KARYOTYPES AND ACCESSORY REPRODUCTIVE GLANDS IN THE RODENT GENUS SCOTINOMYS

The following information on karyotypes and male accessory glands is directed toward understanding kinships of Scotinomys. Though the genus was recently revised (Hooper, 1972), its relationships with other rodents are not yet entirely clear. Authors have linked Scotinomys with akodont rodents of South America, but those resemblances may be ones of ecological equivalents not necessarily closely related (Hershkovitz, 1972:387–88). Other authors have suggested that close affinities are with a North and Middle American group of some 12 genera variously referred to as peromyscines and neotomines (Hooper, 1959, 1960; Hooper and Musser, 1964), the tribes Reithrodontomyini, Onychomyini and Neotomini (Vorontsov, 1959), or “pastoral peromyscines”—tribe Peromyscini (Hershkovitz, 1962:85, 1972:387–88). These and other views regarding propinquity of Scotinomys need further testing by new sorts of data, for example, from chromosomes and accessory reproductive glands.

The animals used for karyotypic analysis consisted of both wild-caught individuals and their F1, laboratory-raised progeny as follows: S. teguina (Costa Rica, Cartago, Volcán Irazú, 12; Nicaragua, Matagalpa, Santa Maria de Ostuma, 2); S. xerampelinus (Costa Rica, Cartago, Volcán Irazú, 4; Volcán Turrialba, 2).

Mitotic chromosome spreads were prepared as described by Patton (1967) with the exception that cells in the sodium citrate solution were incubated at 38°C for approximately 20 minutes. A total of 94 spreads, approximately five per individual, were counted and 32 were photographed for more detailed examination and comparisons. The standard four-class system (metacentric, submetacentric, subtelocentric, acrocentric) was employed in describing the chromosomes. Voucher specimens are deposited in the University of Michigan, Museum of Zoology.

Dissection of ten reproductively-mature males of each species, together with ten examples of Baiomys for comparison, provided information on the number and kinds of accessory reproductive glands. The specimens, preserved in formalin or alcohol, are as follows: S. teguina (Costa Rica: Cartago, Moravia, 2; Volcán Irazú, 2; Puntarenas, Monte Verde, 3; Nicaragua: Matagalpa, Santa Maria de Ostuma, 1. Panamá: Chiriquí, Río Chiriquí Viejo, 2); S. xerampelinus (Costa Rica: Cartago, Volcán Irazú, 5; Volcán Turrialba, 3; San José, Cerro de la Muerte, 2); Baiomys musculus (México: Chiapas, Berriozabal, 2; Tuxtla Gutiérrez, 4; Oaxaca, Tapanatepec, 1; Tlacolula, 1; Etla, 2).

The reproductive tracts were examined under a Bausch and Lomb Stereozoom scope (7×–30×), and sketched with the aid of a camera lucida. Greatest lengths of the various glands (measured to the nearest 0.1 millimeter (mm) from the point of entrance of the glandular duct into the urethra to the extreme margin of the gland) were recorded. Additional immature individuals were examined to determine extent of variation associated with age. Anatomical terminology follows Arata (1964).

Karyotypes.—A diploid number of 58 was observed in both species of Scotinomys. There was no variation in the diploid count. The species also are similar in gross chromosome morphology—the autosomal complement pairs consist of 9 metacentrics, 7 submetacentrics, and 12 acrocentrics to yield a fundamental number of 88 (Fig. 1). The X-chromosome in both species is a large subtelocentric. The element designated as the Y-chromosome is a small metacentric in xerampelinus and a medium-sized submetacentric in teguina. This difference, however, may be due to an artifact in processing (over-contraction) or a mismatch of the chromosomes. Slight heteromorphism noted among individuals of both species was particularly evident in the largest pair of metacentrics and of submetacentrics (Fig. 1). Thomas (1973) noted a high degree of heteromorphic chromosome pairing in those populations of Peromyscus exhibiting a high fundamental number.
Male Accessory Reproductive Glands.—The male accessory glands in *S. teguina* (Fig. 2), described below, provide a basis with which the tracts of *S. xerampelinus* and *Baiomys* may be compared.

One large pair of preputial glands lie alongside the glans penis in *S. teguina*. The long tapering ducts of the preputials are embedded in connective tissue under the prepuce; they open at the edge of the preputial orifice. Th preputials, small in immature animals, increase greatly in size with the advent of reproductive activity (about 4 to 6 weeks in age), and in mature animals they cover as much as 5 mm of the M. rectus abdominis.

One pair of bulbo-urethral glands is situated anterior and lateral to the bulb of the penis in *S. teguina*. These prism-shaped glands are partly embedded in the bulbocavernosus muscle, and their ducts pass between the ischiocavernosus and bulbocavernosus muscles to empty into the bulb of the penis.

The ampullary glands of *S. teguina* consist of a paired mass of branched tubules and 8 to 12 unbranched tubules. Each group of branched tubules forms a fairly compact coiled glandular mass situated anterior to the vas deferens and nestled between the pair of anterior prostates. Each group of branched tubules appears to unite forming a common
ductway, and then to conjoin the vasa deferentia just craniad to the vasa's entrance into the urethra. It is quite evident that the unbranched tubules open separately into the vasa deferentia and not into the urethra. These single tubules (as much as 1 mm long) appear as outpocketings of the walls of the deferent ducts and are located primarily on ventral and posterior surfaces of those ducts. The branched tubules together with the unbranched ones partially encircle the base of the deferent ducts. They do not, however, wholly enclose or cover the ventral surface of the vasa deferentia, as seen in many species of *Peromyscus* (Linzey and Layne, 1969). In specimens that were all freshly-preserved with the same fixative (10 percent buffered formalin) the color of the ampullary glands varied, white in some individuals, light pink in others.

One pair of vesicular glands, the largest in the accessory gland complement, is situated at the anterior end of the prostatic urethra in *S. teguina*. These glands are slightly con-
Table 1.—Average lengths (in mm) of male accessory reproductive glands in Baiomys musculus and species of Scotinomys. \( N = 10 \) for each species.

<table>
<thead>
<tr>
<th>Accessory gland</th>
<th>Scotinomys teguina</th>
<th>Scotinomys xerampelinus</th>
<th>Baiomys musculus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preputial</td>
<td>8.1</td>
<td>8.9</td>
<td>8.0</td>
</tr>
<tr>
<td>Bulbo-urethral</td>
<td>2.9</td>
<td>3.4</td>
<td>3.4</td>
</tr>
<tr>
<td>Ampullary</td>
<td>2.0</td>
<td>1.9</td>
<td>2.1</td>
</tr>
<tr>
<td>Vesicular</td>
<td>7.0</td>
<td>8.1</td>
<td>8.7</td>
</tr>
<tr>
<td>Dorsal Prostate</td>
<td>2.5</td>
<td>2.7</td>
<td>3.3</td>
</tr>
<tr>
<td>Ventral Prostate</td>
<td>4.1</td>
<td>5.2</td>
<td>3.0</td>
</tr>
<tr>
<td>Anterior Prostate</td>
<td>4.8</td>
<td>4.0</td>
<td>5.2</td>
</tr>
</tbody>
</table>

stricter at intervals and curved gradually through their length to a subterminal flexure. The vesiculurs are smaller, smoother, and less curved in immature animals.

One pair of each of the three kinds of prostate glands, namely dorsal, ventral, and anterior are found in S. teguina. Dorsal prostates, tubular structures lying on the prostatic urethra and bordering the descending colon, drain through ducts situated just posterior to those of the vesicular glands. Ventral prostates connect to the urethra through a series of ducts (1 to 3) located lateral and anterior to the stalk of the bladder. Each gland, appressed close to the urinary bladder, is a compact mass of filamentous tissue which shows secondary branching of tubules. Anterior prostates extend along approximately one-half the lesser curvature of the vesicular glands and adhere tightly to them. Anterior prostates are composed of comparatively elongate tubules which branch at the base of the gland near the ducts; the ducts drain adjacent to those of the vesiculurs.

The accessory glands in S. xerampelinus differ slightly in proportions from those of S. teguina (Table 1). The preputial glands of S. xerampelinus are relatively larger, and there is less demarcation between gland body and duct (the body of the gland tapers gradually into the short duct); anterior prostates are smaller; the vesiculurs are slightly longer; ampullary glands lack the single unbranched tubules opening into the base of the deferent ducts. In those ampullaries, however, there are clusters of branched tubules situated between the anterior prostates, much as seen in teguina.

To judge from our specimens, Scotinomys and Baiomys are similar in accessory glands, with minor differences in structure and proportions as follows: vesiculurs in Baiomys smaller in total volume, simpler in form—without less constrictions and curvature, almost straight in some individuals; anterior prostates more filiform and not as tightly clustered as in Scotinomys; ampullary glands in both Baiomys taylors (Arata, 1964) and B. musculus (our specimens) consisting of mainly single, short tubules opening into the base of the deferent ducts. These ampullary tubules (some tightly coiled) in Baiomys are most numerous on the anterior side of the deferent ducts adjacent to the anterior prostates, but this concentration of tubules is not as large as in Scotinomys.

Discussion.—Of the 12 genera of neotomine-peromyscines (Hooper and Musser, 1964) Scotinomys has the highest diploid number of chromosomes \( 2N = 58 \) reported to date. Species of 9 of the 12 genera have been karyotyped; diploid counts range from 36 in Tylomys nudicaudus to 58 in both species of Scotinomys. Other species with high numbers include several kinds of Neotoma (52 to 56; Baker and Mascarelo, 1969) and Ochrotomys nutalli (52; Patton and Hsu, 1967). Diploid number is 48 in Peromyscus (20 species; Hsu and Arrighi, 1968), Neotomodon (Uribe et al., 1973), and Onychomys and Baiomys (Hsu and Benirschke, 1967). The 2N ranges from 38 to 50 in Reithrodontomys (Hsu and Benirschke, 1968; Shellhammer, 1967) and from 36 to 52 in Tylomys (Pathak et al., 1973).
Thus, among these rodents there is considerable inter- and intrageneric variation such that supposedly closely related species may have identical or widely different chromosome numbers. We have no clear guidelines for interpreting this variation in terms of kinships of the species.

In structure of male accessory reproductive glands Scotinomys fits with other genera having a simple glans penis (Hooper and Musser, 1964), and within that group it closely resembles Baiomys. The amount of difference between those two genera is less than that reported between some subgenera of Peromyscus (Linzey and Layne, 1969). Among the similarities of Scotinomys and Baiomys are the large preputial glands and poorly-developed ampullary glands, with unbranched single tubules (seen in S. teguina, Baiomys taylori, and B. musculus, but not S. xerampelinus). The principal difference observed is the relatively larger size of the vesicular glands in Scotinomys. In this respect, Scotinomys more closely resembles species of Reithrodontomys, or of the subgenus Peromyscus, than those of Baiomys.

Current information on accessory glands does not entirely support Arata’s characterization of Baiomys in relation to other peromyscines. Arata (1964) assembled Baiomys with Ochrotomys and Onychomys in a group characterized by absence or reduction of some accessory glands, but the retention of preputials. He contrasted that group with a second assemblage, comprised of Peromyscus and Reithrodontomys, which have no preputials, but otherwise possess a full complement of glands. Linzey and Layne (1969) have since shown that some species of Peromyscus, particularly those in the subgenus Haplomyomys, do have preputials, which are minute compared to those of Scotinomys and Baiomys. Further, the small size of the ampullaries observed in Baiomys and Scotinomys do not contrast as sharply with Peromyscus or Reithrodontomys as they do with Onychomys and Ochrotomys which have no ampullaries. Moreover, there are large vesiculars in Baiomys and Scotinomys, in contrast to none in Onychomys and minute ones in Ochrotomys. Thus, on the basis of male accessory reproductive glands, Baiomys and Scotinomys form a unit nearer Peromyscus (Haplomyomys) than Ochrotomys and Onychomys. That unit also contrasts with the South American cricetine species examined to date in having slight (rather than well-developed) ampullaries and a single pair (rather than two pairs) of preputials.

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Literature Cited


MOLT IN THE NORTH AMERICAN BADGER, TAXIDEA TAXUS

In the summer of 1963, I examined approximately 1000 badger (Taxidea taxus) skins in the U.S. National Museum. Additional skins were examined in other collections; their location and use are acknowledged elsewhere (Long, J. Mamm., 53:725-759, 1972). Some juvenal pelages and numerous adult ones provided information on molting in Taxidea.

Badgers change from juvenal to adult pelages in their first spring and summer, and molt annually thereafter. The annual molt usually occurs in summer or autumn (at least in the large northern badgers, Taxidea taxus taxus, T. t. jacksoni, and T. t. jeffersonii) so that the badger spends the winter with prime fur. By the following spring the pelage is usually worn and bleached. The northern badger may bring forth young, on the average, somewhat later in its northern latitudes. It also may pass through its pelage change later, on the average, in northern latitudes.

Series of juveniles of jeffersonii from Idaho (mostly from the vicinity of Georgetown) and from Jungo, Nevada, provide data on juvenal pelage. The youngest specimens examined (USNM 22,017-22,019) taken 25 May 1916 are from 20 miles northeast of Georgetown. They are creamy yellow dorsally. There is a small, pale yellowish stripe extending along the midventral area. The feet are dark brownish. The tail, extremely short, is concolor with the dorsum. There is dark brown on the dorsal parts of the pinnae of the ears, and the dark brownish patches ("badges") are immediately anterior to the pinnae, which are whitish adjacent to the brownish areas. Posteriorly from the nose in each specimen a narrow whitish stripe extends onto the crown and neck. Dark brownish