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# The Slugs (Gastropoda:Pulmonata) of Oklahoma and Kansas With New Records

BRANLEY A. BRANSON

Less is known concerning the ecology and taxonomy of the pulmonates called "slugs" in Kansas, Oklahoma and the western Ozarks in general, than of any of the other terrestrial mollusks of this region. Leonard (1959) recorded only three species from Kansas and Branson (1959a) ten from Oklahoma. However, there are several other forms heretofore unrecorded from either state. Furthermore, recent research has necessitated changes which need to be incorporated into the existing body of information.

Four families of slugs have representatives in this area, only the first two of which are native: Philomycidae, Limacidae, Arionidae and Veronicellidae. All of the Philomycids and one limacid, *Deroceras laeve*, naturally occur here; the others are exotic. The Limacidae are primarily European, Eurasian and North African in distribution; arionids are Holarctic, i. e., western North America, Asia, Europe and Africa; and the Veronicellidae are tropical (Burch, 1961). Including one species reported below, there are 13 exotic slugs known from the United States; five of them have been found in Kansas and Oklahoma.

## Annotated List of the Slugs Known from Kansas and Oklahoma

### FAMILY LIMACIDAE

Limacid slugs are easily recognized by the oval mantle which covers only the anterior part of the back and which bears a pneumostome (breathing pore) situated behind a short groove, extending to the right margin, in its posterior half. The foot is definitely tripartite, i. e., a lateral strip along each side of the central one. Five species have been recorded from this region.

#### *Limax flavus* Linnaeus

This is an easily recognized species which attains lengths, in life, of 100 mm or more. The posteriorly attenuated foot consists of a narrowly-elongated and undivided central portion bounded on either side by strips bearing many transverse grooves. The eye stalks are bluish-black and in-versible. The oval mantle, covering a much reduced shell, is blackish or dark gray marked by yellowish-white reticulations. The pneumostome and its groove are surrounded by a light halo. The back, middorsally keeled

near its posterior end, is quite granular, the granules being yellowish and the interspaces between them black or dark gray. The slime is golden or yellow and very adhesive. An exotic from Europe.

*Limax flavus* is a very common species throughout Kansas and Oklahoma, especially in urban areas. In the western counties it is often found in greenhouses and around the bases of houses where moisture is abundant. It sometimes becomes a pest in gardens but prefers molds and fungi to green leafy plants. Although Leonard (1959) did not report this species from Kansas the specimen he illustrated is *L. flavus*.

*Limax maximus* Linnaeus

This species is similar to *L. flavus* but attains a somewhat larger size, up to 120 mm or more when fully extended. The lateral margins of the foot are narrower and the transverse grooves are indistinct to nearly lacking. The mantle is light yellowish or white profusely marked by black spots and blotches. The back is much less granular than that of the last species and characteristically has black streaks which sometimes fuse into three or four longitudinal black stripes on a light background. The slime is clear. Another exotic from Europe.

*L. maximus* is always associated with man's activities in this country (Pilsbry, 1948), especially with greenhouses and truck gardens. I have not seen this species in Oklahoma and only from northeastern Kansas. The common large *Limax* in Kansas is *L. flavus*.

*Limax valentianus* Férussac

This slug attains sizes from 50 to 75 mm when extended. The foot is very similar to that of *L. flavus* but the mantle and back are tan or light brown, becoming lighter on the sides, with a darker, dorsolateral band on each side; that of the mantle is not continuous with the one on the body. The slime is clear and only moderately adhesive. Another exotic.

*L. valentianus* sometimes becomes a serious greenhouse pest. I have, however, collected it in the wild. Messrs. Benjamin Cooksey and James Campbell found 14 specimens in water meters on 11 April 1962 in Pittsburg, Kansas. Leonard (1959) did not record this species from Kansas, but it is common in greenhouses and is widespread in similar situations in Oklahoma.

This is the species which has been for years called *L. marginatus* Müller. However, Waldén (1960) has pointed out the differences, primarily concerned with the soft anatomy and radular morphology, between these two species. It is probable that all records made in the United

States for *L. marginatus* are based upon *L. valentianus*. All of those from Oklahoma and Kansas definitely are. One specimen was deposited with Waldén, who is also of this opinion (personal communication 3:III: 1962).

The genus *Deroceras* is easily distinguished from *Limax* by having only four gut loops as compared to six in the latter. The size is small; only 35.0 to 50.0 mm when fully extended.

*Deroceras laeve* (Müller)

The foot is very narrow and usually nearly white. The head and tentacles are bluish-black to black. The mantle is uniformly amber to nearly black, without spots or blotches; it is very faintly concentrically striate. The rest of the back, which is acutely keeled only at the very posterior end, is about the same color and bears numerous furrows and elongate granules. The hindgut lacks a diverticulum and the slime is clear and nonadhesive. This is the only limacid native to the United States and has been common since Pleistocene times.

*Deroceras reticulatum* (Müller)

This species, another exotic from Europe, is often confused with the one last discussed. The foot is also narrow but is yellowish or dirty white. The head and tentacles are blackish-gray. The mantle and back are usually whitish-amber or flesh colored, sometimes black, and are often marked with flecks or dashes of dark. The mantle is rather strongly concentrically striated. The hindgut bears a well-developed diverticulum and the slime is milky, when the animal is disturbed, or clear but always adhesive. It has not heretofore been recorded from Kansas but is common in greenhouses and on well-watered lawns, hiding by day near the sides of sidewalks, etc.

FAMILY ARIONIDAE—Genus *Arion*

In this region the members of this family never have keeled backs. The pneumostome is in the anterior half of the mantle and lies directly in the groove connecting it to the mantle margin. The foot is not tripartite and the jaw is strongly ribbed.

*Arion circumscriptus* Johnston

In life this slug can extend to about 35 mm. The foot is nearly truncate behind, pellucid white laterally and grayish centrally; it is not tripartite. The tentacles and head are nearly black. The elongate-oval mantle is slightly granular and faintly rusty-gray in color; it has a black stripe on each lateral field, but these are not continuous with the ones on the back. The pneumostome is a short opening in the anterior one-third

of the right side lying directly in the short groove. The rest of the back is granular, grayish, with a faint sprinkling of red, and has a pair of longitudinal stripes. Another exotic from Europe.

This species has not been reported from Kansas but Branson (1959a) found it in a greenhouse in Kay County and Dundee and Dundee (1958) in Choctaw County, Oklahoma. Since it is nocturnal and secretive (Barnes and Weil, 1945) it should be carefully sought in such places in Kansas. It sometimes becomes a destructive pest.

#### FAMILY PHILOMYCIDAE

This family, our largest assemblage of native slugs, is easily recognized by the large, strongly convexly curved mantle which covers the entire back and which lacks an internal shell. The foot is undivided and the pneumostome is located in the right, anterior one-third of the mantle.

Although Webb (1953, 1951, 1950) insists that Refinesque's genus *Eumelus* is distinct, it is considered to be a synonym of *Philomycus* (Hubricht, 1952; Pilsbry, 1948). *Eumelus wetherbyi* (W. G. Binney) is a *Pallifera*. As now understood, then, there are two genera of philomycids in the United States, *Philomycus* and *Pallifera*. There is a great deal of confusion, however, concerning the species of slugs found in the western Ozarks, especially since there is considerable external similarity between the two genera.

In *Philomycus* the mantle completely covers the head, when it is retracted, and a row of roundish black spots, on each side, usually delimits a central, lighter gray area. The sides of the foot are clear yellowish or white. There is a unique, curved calcareous stimulating organ or "dart" (Pilsbry, 1948) on the vagina. At least five species have been confused with *Philomycus*.

*Pallifera*, on the other hand, although superficially like the last-named genus, has a mantle which does not completely cover the head, even in strongly alcoholized specimens, so that both pairs of tentacles are exposed and sometimes the head as well. The sides of the foot are brownish to gray and the calcareous stimulating organ is lacking.

#### *Philomycus carolinianus* (Bosc)

This is a large species which can extend to 100 mm or more. The foot, including its edges, is milky white. The mantle is laterally much reticulated, the reticulations becoming more concentrated on the upper sides. Above this the mantle is nearly slate gray with white reticulations. A row of dorsolateral black spots is longitudinally arranged on each side. The head and tentacles can be completely withdrawn under the mantle.

This is the only philomycid reported from Kansas by Leonard, where it is nearly restricted, as in Oklahoma, to the eastern counties. The form illustrated by Branson (1959b) as *P. carolinianus* is *Pallifera ragsdalei*. *P. carolinianus* seems to prefer lowland areas near streams.

*Pallifera ragsdalei* Webb

This is another large slug which attains lengths of over 100 mm when fully extended. The face and upper head are white and the tentacles smokey blue to black. The foot, except for the sides which are reddish brown for their entire lengths, is dead white. The lower sides of the mantle are grayish brown with faint reticulations of the same but somewhat darker color. A dorsolateral, rather indistinct, bilateral dark gray-brown band extends nearly the whole length of the mantle. These bands are connected across the back by indistinct (distinct in immature specimens) chevron-like marks of the same color. The interspaces between the chevrons are profusely marked by lighter vermiform blotches. The ground color is light tan to chamois. This species lives in fissures of rocky bluffs and under fallen trees, etc., in the uplands.

Leonard (1959) did not report this form from Kansas, nor Branson (1959a) from Oklahoma. However, the species occurs in all the eastern counties of both states. I found it common near Galena, Cherokee County in Kansas. The slug is widespread from North Carolina and Maryland to Illinois, Kansas and Oklahoma. It also probably occurs in northeastern Texas. *P. mutabilis* Hubricht is a synonym of this species.

This is the form which Pilsbry (1948) referred to as *Philomycus caolinianus flexuolaris* Rafinesque. However, Hubricht (1951a) has shown *P. flexuolaris* to be a distinct species, at least in the eastern United States. All of the material from the western Ozarks referred to as this form are probably *Pallifera ragsdalei*. Webb (1950) described this form as a subspecies of *P. wetherbyi*.

*Pallifera marmorea* Pilsbry

This is a fairly small slug, 18.0 to 25.0 mm when extended, which has the mantle much marbled by grayish-brown that becomes more diffuse along the sides; there is no tendency toward band formation. The face and upper head are white and the tentacles bluish black. The edges and anterior one-fifth of the rather smooth foot are rusty brown. The anteroventral edges of the body are also rusty colored, giving the foot, on cursory observation, the appearance of having a double line. This species is often associated with *P. ragsdalei*.

Pilsbry (1948) described this form as a subspecies of *P. hemphilli* (Binney) but there seems to be no intergradation of characters. Con-

sequently, it is herein elevated to species rank. Branson (1959a) found the form rather common in Muskogee County, Oklahoma and several specimens have been collected since then from Ottawa and Cherokee counties, Oklahoma. Two specimens are here reported from Galena, Cherokee County, Kansas.

*Pallifera wetherbyi* Binney

[*P. wetherbyi* is very similar to *P. ragsdalei* in external anatomy and color pattern. It attains extended lengths of well over 100 mm. The face and upper head are white and the tentacles nearly black. The foot is pale white (watery) with rusty edges. The mantle bears seven to ten wide, chevron-like, brownish-gray marks which are obscured middorsally by a light region; there are no lateral longitudinal bands. This species occupies habitats in sandstone and limestone rocks, often near streams. It has not been collected in Kansas and Oklahoma but probably occurs here.]

*Pallifera fosteri* Baker

This is another small species (17.0 to 22.0 mm) which differs markedly from the other slugs discussed above. The head and face are yellowish white and the tentacles bluish-gray. The foot is broad and transversely wrinkled; it is yellowish-white except for the anterior margin which is rusty brown. The mantle, falling well short of the retracted head and tentacles, is very light tan and profusely reticulated with dark brown or grayish-brown. The reticulations are denser mid-dorsally and a lateral row of transverse dashes is formed on each dorso-lateral margin.

This species is a flood plains form, being especially characteristic of the Austroriparian region. Its distribution is spotted: four counties in Illinois, one in Missouri (Pilsbry, 1948), one in Michigan (Grimm, 1961), and one in Oklahoma (Wallen and Dunlap, 1954). I have also found the species abundant near Evans, Louisiana. It has not been found in Kansas but may occur in the southeastern part of the state.

FAMILY VERONICELLIDAE

Veronicellids are peculiar slug-like pulmonate gastropods which have contractile annulated tentacles rather than the inversible ones seen in the other mollusks discussed. The body is somewhat flattened above and mantle cavity and shell are completely lacking. The excretory, breathing and elimination openings are located behind the foot which partially or completely covers them when retracted. The female genital opening is located on the side, usually about midway between the ends of the hypotum (the angularly curved lateral borders of the body). The foot is narrow and transversely rugose. The head and tentacles are completely

covered by the notum the upper covering). Two exotic genera, with one species each, are known from this region. Although neither of these has been reported from Kansas, they should be sought since veronicellids are often transported in imported flowers and other greenhouse materials.

*Veronicella kraussi* (Férussac)

This is a species found in Cuba, Puerto Rico, Jamaica and other tropical areas (Baker, 1925). The notum is tan to cinnamon brown with a median, longitudinal light stripe. In my specimens, from a greenhouse in Oklahoma City (Branson, 1959a) the notum is much reticulated with black and some specimens have small, caudally elongated, black dashes. The anus is a crecentric slit, covered by a small flap (partially by the foot), and extends slightly to the right. As far as I know this is the only locality known for this species in the United States.

*Vaginulus occidentalis* (Guilting)

*V. occidentalis* is, like the other members of the family, a tropical species found in Guatemala, Puerto Rico, Jamaica, the Antilles and some other islands (Baker, 1925). It is a fairly large species, capable of extending to about 60.0 mm. The specimens herein reported are preserved in isopropanol and measure 27.3 to 32.0 mm. They were collected by Mr. R. C. Harrel from a greenhouse on 3 October 1961 in Guthrie, Logan County, Oklahoma. There is an obscure median light line and the general ground color of the notum is olivaceous sprinkled with small scattered melanophores. The female genital opening lies behind the middle of the right hyponotum. The anus is nearly circular and almost median; it is completely covered by the retracted foot. This is the first record for this species in the United States.

There are only two species of veronicellids which are considered to occur natively in the United States and Mexico. *Veronicella floridana* (Leidy), supposedly derived from Cuba (Pilsbry, 1948), is found in Florida and *Vaginulus moreleti* (Crosse and Fischer) is the only one found in Mexico (Baker, 1928).

**Key to the Slugs of Oklahoma and Kansas**

- 1a Mantle covering the entire back or lacking ..... 2
- b Mantle covering only the anterior part of the back ..... 8
- 2a Body nearly round in section; mantle cavity and shell sac present; tentacles inversible, not annulated; pneumostome in anterior half of mantle ..... Philomycidae ..... 3



- b Body lenticular in section, sides strongly angular; mantle cavity and shell sac lacking; tentacles retractile, annulated; pneumostome at posterior end of body... *Veronicellidae*..... 7
- 3a Mantle completely covering withdrawn head and tentacles; sides of foot white or pale, no dusky pigmentation; vagina bears a curved calcareous stimulating organ (dart).....  
..... *Philomycus carolinianus*
- b Mantle incompletely covering withdrawn head and/or tentacles; sides of foot brownish or grayish; calcareous stimulating organ lacking..... *Pallifera*..... 4
- 4a Mantle with distinct to indistinct longitudinal grayish-brown bands connected across back by diagonal, chevron-like markings; ground color light tan to chamois; large slugs.....  
..... *Pallifera ragsdalei*
- b Distinct (continuous) longitudinal dorsolateral bands lacking..... 5
- 5a Seven to ten rather broad, brownish, chevron-like marks across back and sides of mantle; no longitudinal bands; large slugs.....  
..... *Pallifera wetherbyi*
- b Chevron-like markings lacking; small forms under 50 mm in length..... 6
- 6a Mantle much reticulated with grayish-brown; edges and anterior one-fifth of foot rusty brown; small slugs 18 to 25 mm in length; head partially covered by mantle..... *Pallifera marmorea*
- b Mantle marked by two or three longitudinal rows of small, grayish, transverse dashes or dots; head and tentacles not covered by mantle; small slugs 17 to 22 mm in length.....  
..... *Pallifera fosteri*
- 7a Anus a posterior concentric slit, only partially covered, extending slightly to right of retracted foot; color brownish, marked by many black reticulations and/or elongate blotches; known only from greenhouses..... *Veronicella kraussi*
- b Anus nearly median, completely covered by retracted foot; color very light brown or olivaceous with scattered black punctae; known only from greenhouses..... *Vaginulus occidentalis*
- 8a Pneumostome, in anterior half of mantle, situated directly in groove which continues it to mantle margin.....  
..... *Arionidae*..... *Arion circumscriptus*.

- b Pneumostome, in posterior half of mantle, situated behind the groove continuing it to mantle margin .....  
..... *Limacidae* ..... 9
- 9a Intestine with four loops; mantle and back not conspicuously marked by blotches and/or bands .....  
..... *Deroceras* ..... 10
- b Intestine with six loops; mantle and back with conspicuous blotches and/or bands ..... *Limax* ..... 11
- 10a Mantle without spots or blotches, only faintly concentrically striated; back strongly granulose; foot watery white; hindgut without a diverticulum; mucus (when disturbed) watery .....  
..... *Deroceras laeve*
- b Mantle marked with inconspicuous spots or blotches, strongly concentrically striate; back less granulose; foot yellowish or dirty white; hindgut with a well-developed diverticulum; mucus (when disturbed) milky and adhesive ..... *Deroceras reticulatum*
- 11a Mantle and back color black, gray or whitish marked with black or white blotches and vermiform reticulations ..... 12
- b Mantle and back brownish or tan marked along each dor-solateral margin by a dark brown longitudinal band .....  
..... *Limax valentianus*
- 12a Mantle and back color dark with light markings; slime golden or yellowish ..... *Limax flavus*
- b Mantle and back color light with dark markings; slime clear or slightly milky ..... *Limax mavimus*

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