure is highly flexible and is subject to great distortion in mounting. The plates at the extremities of the jaw are small, usually narrow, and overlap considerably. They regularly increase in size as they approach the central part. Although in most bulimulid genera the entire jaw is composed of overlapping plates, in *Drymaeus* the central part is composed of from three to eight plates which are partly fused to form roughly a triangular mid-section. Variation occurs in size, number, and overlap of plates, in formation of the central area, and in serration of the lower margin of the jaw. In mounted jaws the most obvious variations are in amount of overlap of the individual plates and the extent to which the upper margins of plates near the central area are free from one another. Such variations are artifacts introduced by the process of mounting and are of no importance.

With respect to jaw variation there appear to be four distinct groups which do not coincide with the observed radular variation, except for *D. rudis* and *D. sulcosus* (Pl. III, Fig. 1), which are closely allied in all respects. The jaw of *D. attenuatus* (Pl. III, Fig. 4) is distinguished from the jaws of other forms by the relatively large size of the individual plates and the heavy serration of the lower margin. *D. emeus* (Pl. III, Fig. 8), *D. sulphureus* (Pl. III, Fig. 3), and *D. droueti* (Pl. III, Fig. 6) form one group separated from that of *D. aurifluus* (Pl. 3, Fig. 7), *D. necaxanus* (Pl. III, Fig. 5), and *D. serperastrus* (Pl. III, Fig. 2) by the totally different structure of the central part.

Within each species the amount of serration, the number of plates and the formation of the central part of the jaw appear constant, although very young specimens may have a slightly lower number of plates, and the central part appears less completely fused than in adult specimens. The size of the individual plates appears to be another age-dependent factor.

Genitalia

The external genitalia of *Drymaeus* show few features that would distinguish them from those of other bulimulid genera. The major difference lies in the insertion of the penial retractor muscle. In *Drymaeus* it inserts at the apex of the epiphallic flagellum, but in *Bulimulus* the insertion is near the point of union of the vas deferens and the epiphallus.

With the exception of the functional parts of the male system, the genitalia of the species examined show no specific differences. The genital system of *D. sulcosus* is figured in its entirety (Pl. IV, Fig. 1), and, with the exception of the penial complex, could represent the genitalia of any of the species. The several organs are discussed below, and the variations observed are described briefly.

Ovotestis (G) is a mass of from one to six weakly lobed, club-shaped alveolar glands. The variation in number of lobes appears individual. *Hermaphroditic duct* (GD) is a highly convoluted tubule connecting the ovotestis and albumen gland. The absolute length and amount of convolution vary individually. *Talon* (GT) is partly imbedded in the albumen gland; its free part varies in shape from a slender rod to a swollen, twisted sac. *Albumen gland* (GG) is large, sickle-shaped, yellowish, varying greatly in size. *Carrefour* (X), buried at base of talon in albumen gland, receives ducts of albumen gland, hermaphroditic duct, and talon. Out of the carrefour opens the spermoviduct with a seminal groove. This consists of two parts: the *uterus* (DT), a large convoluted whitish mass

capable of doubling its size by swelling when transferred from alcohol to water; and the smaller, yellowish glandular tissue, the *prostate* (DG), running alongside of the uterus. The carrefour lies at the apical part of the pulmonary chamber, and the spermoviduct spirals down along the inner wall of the lung.

The male system extends from the carrefour to the atrium and consists of a prostatic part (seminal groove down the inside of the uterine cavity in the spermoviduct), the free vas deferens, the epiphallus and accessory organ, and the penis. The *vas deferens* (D) is a long narrow tube leading from the seminal groove to the epiphallus. It is loosely joined to other organs by connective tissue, passing alongside of the free oviduct and vagina, through the penial sheath, along one side of the penis (crossing to the other at the juncture of the penis and the epiphallus), and entering the epiphallus at the base of the epiphallic flagellum. *Epiphallus* (E) has a flagellar part (EF) to the apex of which the *penial retractor* (PR) attaches. The flagellar part is sculptured internally with small beaded nodules. The epiphallus is sculptured internally with longitudinal ridges. *Penis* (P) occasionally is quite convoluted and twisted, but generally relatively straight. The internal pilaster pattern of the penis (Pl. V, Fig. 2) is continuous to the penial sheath region, which sometimes contains only a few strong ridges. This pilaster pattern is most highly developed in those individuals which contain traces of spermatophore formation, and is greatly reduced in those with little or no trace of spermatophores, indicating that the pilaster pattern is formed by glandular material connected with spermatophore formation. *Penial sheath* (PS) is usually present, but is lacking in a few species. The relative lengths of the penis and penial sheath may provide some criteria for species differentiation and are discussed below. The system opens externally through an *atrial pore* (YO) shared with the female system.

The female system consists of the uterine part of the spermoviduct, the free or postuterine oviduct, the spermatheca, and the vagina. The free or *postuterine oviduct* (UZ) extends from the end of the spermoviduct to the union of the spermatheca and the vagina. The *vagina* (V) is a long slender duct leading down to the atrial pore. *Spermatheca* (S) is a long tubular organ extending from the base of the postuterine oviduct to the carrefour, loosely bound to the spermoviduct by connective tissue. When containing spermatophores it is swollen, and the apical sac is not distinguishable (Pl. IV, Fig. 1). When empty it is very slender and with a distinct round apical sac.

Variation within the penial complex takes several forms: individual, seasonal, and structural. Individual variation includes the apparent length of the penial retractor (dependent upon degree of contraction at time of death), the degree of coiling of the penis and epiphallus, the point of emergence of the vas deferens from the glandular tissue at the base of the spermoviduct, and the relative length of the genital atrium. All of these characters vary greatly and, if considered uncritically, might be taken as indicating actual structural modifications. Fortunately, enough specimens were available to enable the individual nature of the variations to be established.

That there is a seasonal aspect in the appearance of the genitalia among many pulmonates has been known for a long time. There are variations in the time of development of the male and female systems, an actual alternation of sexual activity, or merely increased obesity of the organs during periods of sexual functioning. The limited number of species studied and the small number of each species dissected indicate that in *Drymaeus* seasonal variation is limited to changes in obesity of the genitalia. Since no really juvenile material was available, it was impossible to trace any changes with age in the relative proportions of the penial complex. Some difference in the obesity of the organs was found; the most obese ones were those containing the greatest amount of spermatophore material.

The structural variations consist primarily of changes in the penial sheath and possibly some difference in the relative proportions of the lengths of the organs of the penial complex. In *D. sulphureus* (Pl. IV, Fig. 2) and *D. emeus* the penial sheath is lacking. It was very much reduced in *D. necaxanus* and *D. serperastrus* (Pl. IV, Figs. 5, 6); of medium length in *D. rudis, D. sulcosus, D. attenuatus,* and *D. auriflauus;* and very long in the *D. droueti* complex. Some intraspecific variation in size was found, but this was accompanied by greatly expanded or contracted muscles and represented an individual variation. Certainly, the four groups could be separated immediately by the condition of the penial sheath. The drawings of the penial complex (Pl. IV) show some of the variations in the relative proportions of the penis and epiphallus. To what extent these differences are individual variations or structural in nature is unknown. The evidence points both ways, and more material must be examined before a conclusion can be reached.

Traces of spermatophore material were found in nearly every penis examined, but fully developed spermatophores appeared only in the

spermathecae of two specimens of *D. sulcosus*. In both cases the smaller, closed end of the tube was near the apical sac, and the wider, open end was slightly above the opening to the vagina. The shape of the spermatophore (Pl. V, Fig. 1) gradually changes from triangular at the closed head to rectangular at the open end. In cross section it shows a supporting rod, thin horny walls, and a central part packed with a whitish mass of sperm.

As mentioned above, the internal pilaster pattern of the penial complex is often of value in both specific and generic designations. In the species of *Drymaeus* examined both the prominence of the pilaster pattern and the obesity of the penial complex increased with the amount of spermatophore material present; however, no constant differences could be found in any of the penes examined. The illustration of the pilaster pattern of *D. sulcosus* could just as well represent any of the other species. The only other illustrations of the penial pilaster pattern in bulimulid snails known to me are those in Strebel and Pfeffer. Their figures are too vague to be of any value for indicating possible generic differences.

In conclusion, the only specific differences in the genitalia were those features associated with the structure of the penial sheath. There is also a possibility that the relative length of the penis and epiphallus may differ specifically.

HABITAT

Extensive ecological notes were taken by Dr. Baker on each collecting locality, and a detailed discussion of the ecology of these stations was given by Baker (1928). A brief abstract of that information is presented below. The symbols are those employed by Baker.

A. Rocky summits with heavy rainfall
B. Alder forests near Necaxa; damp
C. Pine and oak forests
D. Tropical and subtropical jungle
E. Semidesert conditions
F. Cypress woods

I. Natural forests (leaf humus; trees show no signs of *recent* disturbance)
II. Second growth (brush areas)
III. Found in both or ecotonal areas

a. Ground strata (humus, leaves, and so forth)
d. Shrub strata (less than 2 meters above ground)
e. Arboreal strata (aestivate in ground, but when active higher than 2 meters on trees)

With reference to this outline, the *Drymaeus* species are accompanied by key symbols as follows:

attenuatus (AD, III, e)
aurifluus (D, III, e)
droueti droueti (AD, III, e)
droueti deletus (D, I, e)
droueti sporlederi (AD, III, e)
emeus emeus (CD, III, e)
emeus palpaloensis (C, III, e)
necaxanus (ABCD, III, e)
rudis (EF, II, e)
serperastrus (E, I, e)
sulcosus (C, III, ade)
sulphureus (AD, III, e)

According to Pilsbry (1926:87), *Drymaeus* is typically arboreal and occurs "throughout the humid mainland tropics, and is represented more or less abundantly except in savanna or arid districts, where *Bulimulus* appears to replace it." All of the species given are arboreal, and, with two exceptions, were collected in humid areas. *D. serperastrus* is known to occur under semidesert conditions in Yucatán, whereas *D. rudis* was found in both the cypress woods and on cactus in drier sections of Chapultepec Park, Federal District. In addition to the usual jungle habitat, the *D. emeus* group and *D. sulcosus* occur in the pine-oak forest zone. It might be added that this genus is one of the few which is not restricted to natural areas, but thrives well even in the coffee plantations.

SYSTEMATICS

It is impossible to obtain a clear picture of specific relationships based on variation in radula, jaw, genitalia, and shell of these *Drymaeus* forms. Some species are obviously closely related in all characters; others fit no consistent pattern. A rough indication of relationships, using information available among the characters previously discussed, is presented in Table I.

TABLE I

RELATIONSHIPS OF SPECIES OF *Drymaeus* AS DETERMINED BY THE KEY CHARACTERS USED IN SPECIFIC IDENTIFICATION

Numbers arbitrarily assigned to the morphological groups indicated above.

Species	Radula	Jaw	Character Genitalia	Shell
emeus	1	1	1	1
sulphureus	1	1	1	1
aurifluus	1	2	3	1
droueti	2	1	4	2
necaxanus	2	2	2	2
serperastrus	2	2	2	4
attenuatus	2	4	3	4
rudis	3	3	3	3
sulcosus	3	3	3	3

Bartsch (1907) described two species of *Drymaeus* from Central Mexico. Dr. Harald Rehder of the United States National Museum kindly permitted me to examine the types of both forms. *D. herrerae* Bartsch is synonymous with *D. uhdeanus* von Martens (1890: 234, Pl. 15, Figs. 1–3); *D. herrerae veracruzensis* Bartsch is the same as *D. uhdeanus cuernavacensis* Crosse and Fischer (Fischer and Crosse, 1870: 532, Figs. 11, 11*a*).

In the following consideration of the several species no attempt has been made to list full synonymies for the species since that already has been done by Pilsbry (1899). For convenience, however, references to the original description and to the major faunal works of Fischer and Crosse, Strebel and Pfeffer, von Martens, and Pilsbry are included in an abbreviated form.

Drymaeus attenuatus (Pfeiffer)

(Pl. I, Fig. 7)

Bulimus attenuatus Pfeiffer, 1853:256.
Bulimulus attenuatus (Pfeiffer), Fischer and Crosse, i (1875):491, Pl. 23, Figs. 1, 1a.
Bulimulus attenuatus (Pfeiffer), Strebel and Pfeffer, V (1882):79–81, Pl. 5, Figs. 7a, b, 8 a–c; Pl. 13, Fig. 13; Pl. 5, Fig. 15.
Otostomus attenuatus (Pfeiffer), von Martens, 1893:215, Pl. 13, Figs. 15–16.
Drymaeus attenuatus (Pfeiffer), Pilsbry, 12 (1899):60–61, Pl. 2, Figs. 6–16.

TYPE LOCALITY.—Veracruz.

MATERIAL.—Fifty-eight specimens from stations 2, 3, 4, 5, and 6 (Córdova and Sumidero, Veracruz).

DISCUSSION.—A number of varieties based on variation in shape and color pattern have been described, but with the exception of *pittieri* von Martens all can be found in the Baker material. The basic color pattern consists of from nine to twelve longitudinal stripes on the body whorl, with fewer present on the spire. The stripes vary from narrow uninterrupted streaks to wide bands broken up into three or four rows of blotches. Occasionally, the color pattern is missing. External shape varies considerably, the most slender specimen measured 36.8 by 14.5 mm. (h/d ratio 39.4) and the widest individual 28.1 by 13.0 mm. (h/d ratio 46.3). The latter closely resembles *D. sulphureus* in shape. Differences of shape are characteristic of *Drymaeus,* and names have been applied to many individual variations. All adult specimens have a well-reflexed lip; occasionally, traces of a second lip appear behind the first.

RADULA. (Pl. II, Fig. 2).—Of 113–121 rows; formula (54–70)-1-(54–70). Strebel and Pfeffer (Pt. V, Pl. 13, Fig. 13) show this species with a much more prominent endocone on the first lateromarginal and more prom-

inent ectocones on the rachidian tooth than occur in any of my specimens. Embryonic teeth with an extremely long, slender mesocone.

JAW (Pl. III, Fig. 4).—Fifteen side plates and fused central area; side plates wide and strongly serrated along lower margin. Central part composed of only a few plates.

GENITALIA (not figured).—Penial sheath as in *D. aurifluus*. Genitalia more closely bound to viscera by connective tissue than in other species examined.

Drymaeus droueti droueti (Pfeiffer)
(Pl. I, Figs. 11, 13, 14)

Bulimus droueti Pfeiffer, 1857:319, Pl. 35, Fig. 12.
Bulimulus droueti (Pfeiffer), Fischer and Crosse, i (1875):533, Pl. 23, Figs. 9, 9a.
Bulimulus droueti (Pfeiffer), Strebel and Pfeffer, IV (1882): Pl. 6, Fig. 13; V:77, Pl. 6, Fig. 6 (juv.), Pl. 12, Fig. 7b.
Otostomus droueti (Pfeiffer), von Martens, 1893:218.
Drymaeus droueti (Pfeiffer), Pilsbry, 12 (1899): 65–67, Pl. 3, Figs. 36, 38, 43 (?).
Drymaeus bourgeoisae Rehder, 1943:28, Pl. 6, Fig. 10.

TYPE LOCALITY.—Córdova, Veracruz, Mexico. (A. Sallé).

MATERIAL.—Seven specimens from stations 2, 3, 4, and 6 (Potrero to Sumidero, Veracruz).

DISCUSSION.—Variation in shape and color pattern has led to a great deal of confusion concerning members of this species complex. Notwithstanding examination of the considerable number of specimens collected by Baker, the material borrowed from Miss Marie Bourgeois, and the collections in the Chicago Natural History Museum, the Academy of Natural Sciences of Philadelphia, the United States National Museum, and the University of Michigan Museum of Zoology,[2] the proper taxonomic position of these forms still remains uncertain. Although the three varieties indicated here are obviously closely related and differ primarily in color pattern, the differences are very constant and without intergradation. These three types are considered here as color forms of the same species. Only breeding experiments and ecologic studies can settle their relationship as sibling species or color forms of a single polymorphic species.

The typical form described by Pfeiffer is the one most commonly seen in collections. In shape it varies from the squat globose form illustrated by Pfeiffer to the narrow elongate *bourgeoisae*. Intergrades between the two forms exist if a sufficiently large series is available for examination. There are two shells in the Chicago Natural History

[2] Hereafter abbreviated CNHM, ANSP, USNM, and UMMZ, respectively.

Museum collected at Córdova by Sallé, which represent the globose form of Pfeiffer. The color pattern in these and others observed (Pl. I, Fig. 13) has the maculations reduced to squares rather than the arrow-shaped markings of *bourgeoisae*. Most of the specimens are nearer the latter form. There is no correlation between color pattern and shape.

An interesting monstrosity is found occasionally, at present known only in the typical variety. It is an extremely depressed and swollen shell (Pl. I, Fig. 11), of which I have seen three specimens (UMMZ 181379, CNHM 17889, and USNM 24975).

RADULA (Pl. II, Fig. 4).—Of 116–122 rows; formula 56-1-56 to 71-1-71. The radulae within this complex do not vary, and only teeth of the typical variety have been illustrated. Extremes of variation in both row count and formula occurred in var. *sporlederi*. Formation of the transverse rows is as in *D. attenuatus*. The variation shown in the latero-marginal teeth may be considered typical for all species examined.

Pfeffer's (V:79, Pl. 13, Fig. 10) illustration of the radula of *sporlederi* is totally inaccurate, if I examined the same species that Pfeffer did. Occasionally poor focusing of the microscope will cause underlying parts of the tooth to appear as ectocones, and the tricuspid appearance of the rachidian tooth may have been caused in this way.

JAW (Pl. III, Fig. 6).—Composed of 15–20 plates, with the central area formed by five to six partly fused plates. Side plates generally narrow; no constant intervarietal variation found.

GENITALIA (Pl. IV, Fig. 4).—Penial sheath long, practically no spermatophore material found in the penes. No significant variation found in the eight specimens of this complex examined.

Drymaeus droueti deletus, new subspecies[3]

(Pl. I, Fig. 12)

Bulimulus droueti (Pfeiffer), var. γ, Fischer and Crosse, i (1875):533, Pl. 23, Fig. 9*b*.
Otostomus droueti (Pfeiffer), var. a, von Martens, 1893:219.
Drymaeus droueti (Pfeiffer), Pilsbry, 12 (1899):66, Pl. 3, Fig. 39.

TYPE LOCALITY.—Sumidero, Mexico, D.F. (Station 6).

MATERIAL.—Eight specimens. Holotype UMMZ 181389, paratypes CNHM 45543, USNM 607489, ANSP 191370, Museum of Comparative Zoology and Baker collection.

DESCRIPTION.—Separable from the other members of this complex by the reduction of the color pattern to a few spots on the body whorl,

[3] A nomenclatural rather than a biological subspecies.

occasionally spreading to the spire. Otherwise the same as the elongate form of the typical variety. Known from Sumidero, Orizaba, and Córdova.

Drymaeus droueti sporlederi (Pfeiffer)

(Pl. I, Fig. 10)

Bulimus sporlederi Pfeiffer, 1866:83
Bulimulus sporlederi (Pfeiffer), Fischer and Crosse, i (1875):535, Pl. 21, Figs. 5, 5a.
Bulimulus sporlederi (Pfeiffer), Strebel and Pfeffer, IV (1882): Pl. 6, Fig. 12. V:78, Pl. 12, Figs. 7a, c; Pl. 13, Fig. 10; Pl. 14, Figs. 18a, c.
Drymaeus droueti sporlederi (Pfeiffer), Pilsbry, 12 (1899):66, Pl. 3, Figs. 40–41.

TYPE LOCALITY.—Mirador near Veracruz (Berendt).

MATERIAL.—Six specimens, only one adult, from stations 3, 4, 5, and 6 (Peñuela to Sumidero, 2625–3400 feet).

DISCUSSION.—Color pattern in adults consists of from ten to thirteen longitudinal lines on the body whorl. Sculpture as in typical *droueti*. The figures in Fischer and Crosse are evidently juveniles. Baker's adult specimen closely approximates the one figured by Strebel (IV, Pl. 6, Fig. 12). Strebel's (V, Pl. 12, Fig. 7c) may be *D. necaxanus,* but is more likely a poor picture of *sporlederi*.

Drymaeus necaxanus, new species

(Pl. I, Fig. 9)

HOLOTYPE.—UMMZ 181377, from station 51, pine slopes near Salto Grande, Necaxa, Pueblo, Mexico. Has six whorls, is 23.5 mm. high and 12.5 mm. in diameter.

PARATYPES.—Twenty-six specimens from stations 24, 33–36, 41, and 51–54 in the vicinity of Necaxa, Pueblo. They are distributed as follows: UMMZ 181395, CNHM 45542, USNM 607488, ANSP 191369, Museum of Comparative Zoology, Solem collection 2671, and Baker collection.

DIAGNOSIS.—A *Drymaeus* of the *Mesembrinus* group superficially similar to *Drymaeus droueti sporlederi,* but easily distinguished from it by the differences in color pattern, sculpture, lip, and anatomy.

DESCRIPTION.—Shell ovate-conic, thin, 2¼ embryonic whorls with typical *Drymaeus* sculpture; whorls 5¾ to 6½, evenly rounded with sutures slightly impressed; shell straw-colored with 16–20 longitudinal reddish brown bands on the body whorl; columella folded back so shell is barely perforate; lip sharp and simple; aperture slightly longer than spire; sculpture consists of minute longitudinal growth striae crossed

by a number of wide spiral lines, which, on the body whorl, are often wider than their interstices; at the bottom of these striae the surface is dull and has the appearance of extremely fine sandpaper.

DISCUSSION.—Juvenile specimens of *sporlederi* and *necaxanus* can be confused, but adult specimens are easily separated by the heavier sculpture and greater number of color bands on *D. necaxanus*. In the *droueti* complex the lip is slightly reflexed, whereas in *necaxanus* the lip is simple. As is pointed out below, there are differences in the jaw and the genitalia.

RADULA (Pl. II, Fig. 6).—Of 98–107 rows; formula (64–67)-1-(64–67); row contours typical. It is doubtful that the number of rows is significantly different from that of the *droueti* complex.

JAW (Pl. III, Fig. 5).—Sixteen side plates; central part composed of only two or three fused plates in contrast with the five or six of the *droueti* complex.

GENITALIA. (Pl. IV, Fig. 5).—Penial sheath short compared with the very long sheath of the *D. droueti* group.

Drymaeus serperastrus (Say)

(Pl. I, Fig. 8)

Bulimus serperastrus Say, 1829:25.
Bulimus paivanus Pfeiffer, 1866:81.
Bulimulus serperastrus (Say), Fischer and Crosse, i (1875):488, Pl. 24, Fig. 4.
Bulimulus paivanus (Pfeiffer), Fischer and Crosse, i (1875):490, Pl. 21, Figs. 1, 1a.
Bulimulus paivanus (Pfeiffer), Strebel and Pfeffer, V (1882):82, Pl. 6, Fig. 11; Pl. 12, Fig. 18; Pl. 13, Fig. 12; Pl. 14, Figs. 9G, 10A, B, D, 11; Pl. 16, Fig. 3.
Bulimulus serperastrus (Say), Strebel and Pfeffer, V (1882):83, Pl. 6, Fig. 12.
Otostomus serperastrus (Say), von Martens, 1893:203.
Drymaeus serperastrus (Say), Pilsbry, 12 (1899):37–39, Pl. 9, Figs. 34–41.

TYPE LOCALITY.—Between Veracruz and Mexico City.

MATERIAL.—Nine specimens from station 61, San Ignacio, Yucatán.

DISCUSSION.—This is a variable species in respect to color and size, but complete intergradation is present between *paivanus* and typical *serperastrus*. Say's type specimen in the ANSP is much larger than Baker's material, which come closest to the specimens illustrated by Strebel and Pfeffer as *D. paivanus*. Harry (1950) collected at this station and found no differences in the animals of the *paivanus* and *serperastrus* color phases, which were found living together.

RADULA (Pl. II, Figs. 1, 10).—Of 127 rows; formula 79-1-70; row contour as in group. The one specimen available differs from Pfeffer's illustration (V, Pl. 13, Fig. 12) which seems to represent worn material.

JAW (Pl. III, Fig. 2).—Seventeen plates per side, central part formed by three wide partly fused plates. Outer plates very narrow. Strebel and Pfeffer's illustration (V, Pl. 16, Fig. 3) is a good likeness and shows detail of plate overlap very well.

GENITALIA (Pl. IV, Fig. 6).—Penial sheath reduced.

Drymaeus rudis (Anton)
(Pl. I, Fig. 5)

Bulimulus rudis Anton, 1839:43.

Bulimulus rudis (Anton), Fischer and Crosse, i (1875):523, Pl. 23, Figs. 6, 6a; Pl. 22, Figs. 7–11 (anatomy).

Bulimulus rudis (Anton), Strebel and Pfeffer, V (1882):63, Pl. 5, Fig. 3; Pl. 6, Fig. 9; Pl. 11, Figs. 12–15 (labeled *D. sulcosus*).

Otostomus rudis (Anton), von Martens, 1893:209.

Drymaeus rudis (Anton), Pilsbry, 12 (1899):49–50, Pl. 10, Figs. 65–67; Pl. 15, Figs. 43–46.

TYPE LOCALITY.—None given.

MATERIAL.—Fifty specimens from station 14, Chapultepec Park, Mexico, D.F.

DISCUSSION.—The exact relationships of *D. rudis, D. sulcosus,* and *D. ghiesbreghti* are as yet unsettled. Juvenile specimens of the three forms are strikingly similar and may be but variants of a single species, as has been suggested by Pilsbry. Baker's material agrees very well with Pilbry's figures of *D. rudis* from Chapultepec Park. Shells from the park are much thinner, have weaker sculpture, darker coloration, and a sharper lip than specimens from other localities. Height varies from 22–25 mm. with 5½ to 6 whorls in Baker's specimens. Jacobson (1952) could not find this shell and reported that *Helix aspersa* was now the dominant snail in Chapultepec Park.

RADULA (Pl. II, Fig. 11).—Of 120–146 rows; formula (67–74)-1-(67–74). The illustration in Fischer and Crosse (Pl. 22, Fig. 8) is excellent.

JAW.—Not illustrated, but identical with *D. sulcosus.*

GENITALIA (Pl. IV, Fig. 7).—Penial sheath of medium size.

Drymaeus sulcosus (Pfeiffer)
(Pl. I, Fig. 6)

Bulimus sulcosus Pfeiffer, i (1841):43.

Bulimulus sulcosus (Pfeiffer), Fischer and Crosse, i (1875): 520, Pl. 23, Figs. 2, 2a,b.

Bulimulus sulcosus (Pfeiffer), Strebel and Pfeffer, V (1882):60, Pl. 5, Figs. 1, 2, 4—Form A; p. 61, Pl. 5, Fig. 2—Form Aa; p. 61, Pl. 5, Fig. 1—Form B; p. 62, Pl. 5, Fig. 4.

Otostomus sulcosus (Pfeiffer), von Martens, 1893:208, Pl. 13, Figs. 3, 3a, 4.

Drymaeus sulcosus (Pfeiffer), Pilsbry, 12 (1899):48–49, Pl. 10, Figs. 59–63.

TYPE LOCALITY.—Tacubaya, Mexico (Hegewisch).

MATERIAL.—Eighty-two specimens from stations 11 and 12 (Santa Rosa to El Desierto de los Leones, 8525–9850 feet, usually on shrubs).

DISCUSSION.—As mentioned under *D. rudis* there is some question as to the interrelationships of three forms. All have heavy longitudinal plications on the whorls, but have been separated on the basis of coloration and external shape. The closeness of the forms has caused confusion in the past. Strebel and Pfeffer have figured (Pl. 6, Fig. 17) a variety of *D. botterii* (Fischer and Crosse) as *D. sulcosus* and also (Pl. 11, Figs. 12–15) specimens of *D. rudis* as *D. sulcosus*.

Von Martens and Strebel have distinguished several varieties, all of which can be found in Baker's series. As mentioned by Pilsbry and others, color variation within this species is extensive. Baker's specimens have the surface unicolored, lip and columella white, aperture roseate in 76 specimens and white in six specimens. Height varies from 26.5 to 37.5 mm. with from 5¾ to 6½ whorls. All adult specimens have a strongly reflexed lip, contrary to some previous reports.

RADULA.—Of 101–110 rows; formula (68–70)-1-(68–70). Pfeffer's (V, Pl. 13, Fig. 8) illustration is very inadequate. Embryonic teeth are similar to those of *D. sulphureus* but have shorter ectocones.

JAW (Pl. III, Fig. 1).—Seventeen to 18 wide plates, center partly fused.

GENITALIA (Pl. IV, Fig. 1).—For discussion of various organs, see general section on genitalia.

Drymaeus aurifluus (Pfeiffer)

(Pl. I, Fig. 4)

Bulimus aurifluus Pfeiffer, 1857:319, Pl. 35, Fig. 10.
Bulimulus aurifluus (Pfeiffer), Fischer and Crosse, i (1875):499, Pl. 20, Figs. 21–22.
Bulimulus aurifluus (Pfeiffer), Strebel and Pfeffer, IV (1882): Pl. 6, Fig. 14; V:79.
Otostomus aurifluus (Pfeiffer), von Martens, 1893:213.
Drymaeus aurifluus (Pfeiffer), Pilsbry, 12 (1899):55, Pl. 1, Figs. 86–87.

TYPE LOCALITY.—Córdova, Veracruz, Mexico (A. Sallé).

MATERIAL.—One specimen each from stations 4 and 6 (Córdova and Sumidero).

DISCUSSION.—The two specimens, 21.3 and 22.5 mm. long, correspond very well to those figured by Pilsbry. To judge from the quoted illustrations, there appears to be some variation in color pattern, but no conclusions can be drawn from the limited material seen. In the one unbroken specimen the lip is slightly reflexed, and the sculpture consists of many fine, wavy spiral lines.

RADULA (Pl. II, Fig. 5).—Of 127 rows; formula 73-1-73. The peculiar central tooth is present in both specimens. Contour with a double sinuation rather than of the *D. attenuatus* type.

JAW (Pl. III, Fig. 7).—Lower margin of the fourteen side plates unserrated, central part composed of a few widely fused plates.

GENITALIA (Pl. IV, Fig. 3).—Penial sheath long. Genitalia more obese than in the other species examined. Whether this obesity is an individual trait as in several other species, or actually represents a structural characteristic could not be determined because of the scarcity of material.

Drymaeus emeus (Say)

(Pl. I, Figs. 1, 2)

Bulimus emeus Say, 1829:26.
Bulimulus alternans, var. d, Fischer and Crosse, i (1875):501.
Bulimulus tryonii Fischer and Crosse, i (1875):565 *(partim).*
Bulimulus palpaloensis Strebel and Pfeffer, V (1882):85–87, Pl. 5, Fig. 12*a–c;* Pl. 13, Fig. 14; Pl. 15, Figs. 1, 1a; Pl. 16, Figs. 4, 7, 8, 11.
Otostomus emeus (Say), von Martens, 1893:222, Pl. 14, Figs. 6, 6a, 8, 8a.
Drymaeus emeus (Say), Pilsbry, 12 (1899):73–75, Pl. 4, Figs. 52–61.

TYPE LOCALITY.—Road from Veracruz to Mexico City.

MATERIAL.—Ten specimens from stations 35–38, 53–55 near Necaxa, Pueblo.

DISCUSSION.—The great variability in color pattern has given rise to several names. Since none of the variations appears constant, and since intergrades are common, it seems best not to divide this species into subcategories. Specimens nearest the typical form were collected at stations 36, 53, 54, and 55 (2215–4600 feet), whereas specimens nearer to var. *palpaloensis* were taken at stations 35, 37, and 38 (4430–4925 feet), indicating some geographic separation. The sculpture is typical of *Drymaeus,* consisting of fine impressed spiral lines.

RADULA (Pl. II, Fig. 7).—Of 147 rows; formula 85-1-85 at 80th row from posterior end; 80-1-80 at the 90th row. Pfeffer's illustrations of *palpaloensis* (V, Pl. 13, Fig. 14 A–E) look like my findings for the typical variety, but his radula formula of (150–160)-1-(150–160) remains problematic, if these forms are to be considered the same. Unfortunately, no anatomical material of var. *palpaloensis* was available.

JAW (Pl. III, Fig. 8).—Twenty-three to 24 narrow, unserrated side plates, center part composed of 6–8 partly fused plates. Pfeffer (V, Pl. 16, Figs. 7, 8, 9, 11, 13–15) gives good examples of the relationship of individual plates.

GENITALIA (Not figured).—As in *D. sulphureus* the penial sheath is lacking.

Drymaeus sulphureus (Pfeiffer)
(Pl. I, Fig. 3)

Bulimus sulphureus Pfeiffer, 1857:318, Pl. 35, Fig. 11.
Bulimulus sulphureus Fischer and Crosse, i (1875):495, Pl. 23, Figs. 3, 3a.
Bulimulus sulphureus (Pfeiffer), Strebel and Pfeffer, V (1882):87, Pl. 5, Fig. 11a–d; Pl. 13, Figs. 15, 15b, 16; Pl. 15, Fig. 2a–c.
Otostomus sulphureus (Pfeiffer), von Martens, 1893:225, Pl. 14, Figs. 14–18.
Drymaeus sulphureus (Pfeiffer), Pilsbry, 12 (1899):76–78, Pl. 4, Figs. 65–68.

TYPE LOCALITY.—Córdova, Veracruz (Sallé).

MATERIAL.—Twenty-nine specimens from stations 1–6 (Atoyac, Sumidero, and Córdova, 1300–3400 feet).

DISCUSSION.—This highly characteristic shell cannot be mistaken for any other in the area. The peculiar cross-barred sculpture is definitive, yet has not been adequately illustrated, although the drawings of Fischer and Crosse come closest to representing this species. Most of the so-called varieties seem to be based on juvenile specimens, since these may be found among Baker's material. The only fully adult specimen is 29.5 mm. long with six whorls, and the lower part of the lip is slightly reflexed.

RADULA (Pl. II, Figs. 6, 9, 12).—Of 130 rows, formula 76-1-76. Row contour as in *D. emeus*. The rachidian tooth is extremely variable.

JAW (Pl. III, Fig. 3).—Nineteen to 23 plates per side, which are narrow and unserrated. Central part composed of six to eight slightly fused plates.

GENITALIA (Pl. IV, Fig. 2).—Penial sheath lacking.

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Plates

PLATE I

Shells of *Drymaeus*

FIG. 1. *D. emeus* (Say), form *palpaloensis* (Strebel). Sta. 35, Necaxa, Pueblo, Mexico. UMMZ 181383.

FIG. 2. *D. emeus* (Say). Sta. 36, Necaxa, Pueblo, Mexico. UMMZ 181386.

FIG. 3. *D. sulphureus* (Pfr.). Sta. 6, Sumidero, Córdova, Veracruz, Mexico. UMMZ 181387.

FIG. 4. *D. aurifluus* (Pfr.). Sta. 6, Sumidero, Córdova, Veracruz, Mexico. UMMZ 181388.

FIG. 5. *D. rudis* (Anton). Sta. 14, Chapultepec Park, D. F., Mexico. UMMZ 181381.

FIG. 6. *D. sulcosus* (Pfr.). Sta. 11, El Desierto, D. F., Mexico. UMMZ 181378.

FIG. 7. *D. attenuatus* (Pfr.). Sta. 6, Sumidero, Córdova, Veracruz, Mexico. UMMZ 181376.

FIG. 8. *D. serperastrus* (Say). Sta. 61, San Ignacio, Yucatán, Mexico. UMMZ 181380.

FIG. 9. *D. necaxanus,* new species. Sta. 51, Salto Grande, Necaxa, Pueblo, Mexico. Holotype UMMZ 181377.

FIG. 10. *D. droueti sporlederi* (Pfr.). Sta. 3, Peñuela, Veracruz, Mexico. UMMZ 181382.

FIG. 11. *D. droueti* (Pfr.), typical form (monstrosity). Sta. 2, Potrero, Veracruz, Mexico. UMMZ 181379.

FIG. 12. *D. droueti deletus,* new subspecies. Sta. 6, Sumidero, Córdova, Veracruz, Mexico. Holotype UMMZ 181389.

FIG. 13. *D. droueti* (Pfr.). Sta. 6, Sumidero, Córdova, Veracruz, Mexico. UMMZ 181384.

FIG. 14. *D. bourgeoisae* Rehder = *droueti droueti* (Pfr.). Córdova, Veracruz, Mexico. Coll. by M. E. Bourgeois. UMMZ 181385.

PLATE I

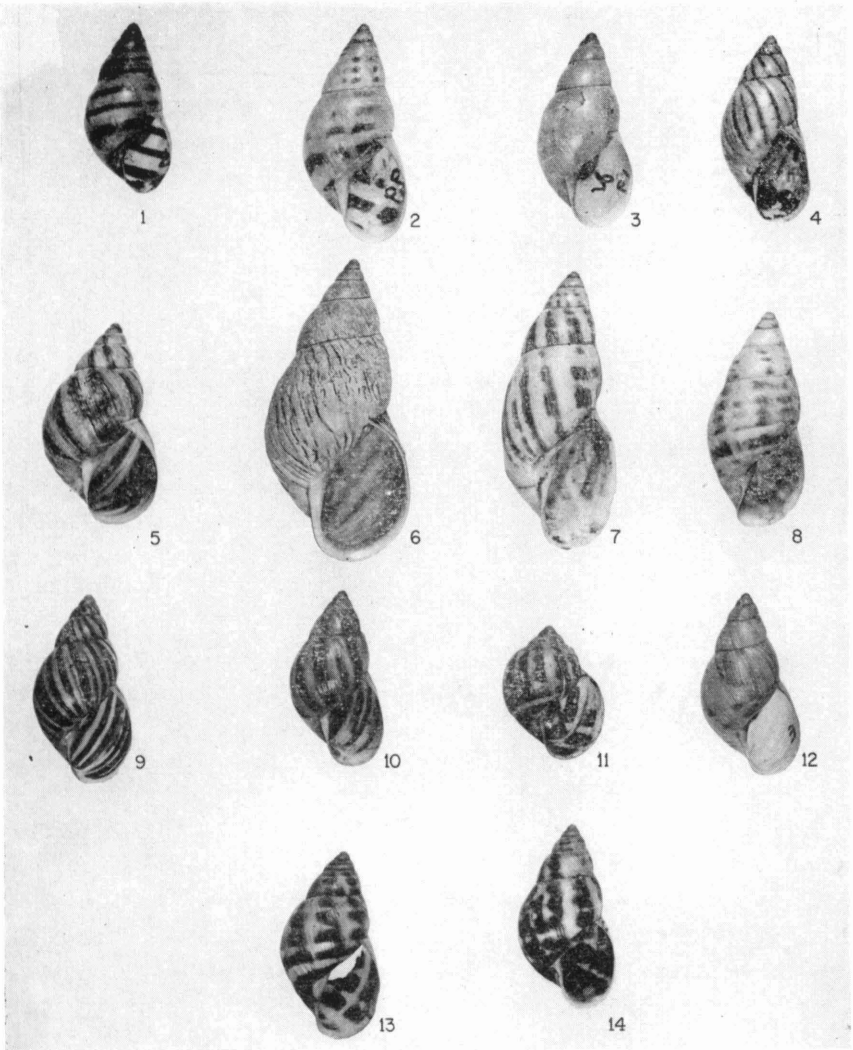

PLATE II

Radulae of *Drymaeus*

FIG. 1. *D. serperastrus* (Say). Sta. 61, No. 143, San Ignacio, Yucatán, Mexico. Twenty-sixth lateromarginal tooth in 40th row from anterior end, showing relationship of denticle to basal plate.

FIG. 2. *D. attenuatus* (Say). Sta. 4, nop, Las Tortolas, Córdova, Veracruz, Mexico. Rachidian tooth and first lateromarginal.

FIG. 3. *D. sulcosus* (Pfr.). Sta. 11, El Desierto, D. F., Mexico. Rachidian tooth and first lateromarginal.

FIG. 4. *D. droueti* (Pfr.). Sta. 3, No. 8de, Peñuela, Córdova, Veracruz, Mexico. A. Rachidian tooth; B. first lateromarginal tooth; C. 25th lateromarginal tooth; D. 62d lateromarginal tooth; E. 67th lateromarginal tooth.

FIG. 5. *D. aurifluus* (Pfr.). Sta. 4, Las Tortolas, Córdova, Veracruz, Mexico. Rachidian tooth and first lateromarginal.

FIG. 6. *D. necaxanus*, new species. Sta. 54, No. 99, Intake Gorge, Necaxa, Pueblo, Mexico. Rachidian tooth and first lateromarginal.

FIG. 7. *D. emeus* (Say). Sta. 53, No. 65, Necaxa, Pueblo, Mexico. Rachidian tooth and first lateromarginal.

FIG. 8. *D. sulphureus* (Pfr.). Sta. 4, No. 6def, Las Tortolas, Córdova, Veracruz, Mexico. Rachidian tooth and first lateromarginal from first distinguishable row of embryonic teeth.

FIG. 9. *D. sulphureus* (Pfr.). Sta. 6, No. 17def, Sumidero, Córdova, Veracruz, Mexico. Rachidian tooth and first lateromarginal.

FIG. 10. *D. serperastrus* (Say). Sta. 61, No. 143, San Ignacio, Yucatán, Mexico. Rachidian tooth and first lateromarginal.

FIG. 11. *D. rudis* (Anton). Sta. 14, Chapultepec Park, D. F., Mexico. Rachidian tooth and first lateromarginal.

FIG. 12. *D. sulphureus* (Pfr.). Sta. 6, No. 17def, Sumidero, Córdova, Veracruz, Mexico. Variation in rachidian teeth.

PLATE II

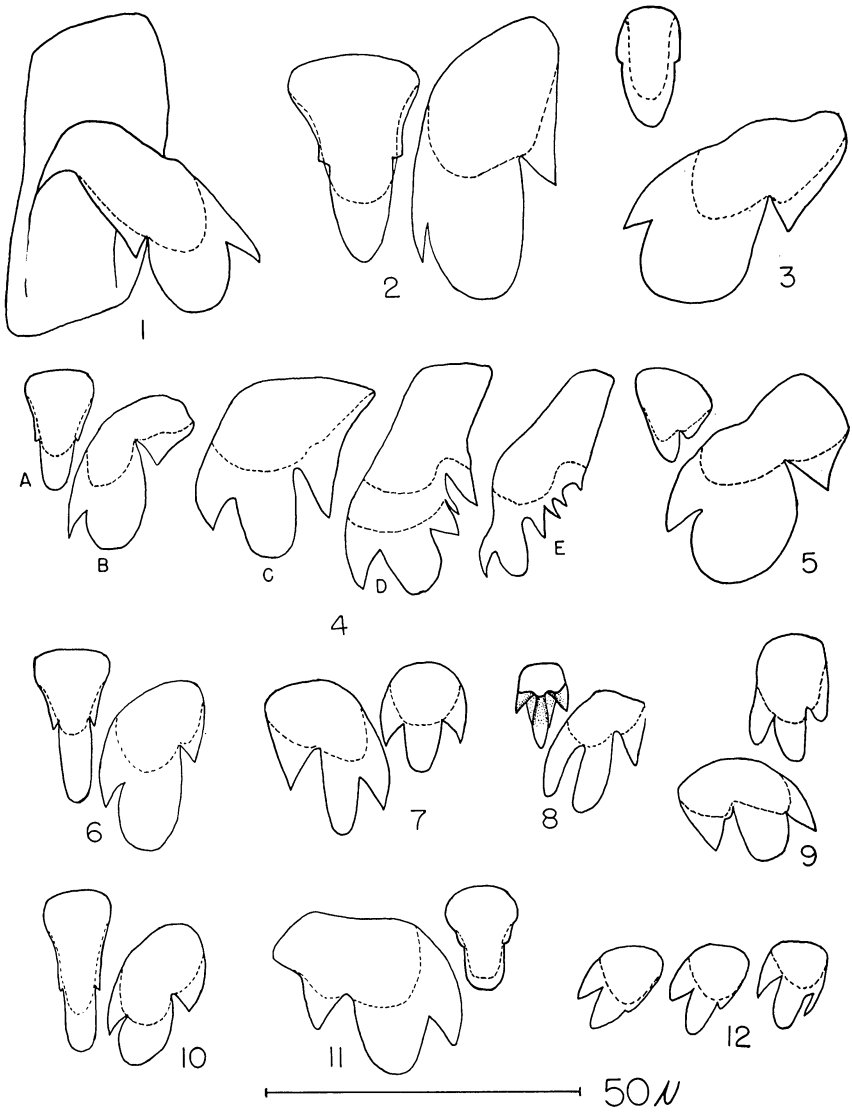

PLATE III

Jaws of *Drymaeus*

FIG. 1. *D. sulcosus* (Pfr.). Sta. 12, Santa Rosa, Veracruz, Mexico.

FIG. 2. *D. serperastrus* (Say). Sta. 61, No. 143, San Ignacio, Yucatán, Mexico.

FIG. 3. *D. sulphureus* (Pfr.). Sta. 6, No. 19def, Sumidero, Córdova, Mexico.

FIG. 4. *D. attenuatus* (Pfr.). Sta. 6, No. 19def, Sumidero, Córdova, Veracruz, Mexico.

FIG. 5. *D. necaxanus,* new species. Sta. 54, No. 99, Intake Gorge, Necaxa, Pueblo, Mexico.

FIG. 6. *D. droueti deletus,* new subspecies. Sta. 4, No. 4f, Las Tortolas, Córdova, Veracruz, Mexico.

FIG. 7. *D. aurifluus* (Pfr.). Sta. 5, No. 136a, Cerro de las Palmas, Córdova, Veracruz, Mexico.

FIG. 8. *D. emeus* (Say). Sta. 54, No. 65, Necaxa, Pueblo, Mexico.

PLATE III

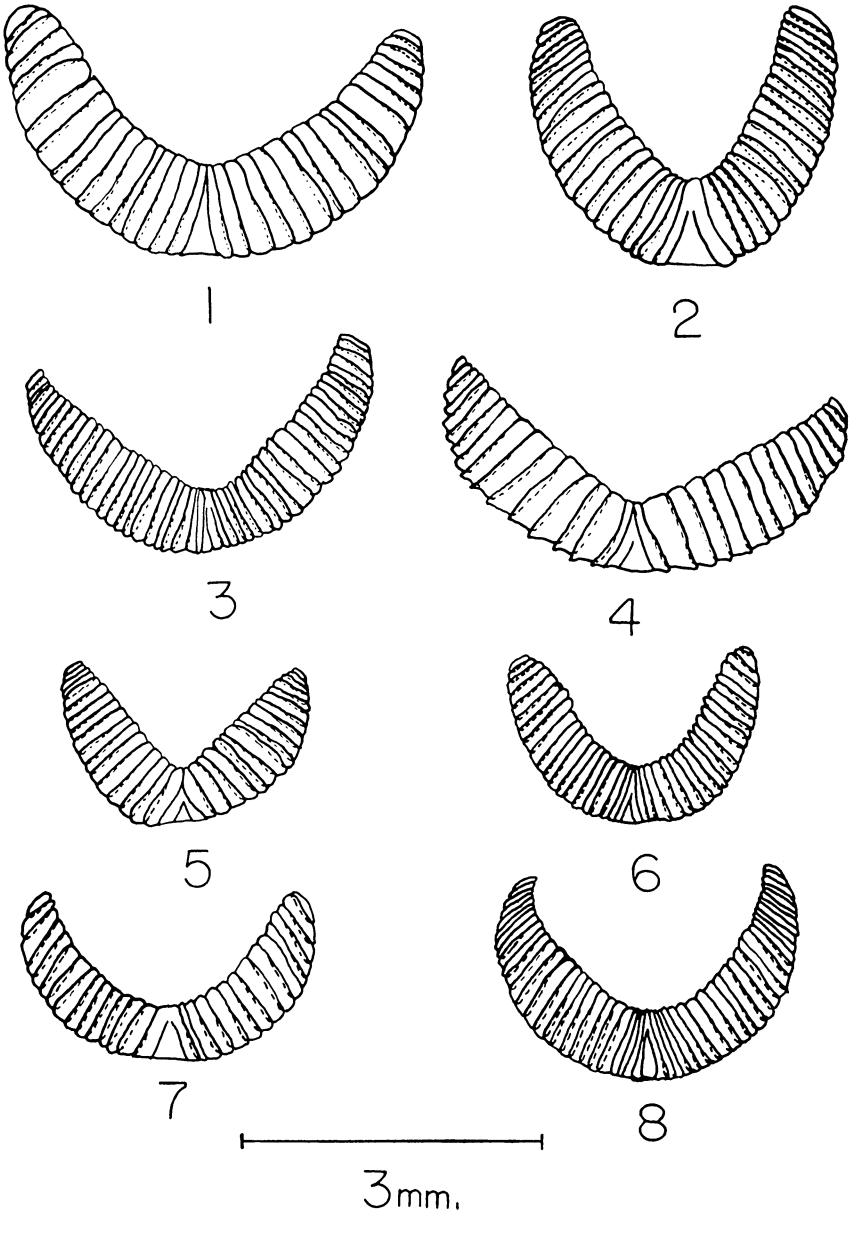

PLATE IV

Genitalia of *Drymaeus*

FIG. 1. *D. sulcosus* (Pfr.). Sta. 12, Santa Rosa, D. F., Mexico.
Genital System, symbols after H. B. Baker.

D, vas deferens	GT, talon
DG, prostate	P, penis
DT, uterus	PR, penial retractor
E, epiphallus	PS, penial sheath
EF, epiphallic flagellum	S, spermatheca
G, ovotestis	V, vagina
GD, hermaphroditic duct	YO, atrial pore
GG, albumen gland	X, carrefour

Figs. 2–7 are of male genitalia.

FIG. 2. *D. sulphureus* (Pfr.). Sta. 4, No. 16def, Las Tortolas, Córdova, Veracruz, Mexico.

FIG. 3. *D. aurifluus* (Pfr.). Sta. 5, No. 13bd, Cerro de las Palmas, Veracruz, Mexico.

FIG. 4. *D. droueti deletus*, new subspecies. Sta. 4, No. 17ab, Las Tortolas, Córdova, Mexico.

FIG. 5. *D. necaxanus*, new species. Sta. 53, No. 45, Necaxa, Pueblo, Mexico.

FIG. 6. *D. serperastrus* (Say). Sta. 61, No. 143, San Ignacio, Yucatán, Mexico.

FIG. 7. *D. rudis* (Anton). Sta. 14. Chapultepec Park, D. F., Mexico.
Scale Line = 5 mm.

PLATE IV

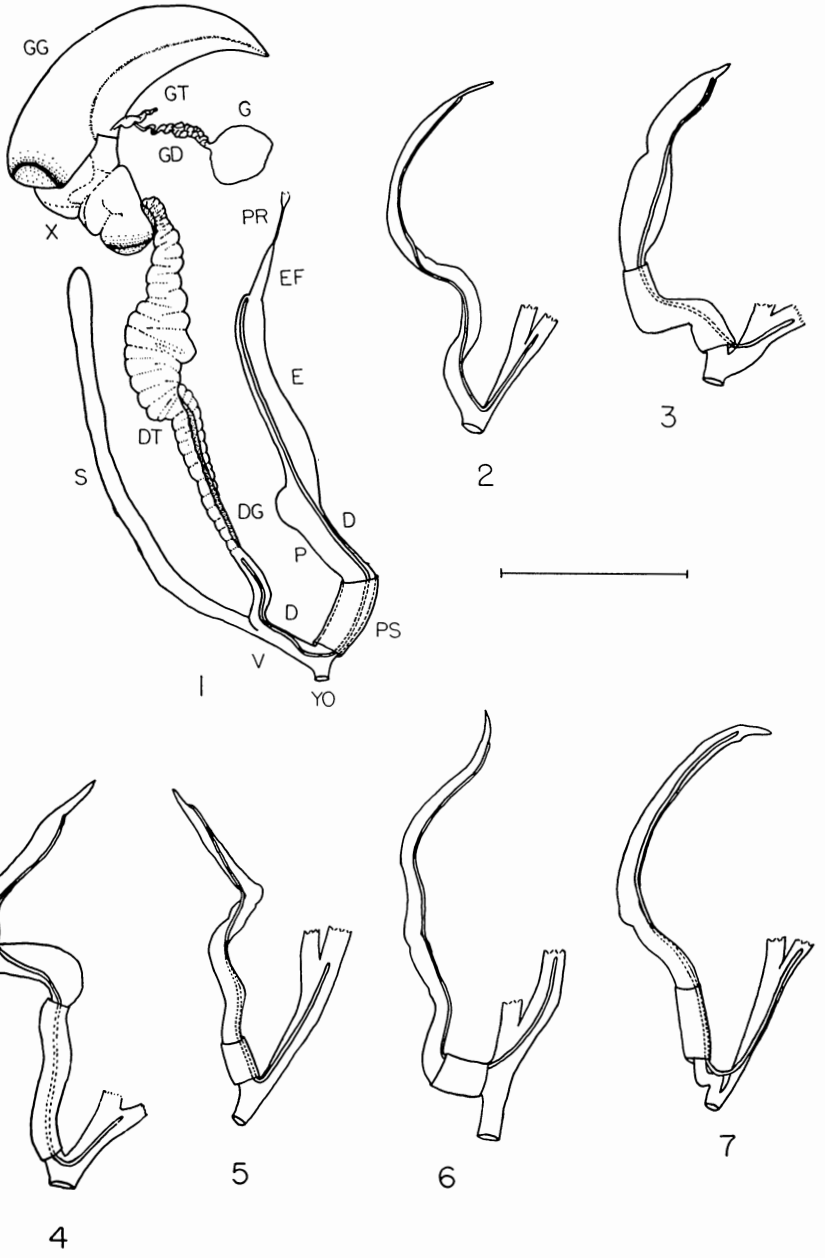

PLATE V

Penis and Spermatophore of *Drymaeus*

FIG. 1. *D. sulcosus* (Pfeiffer). Sta. 12, Santa Rosa, D. F. Mature spermatophore and cross section.

FIG. 2, 3. *D. sulcosus* (Pfeiffer). Sta. 12, Santa Rosa, D. F.
Internal anatomy of epiphallus and penis:

P, penis
E, epiphallus
EF, epiphallic flagellum
PR, penial retractor
VD, entrance of vas deferens

Drawing by William L. Brudon, staff artist, Museum of Zoology, University of Michigan.

PLATE V