

# STUDIES ON THE CAVERNICOLE FAUNA OF MEXICO AND ADJACENT REGIONS

Edited by Robert W. Mitchell and James R. Reddell

Association for Mexican Cave Studies, Bulletin 5, 1973

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A NEW CAVE-ADAPTED PLANARIAN (TRICLADIDA, PALUDICOLA, PLANARIIDAE)  
FROM CHIAPAS, MEXICO<sup>1</sup>

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The purpose of this paper is to present the description of a new species of cavernicole planarian of the genus *Dugesia* occurring in caves of Chiapas, México.

ORDER TRICLADIDA

SUBORDER PALUDICOLA (=PROBURSALIA)

FAMILY PLANARIIDAE

Genus *Dugesia* Girard, 1850

*Dugesia mckenziei*, new species

**Description**—A small, rather slender, white, very small-eyed troglobite (appearance in life shown in Figs. 1, 2, and preserved in Figs. 3, 4). In life fully sexually mature specimens measure about 8 mm to 10 mm in length and 1 mm in width. The head is triangular with moderately developed and rather pointed auricles. The anterior end of the head is bluntly pointed (Fig. 2). Behind the head the body begins to widen slightly, reaching its greatest width at about mid-body, finally tapering to a bluntly pointed pos-

terior end. The rather long pharynx is situated somewhat behind the middle of the body, the mouth at about the middle of the postpharyngeal region. The genital pore opens midway between the mouth and the posterior end. In living animals the copulatory apparatus and a pair of spermiducal vesicles are visible from the ventral side as opaque areas.

A pair of very small eyes is situated at the anterior level of the auricles; they are scarcely noticeable in living specimens. Distance between the eyes is slightly more than one-third the width of the head at the level of the eyes.

Although in gross aspect presenting a milky-white appearance, microscopic examination reveals that the species is a low pigmented form with pale yellowish-brown pigments (as seen in material preserved in isopropyl alcohol). Drop-shaped areas on the basal parts of the auricles are free of pigment as is the submarginal adhesive zone (Fig. 4).

The structure of the pharynx is typical of the family Planariidae, the muscle fibers of the internal zone forming two separate layers, an inner, thick, circular layer and an outer, thin, longitudinal one. The dorsal epidermis is thicker than the ventral. The anterior trunk of the intestine bears 13 to 15 lateral branches; each posterior trunk, 12 to 15 or more short

<sup>1</sup>Supported in part with funds provided by the Graduate School and the Office of Research and Special Programs, Texas Tech University.

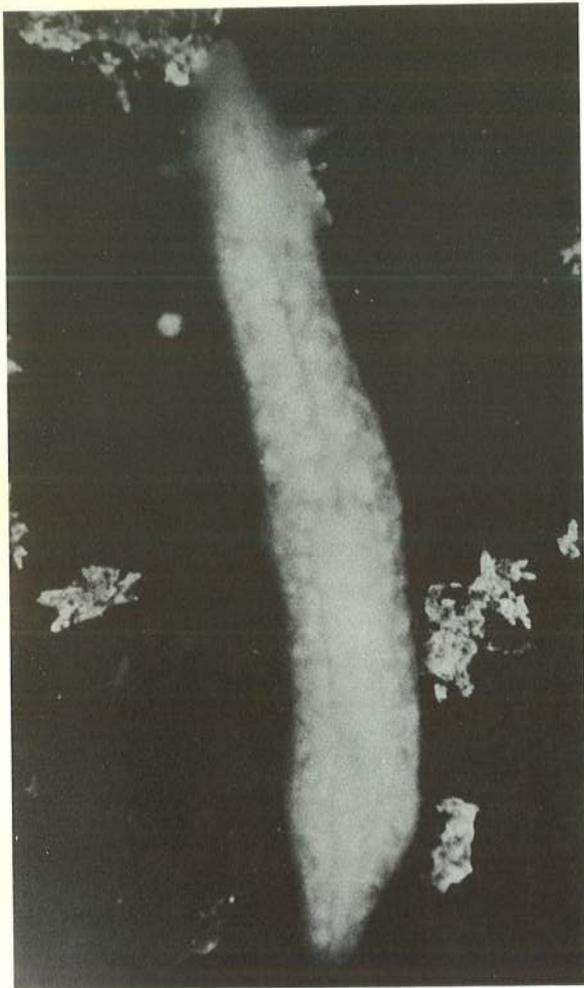


Fig. 1. *Dugesia mckenziei*, holotype in life, dorsal. Note size and arrangement of testes.



Fig. 2. *Dugesia mckenziei*, holotype in life, ventral. Note size and shape of auricles and shape of head.

lateral branches.

The minute eyes (Fig. 5) are embedded in the parenchyma slightly beneath the dorsal subepidermal muscles. The pigment cell layer is conspicuous but very small in size, and the photoreceptor cells are but slightly developed (Fig. 6). In one specimen measured (La Cueva de Los Llanos, Specimen Lot No. 1151a) the pigment cup was about  $30\ \mu$  in diameter and about  $12\ \mu$  in depth (depth of the body at the level of the eyes about  $290\ \mu$ ).

The ovaries are located, as is typical, at a level behind the second or third diverticulum of the anterior trunk of the intestine. The ovaries are large, their diameter being about one-half the depth of the body at their level. Numerous yolk glands located between the intestinal diverticulae occur throughout the body.

The testes occur in a band running the length of the body (Fig. 3) and are situated in the dorsal

parenchyma (Fig. 7). No testes were found in the parenchyma between the two posterior intestinal trunks. There are apparently somewhat less than 40 testes on each side of the body.

The copulatory apparatus of *D. mckenziei* is shown by photomicrographs in Figs. 8, 9, and in semi-diagrammatic sagittal view in Fig. 10.

The genital pore leads posterodorsally into the terminal part of the bursal canal and anterodorsally into the male antrum. A common genital pore is lacking. The outer wall of most of the male antrum is clothed with a flattened, glandular, nucleate epithelium below which occurs two muscle layers, an outer one of circular fibers and an inner one of longitudinal fibers. The epithelial cells of the basal and posterior parts of the male antrum are taller and more glandular than elsewhere.

The penis consists of a bulb embedded in the parenchyma and a papilla projecting into the male

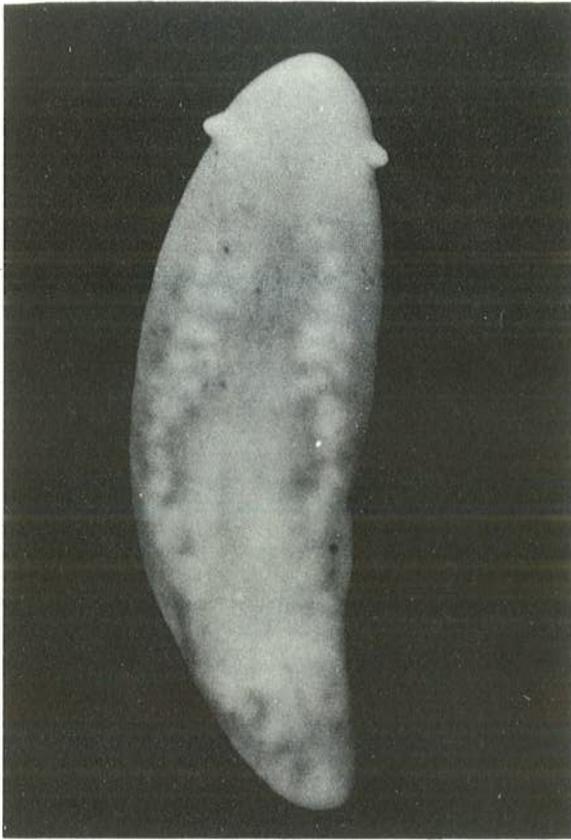


Fig. 3. *Dugesia mckenziei*, holotype, fixed in Bouin's fluid, dorsal. Note size and arrangement of testes.

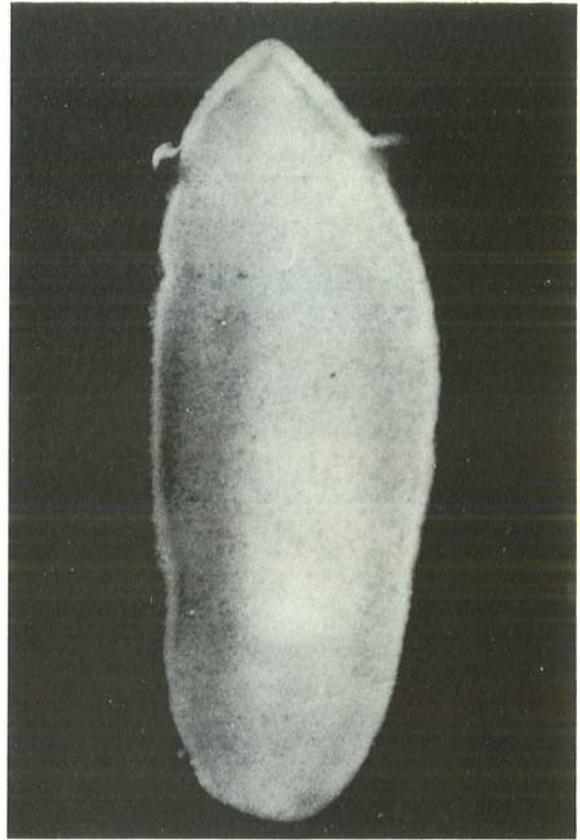


Fig. 4. *Dugesia mckenziei*, paratype, fixed in isopropyl alcohol, ventral. Note marginal adhesive zone.

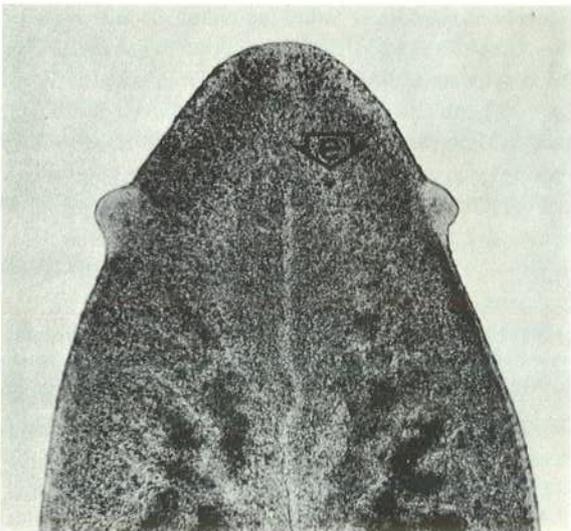


Fig. 5. Head of stained whole mount. Note minute eyes.



Fig. 6. Sagittal section showing eye.

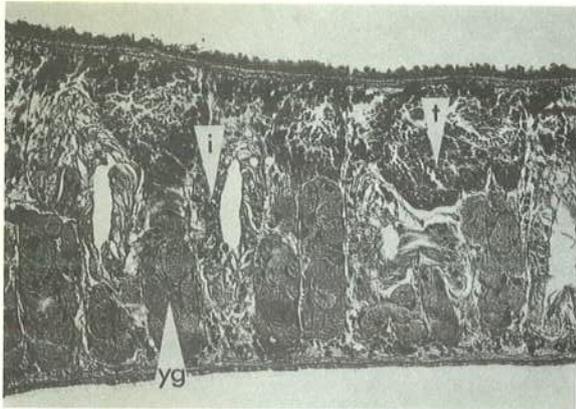


Fig. 7. Sagittal section showing dorsal position of testes.

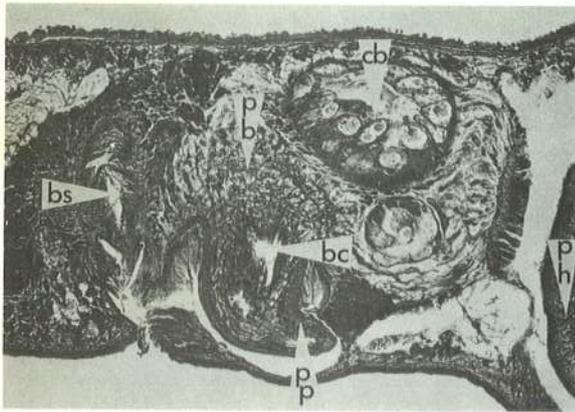


Fig. 8. Sagittal section showing parts of the copulatory apparatus.

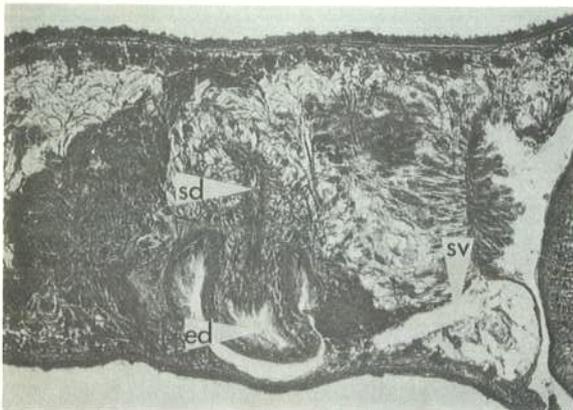


Fig. 9. Sagittal section showing parts of the copulatory apparatus.

antrum. The bulb is hemispherical in shape and is moderately muscular. It contains a moderately wide bulbar cavity or seminal vesicle. The bulbar cavity continues into the papilla as a wide ejaculatory duct and opens at the tip of the papilla. The penis lumen (bulbar cavity + ejaculatory duct) is lined with a tall, glandular epithelium tapering in thickness anteriorly. The sperm ducts form highly developed spermiducal vesicles on each side of the postpharyngeal region between the mouth and the anterior level of the penis bulb. Along the sides of the penis each vesicle narrows to a slender duct that proceeds posteriorly to the level of the genital pore, then ascends vertically, curves anteroventrally, and finally opens separately into the posterior part of the bulbar cavity. The penis bulb is pierced by a considerable number of ducts of the penis glands.

The penis papilla is symmetrical and is of a long, rather pointed, conical shape. It is moderately muscular. The outer wall is covered by an epithelium similar to that lining the male antrum. The nucleate epithelium is taller at the basal part of the papilla than in the distal portion. Below the epithelium there is a layer of circular muscle fibers followed by a layer of longitudinal ones.

The copulatory bursa, situated in the usual position, is a medium-sized sac with a wide lumen. It is lined with a tall, glandular epithelium. The bursal stalk runs posteriorly over the posterodorsal portion of the penis, and at a point just posterior to the level of the genital pore it curves ventrally and opens at the pore. The bursal stalk is lined with a tall, glandular, nucleate epithelium and is covered by a muscular coat of inner circular and outer longitudinal fibers. The two ovovitelline ducts converge at the level of the copulatory apparatus and open separately into the bursal canal at a point about mid-way between the bursa and the genital pore. At this point the bursal stalk is somewhat wider and the muscular coat thicker than in the more anterior part of the stalk. Many eosinophilous cement glands open into the terminal part of the genital antrum near the genital pore.

The egg capsule, or cocoon, of *D. mckenziei* is not known.

**Remarks**—Seven species of freshwater triclad are now known with certainty to occur in México. These are *Dimarcus villalobosi* Mitchell and Kawakatsu, 1972; *Dugesia dorotocephala* (Woodworth, 1897); *Dugesia typhlomexicana* Mitchell and Kawakatsu, 1973; *Dugesia barbarae* Mitchell and Kawakatsu, 1973; *Dugesia guatemalensis* Mitchell and Kawakatsu, 1973; *Dugesia mckenziei* Mitchell and Kawakatsu, n.sp.; and *Cura azteca* Benazzi and Giannini, 1971.

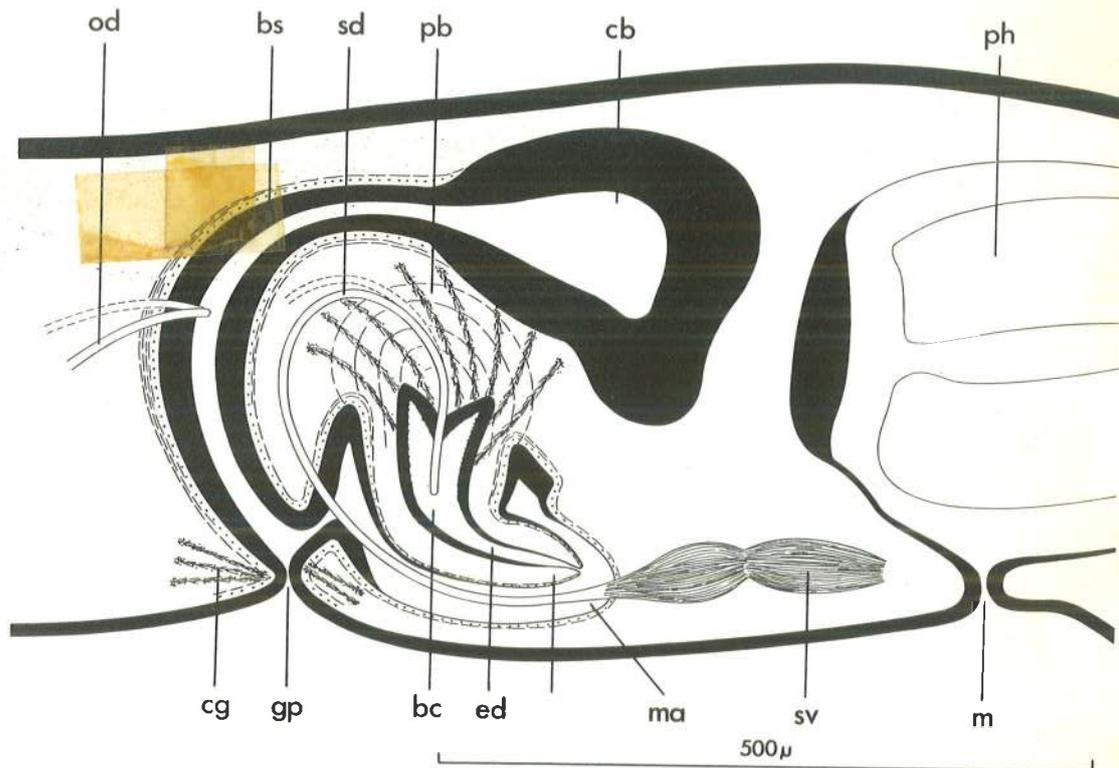


Fig. 10. Semi-diagrammatic sagittal view of copulatory apparatus.

*Dimarcus villalobosi* is a marine relict of unique morphology occurring in Las Grutas de Coconá, Teapa, Tabasco (cf. Mitchell and Kawakatsu, 1972). Of the remaining six species, *Dugesia dorocephala* and *Cura azteca* are eyed, pigmented, epigean forms; while *Dugesia typhlomexicana*, *D. barbarae*, *D. guatemalensis*, and *D. mckenziei* are cavernicoles. *D. guatemalensis* is a small-eyed troglophile occurring in La Cueva de las Perlas in the Sierra de Guatemala of Tamaulipas. *D. typhlomexicana* and *D. barbarae* are eyeless troglobites occurring in La Cueva de la Mina and La Cueva de Capilla, respectively, caves also located in the Sierra de Guatemala. A detailed discussion of the affinities of the three latter *Dugesia* species may be found in Mitchell and Kawakatsu, 1973.

*Dugesia mckenziei* is easily separable from the dark, eyed epigean species. Its minute eyes separate it from *D. typhlomexicana* and *D. barbarae*. It bears the closest resemblance to *D. guatemalensis*, but the course of its sperm ducts and the wide ejaculatory duct separate it from the latter species.

We regard *Dugesia mckenziei* a troglobite. Even though it possesses eyes, they are minute, and the body is scarcely pigmented, appearing white in life. It is surely confined to a subterranean habitat. There seems, however, no doubt that it is a young troglo-

bite. Further discussion of this species will await future publications of ours on the freshwater triclad fauna of México.

**Differential Diagnosis**—*Dugesia mckenziei* differs from the other members of the genus by the following combination of characteristics: Troglotic species with slight, microscopic pigment and two minute eyes. Small, 8 to 10 mm in length in life. Auricles of moderate length. Testes moderate in number and dorsal. Penis bulb well-developed, moderately muscular, and with a single bulbar cavity. Sperm ducts opening separately into a bulbar cavity at the basal part of the penis lumen. Penis papilla symmetrical, conical, long, rather pointed, and with a wide ejaculatory duct. No common genital antrum. Copulatory bursa medium-sized. Two ovovitelline ducts entering the bursal stalk separately.

**Collection Data**—*Specimen Lot No. 1150*. Two sexually mature specimens from La Cueva de Los Llanos, 15 km ESE San Cristobal de las Casas, Chiapas, México. Taken from slow-moving stream. Altitude about 2,295 m. 5 February 1972. Coll. David McKenzie. *Specimen Lot No. 1151*. Two specimens from La Cueva de Los Llanos. One sexually mature, the other a prepharyngeal piece. 27 August 1972. Water temperature, 16.5°C (61.5°F). Coll. Robert W.

Mitchell, William H. Russell, Jerry W. Cooke. *Specimen Lot No. 1152*. One specimen from La Cueva de los Murciélagos, 15 km ESE San Cristobal de las Casas. This cave is within 100 m of La Cueva de Los Llanos and it is probable that the waters of the two caves are connected. 29 August 1972. Water temperature 24°C (75°F). (Differences between the water temperatures of these two caves possibly resulted from taking the measurements near the entrances during times of differing epigeal temperatures.) Coll. Robert W. Mitchell.

**Type Series**—Holotype, a set of serial sagittal sections (No. 1151a, 3 slides) deposited in the Division of Worms, U.S. National Museum. Two paratypes also deposited in the U.S.N.M., one a set of sagittal sections (No. 1152a, 3 slides), the other a whole mount of a prepharyngeal piece with a pharynx (No. 1151b). The other paratypes are sets of sagittal sections (Nos. 1150a and b) and are retained in Kawakatsu's laboratory in Sapporo and in The Museum, Texas Tech University.

**Type Locality**—La Cueva de Los Llanos, 15 km ESE San Cristobal de las Casas, Chiapas, México.

**Distribution**—Known only from the type locality and a nearby cave, La Cueva de los Murciélagos.

**Etymology**—Named for the discoverer of the first specimens, Mr. David McKenzie, ardent student of physical and biological speleology.

**Methods**—Animals of Specimen Lot Nos. 1151 and 1152 were killed and fixed in Bouin's fluid at ambient temperature. Animals of Specimen Lot No. 1150 were killed and fixed in 70% isopropyl alcohol. All animals were subsequently stored in 70% ethyl alcohol. Serial sagittal sections were cut at 8 microns. Staining employed Delafield's hemotoxylin and eosin.

Sectioning and staining were done in the laboratory of the junior author. Kawakatsu and Miyazaki (1972) have demonstrated that Bouin's fluid is a superior killing and fixing agent for triclad Turbellaria, especially for comparative taxonomic studies. Therefore, the animals killed and fixed in isopropyl alcohol were not used in construction of Fig. 10, the semi-diagrammatic sagittal view of the copulatory apparatus.

**Abbreviations Used in Figures**—bc, bulbar cavity; bs, bursal stalk; cb, copulatory bursa; cg, cement gland; e, eye; ed, ejaculatory duct; gp, genital pore; i, intestine; m, mouth; ma, male antrum; od, oovitellic duct; pb, penis bulb; pc, pigment cell layer; ph, pharynx; pp, penis papilla; sd, sperm duct; sv, spermiducal vesicle; t, testis; vc, photoreceptor (visual) cells; yg, yolk glands.

**Acknowledgments**—We wish to thank Mr. David McKenzie for giving to us the first specimens of the planarian described in this paper and for providing the senior author with directions for locating La Cueva de Los Llanos. We also appreciate the assistance of Mr. William H. Russell and Mr. Jerry W. Cooke in the collection of additional specimens.

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