

NEW RECORDS FOR THE DISTRIBUTION OF CERTAIN LAND
MOLLUSCA IN NOVA SCOTIA

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ABSTRACT

The types of land mollusca of the families Arionidae and Limacidae found in Nova Scotia, particularly Halifax County, have been studied. Five species have been collected, only one of which, *Arion circumscriptus*, has, to the authors' knowledge, been recorded previously. This report contains descriptions of each species, including the external and internal anatomy, the laying periods and types of eggs, the normal environment, and any peculiarities of habit which have been noted from seeing these animals in their natural habitat and from watching them in aquaria in the laboratory.

This paper deals with the species of land Mollusca which have no external shell, and which are commonly called slugs. In these pulmonates the shell is greatly reduced, and usually covered by a flap of tissue, the mantle. Of the many genera found in North America, representatives of only two, *Arion* and *Deroceras*, have been found in Nova Scotia, five species having been collected. Only one of these, *Arion circumscriptus*, has been reported previously to the authors' knowledge. This was collected in Morden and Berwick, King's County, by H. Griffiths of the Institute of Parasitology, MacDonald College, and recorded in a paper by A. LaRocque (1936).

The authors wish to take this opportunity to thank Dr. D. Pelluet, under whose guidance the work was carried out; Dr. H. A. Pilsbry and Mr. G. K. MacMillan, who identified the specimens; Miss Barbara Schwartz who assisted in the photography; Miss Hope Bridgeford who read the manuscript; and all those who aided in collecting the animals.

INTRODUCTION

A great deal of our collecting was done in Halifax County, although we have now done sample collecting in most of

Nova Scotia. We hope that the latter, combined with a fairly complete record for Halifax County, is enough to give a correct representation of the distribution of slugs in Nova Scotia. Collecting was usually done between 10.00 a.m. and 5.00 p.m., and because slugs are least active during these times, most were found beneath boards, stones and dead leaves. The few slugs which were found in the open belong to the genus *Deroceras*. We tried collecting in a number of different types of places, and found that *Deroceras laeve* was the only slug found far away from habitation. *Arion circumscriptus*, *hortensis*, and *subfuscus* were usually found in or near old ruins, the latter particularly under piles of old wood, while *Deroceras reticulatum* and, to a lesser extent *Arion circumscriptus*, were found mostly near inhabited buildings and gardens. Of these five species *Deroceras laeve* is the only species native to North America, the other four having been introduced from Europe (Pilsbry, 1947).

Samples of each species were brought back to the laboratory and kept in covered glass tanks. They were kept out of bright sunlight, aired daily, and fed on lettuce or cabbage leaves. The eggs were collected when laid and put into small glass containers where their progress could be watched. Later it was found more convenient to keep the animals in outdoor containers. These were wooden structures 4 feet long, 3 feet wide and 1 foot deep, partly buried in earth and with screening on the top and bottom.

A map of the distribution of all species in Nova Scotia is given, in addition to maps of the occurrence of each species in Halifax County which accompany the descriptions.

DEROCERAS

This genus, of which two species were found, belongs to the family Limacidae. *Deroceras* is separated from the rest of the family by having an intestine with four folds, two backwardly directed, the second being longer (Pilsbry, 1947).

A key to the figures will be found at the end of this paper.

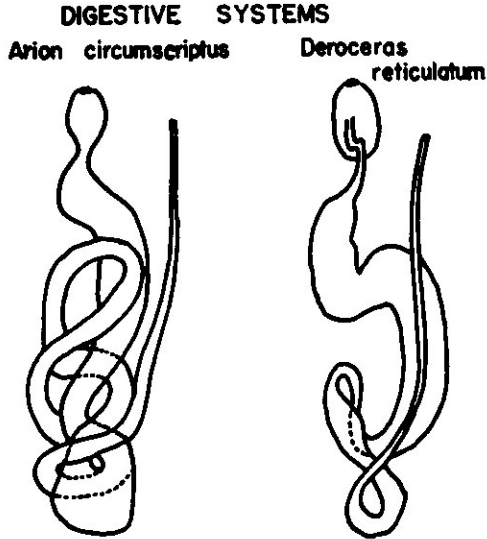


Figure 1

Deroceras reticulatum seems to be the most common slug in Nova Scotia. It has been found in almost all the places where we collected, except those away from habitation, and has been found in great numbers, crowded together, as many as a hundred specimens being found under one small board on several occasions. It is a medium sized animal, its colour varying from cream to very dark grey, and is often mottled. The tentacles are light and the foot is tripartitely coloured, the middle section being darker. It has clear slime when travelling along untouched, but if irritated in any way gives off a milky white slime. This gives it a glistening appearance, and makes it moist to the touch, whereas the Arionidae feel almost dry, although slightly sticky. Dissected specimens, when mature, show a very large ovotestis, dorsally situated and wrapped in lobes of the digestive gland. The penis is divided in three, the last division being a finger-like gland situated just beyond the entrance of the vas deferens. The seminal receptacle is long, becoming wider towards the

posterior end, and attached along a good deal of its length to the free oviduct (Pilsbry). The hermaphroditic duct is short.

**Genital System of
*Deroceras reticulatum***

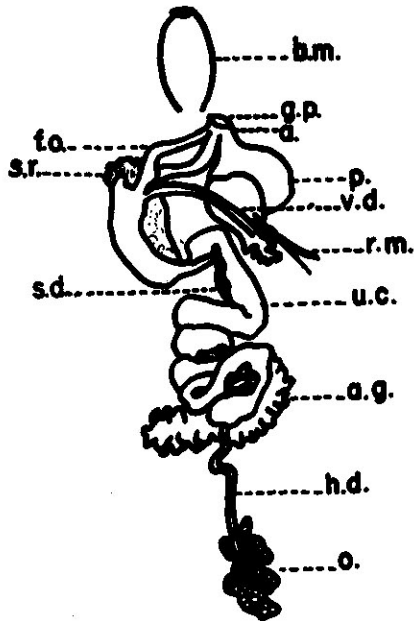


Figure 2

Deroceras reticulatum lays a great number of eggs, almost continually throughout the year. Eggs have been found outdoors from March until December. The eggs are usually laid in clusters, the number of eggs in a group varying from several to fifty or more, although the average clusters have ten to fifteen eggs. Occasionally eggs are found in ones and twos, especially near the end of a breeding season. The eggs are small and transparent, and generally round in shape, about 1.5 mm. in diameter, although large oval eggs with a

length of 2 to 2.5 mm. have been found. They are usually a little beneath the ground in our tanks, and outdoors are found under wood or stones with the slugs themselves. They hatch anywhere from about four days to three weeks into the tiny, pinkish, almost transparent young. There is no regularity in the rate of development and growth, embryos of the same age, and young of the same age often being in different stages and varying greatly in size.

This slug is the one with which almost any Nova Scotian who has had anything to do with gardens is familiar, as it is very active, and on some occasions is found travelling about or eating in daylight. It is much more of a garden slug than *Deroceras laeve* or the Arionidae; the former is more common away from habitation, the latter, at least during the daytime, never being found on plants. *D. reticulatum* was always found near some signs of habitation, generally under cover of anything from boards to old rubber tires, on the ground or in grass.

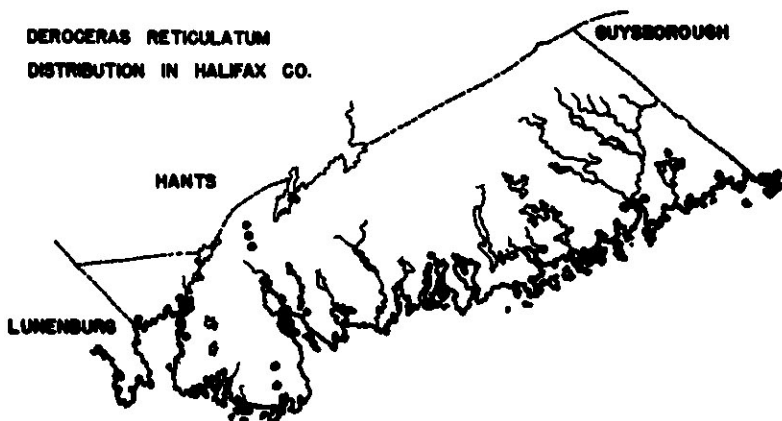


Figure 3

***Deroceras laeve*.** This is the only native species which we have obtained during our collecting trips. It has been found far away from habitation as well as in farm pastures and occasionally country gardens. *D. laeve* is a small animal, our largest specimens being approximately 2.5 cm. in length when moving. It varies in colour from creamish to almost

black, with a greyish foot. Its neck, which it retracts beneath a small oval mantle, is longer than that of other species we have collected. Like *D. reticulatum*, it is wet to the touch, being covered with a thin coat of clear slime. This species can be distinguished externally from *D. reticulatum* by the white slime which the latter excretes when irritated. On dissection (a number of specimens having been tried) only the female parts of the reproductive systems were found to be present

Genital System of
Deroceras laeve

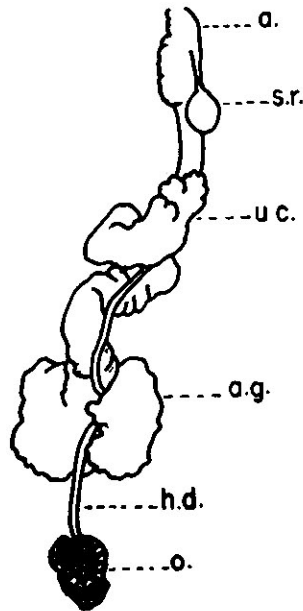


Figure 4

(late October). The ovotestes from these were taken out and smeared in acetic orcein, and sperms were found to be present in all, so that the system is not wholly female. The specimens used were ones which had just reached their full growth, and were at that time laying eggs. The ovotestis is small and hidden in the lobes of the digestive gland. The hermaphroditic duct is short, and the seminal receptacle globular. Self fertilization has been noted in this species.

Deroceras laeve has much the same laying period as *D. reticulatum*, eggs being laid spasmodically all summer. The eggs are laid in twos, threes, and small clusters, not usually more than eight or ten being found together. These, like *D. reticulatum* eggs, are small and globular, about 1.5 mm. in diameter, and cannot be distinguished from the latter. The young are greyish and quite transparent and grow very quickly.

These animals are found with their eggs in grass or moss under wood. They seem to prefer damp places, one specimen being found submerged on *Potamogeton* in the Gaspereau River. They are very active. However, they do not seem to be destructive to gardens, very few ever having been found there, and none being found in Halifax or Dartmouth, where much collecting was done.

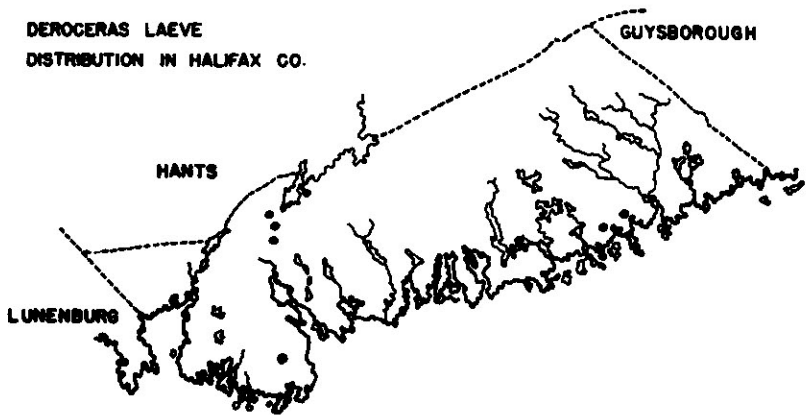


Figure 5

ARION

This genus belongs to the family Arionidae, and three species of Arion, *Arion circumscriptus*, *hortensis*, and *subfuscus*, were collected. The Arionidae are distinctive in having no penis (Pilsbry), no dorsal keel, a wide foot margin, and in being rather flatter than *Deroceras*.

Arion circumscriptus. This slug seems to be the most common species of the family Arionidae in Nova Scotia. It was found almost everywhere we collected (but not in such large numbers as *D. reticulatum*), except for those places which were far away from buildings or other marks of civilization, where only our native *D. laeve* was found. *Arion circumscriptus* is a medium sized slug, varying in length from 2 to 5 cm. when moving. Its colour varies somewhat from grey to sandy with two black longitudinal stripes, which may or may not have a slight orange colour bordering them. The

**Genital System of
*Arion circumscriptus***

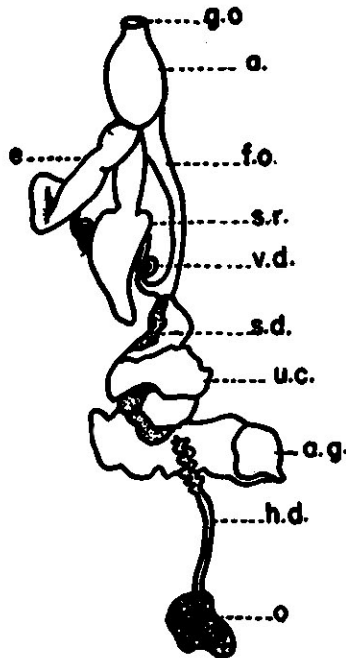


Figure 6

head and tentacles are black, and the foot very white. Their slime is clear and colourless. On two occasions light chestnut

and violet coloured specimens were found (Point Pleasant Park, Halifax, and Mt. Denson, King's Co.). In specimens which were dissected the seminal receptacle was pear shaped, the hermaphroditic duct long, the ovotestis, which is slow in developing, small, the free oviduct long and stout, and the atrium large. There was no penis, and in some specimens the passing of the vas deferens into the epiphallus was quite distinct, while in others it was hardly distinguishable.

The eggs of this animal were found in the spring and also during the early fall. They are yellow or orange in colour, their length varying from 2 to 2.5 mm. and the width from 1 to 1.5 mm. They are usually laid in two's or three's, although sometimes in clusters, with very little protection, often being on top of the ground. The young, which grow more slowly than those of *Deroceras*, are bluish in colour, gradually showing their black stripes.

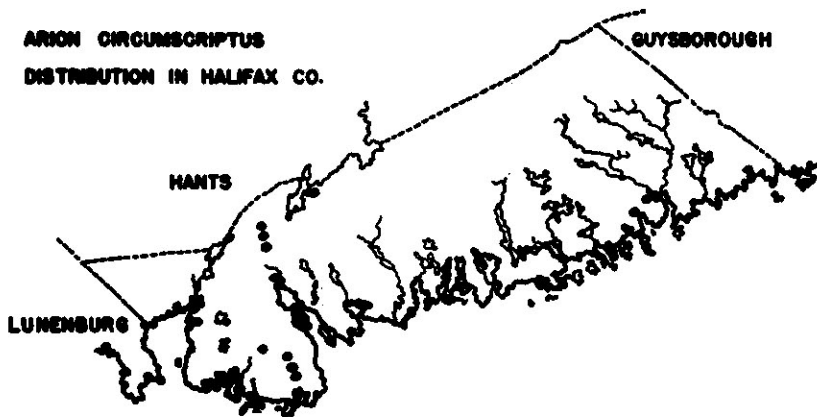


Figure 7

Most of the specimens we collected were found on the ground under boards. During the summer they were never found active in the daytime— but always in a resting position.

Arion hortensis is not a very common species in Nova Scotia, having been found on only a small percentage of our collecting trips, and never in large numbers. Its distribution to our knowledge is very limited. This is rather a small sized animal, black or very dark in colour, sometimes with darker lateral bands, and with dark head and tentacles. An out-

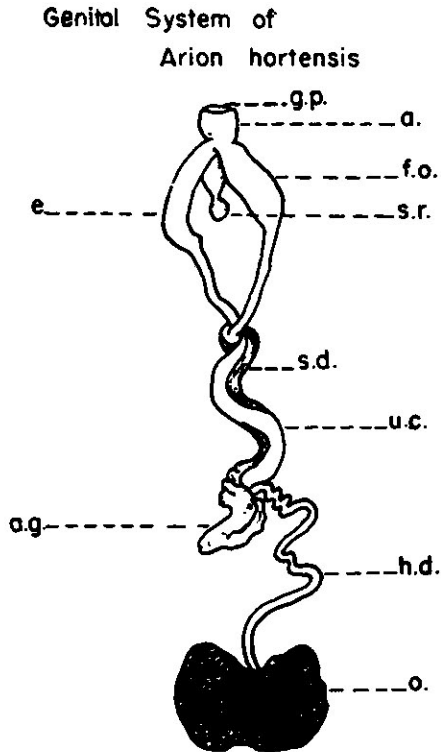


Figure 8

standing characteristic is the shade of its foot, which varies from light yellow to a deep orange. It is generally about 2 to 3 cm. in length. The slime is clear and colourless, but when much irritated the animal sometimes secretes from the foot a small amount of slime which is bright yellow. Partic-

ular characteristics of the genital system are the very long hermaphroditic duct, the long free oviduct, which is very stout at the anterior end, and the short atrium. The vas deferens passes almost unnoticeably into the epiphallus, with no penis, and the seminal receptacle is globular with a stout duct (Pilsbry).

This slug does not seem to be as prolific as our other species, very few eggs ever having been found. In spite of the fact that we had adults in tanks from May until November, only one lot of eggs has ever been laid. This was a group of ten eggs, about 1.5 mm. in diameter and whitish in colour, which were found at the end of June. All ten, after six days, hatched into bluish coloured young, and eight are still alive, having reached a length of about 8 mm. after five months of growth. In the field, although we found eggs of each of the other specimens, no *A. hortensis* eggs were ever collected.

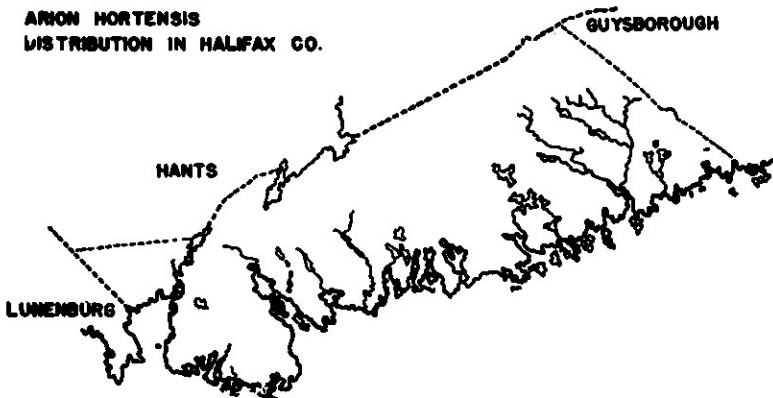


Figure 9

Arion hortensis is usually found among old and decaying leaves, although occasionally on the ground under boards. It has been found particularly around old houses, seldom choosing vegetable gardens. These slugs bury themselves a great deal of the time, and are usually found in a quiescent position (folded head to tail).

Arion subfuscus. Animals of this species are the largest which we have found. *A. subfuscus* is fairly common in distribution, although it is entirely absent in some districts. Our largest specimens are about 10 cm. in length and 1.5 cm. in width when moving. They are mostly a bright yellow or orange when collected, but many, after a few weeks in the

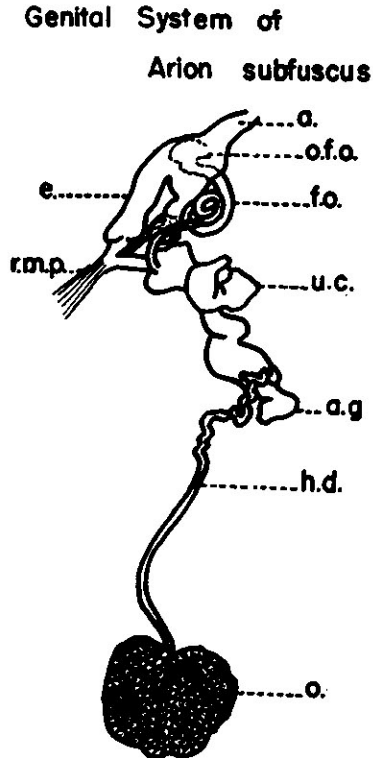


Figure 10

laboratory become greyish white, only their mantle remaining yellow. Faint grey lateral bands which are present in most, can be seen much more clearly after the bright yellow colour has disappeared. The foot is whitish with marginal fringes. The breathing pore is large. This animal secretes a thick

yellow mucus when irritated, but when untouched it leaves behind glistening tracts of clear slime. The head and tentacles are straw coloured. When dissected the ovotestis was found to be large and the hermaphroditic duct long. The seminal receptacle is globular and its duct becomes very stout before entering the atrium. The vas deferens is short and there is a very definite division where it enters the epiphallus. The muscles of the epiphallus and the seminal receptacle are noticeable. The free oviduct is long, and there is a definite globular swelling before it enters the atrium.

Eggs of *Arion subfuscus* have been collected outdoors in June, and also in the last few weeks of August. These eggs are white or pale yellow, opaque, about 2.5 mm. in diameter and laid in clusters of approximately twenty which are stuck tightly together with mucus. They are either attached to the walls of the containers or leaves by slime, or left on top of the ground. After laying their eggs these slugs soon die. The young are sandy in colour, and once hatched survive well.

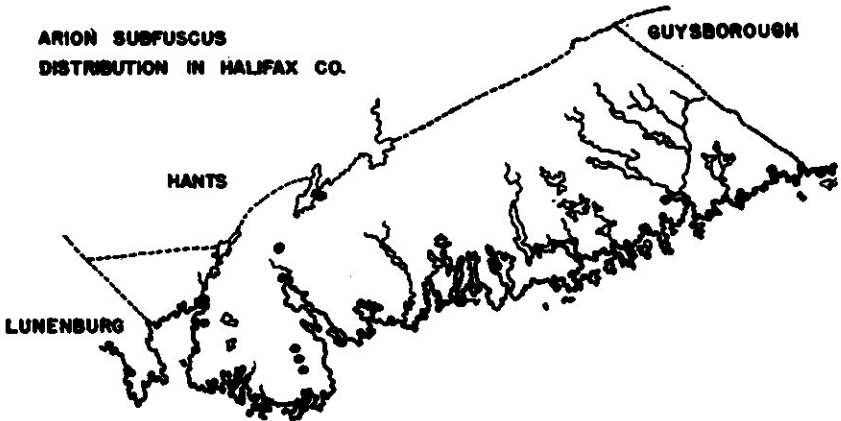


Figure 11

This species of land Mollusca is found mostly under wood piles, among rotting wood, or in manure, away from plants or ground where most of the other specimens were found. However, in the autumn specimens have been observed in

the open during the day. Besides having a large appetite for lettuce and other greens, *A. subfuscus* ate large quantities of brown gummed paper from the edges of the containers. In addition, members of this species show a strong tendency towards eating the muscular wall of their own dead.

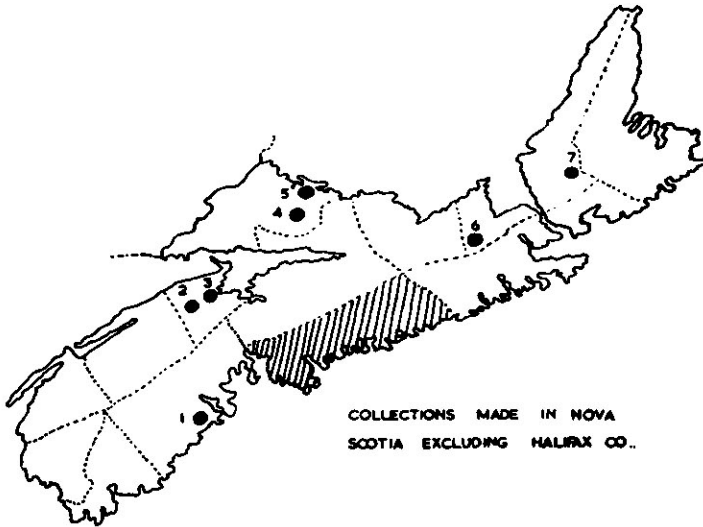


Figure 12

Table I records the results of collections made in Nova Scotia. On the map of Nova Scotia (Fig. 12) are marked the places where collections were made outside Halifax County. The latter has been shaded in, since collections made in this area have been indicated on the maps which accompany the descriptions of the species. The collections made in Cape Breton have not been recorded on this map.

TABLE I

Date	Place	Per Cent of Total Number of Animals Obtained in Search				
		<i>Deroceas Reticulatum</i>	<i>Deroceas Laeve</i>	<i>Arion Circumscriptus</i>	<i>Arion Hortensis</i>	<i>Arion Subfuscus</i>
1948						
May 14	Old garden, Halifax north	20	..	40	40	..
" 20	Old garden, Halifax south	75	..	25	..	..
" 24	Old garden, Halifax north	30	..	..	70	..
" 27	Marlborough Woods, Hfx. Co.	25	..	30	45	..
" 29	Upper Sackville, Hfx. Co.	35	65	..	..	..
" 29	Middle Sackville, Hfx. Co. . . . .	..	..	100	..	..
Jun. 3	Marlborough Woods, Hfx. Co. . . . .	..	..	25	75	..
" 16	Fort Cambridge, Pt. Pleasant, Hfx. . .	25	..	65	10	..
" 17	Fort Cambridge, Pt. Pleasant, Hfx. . .	50	..	48	2	..
" 18	Fort Cambridge, Pt. Pleasant, Hfx. . .	45	..	55	..	..
Jul. 3	Sackville, Hfx. Co.	17	10	25	..	48
" 10	French Village, Hfx. Co. . . . .	..	..	65	..	35
" 15	Silver Lake, Sambro Rd., Hfx. Co. . . .	..	..	95	..	5
" 19	Bedford, Hfx. Co.	65	..	22	12	1
" 20	Black Lake, Sambro Rd., Hfx. Co. . . .	22	15	45	..	18
" 22	Oakfield, Grand Lake, Hfx. Co.	80	5	5	..	10
" 27	Doyle Lake, Sambro Rd., Hfx. Co. . . .	20	75	..	..	5
" 29	Farm, Big Indian Lake Rd., Hfx. Co. . .	..	..	100	..	..
Aug. 12	Windsor Rd., Hants-Hfx. Co. Line. . .	..	..	..	..	..
" 14	Copper Lake, Antigonish Co.	65	..	35	..	..
" 19	Musquodoboit Harbour, Hfx. Co.	100	..	..	..	..
Sep. 2	Wallis Station, Cumberland Co. . . . .	..	100	..	..	..
" 3	Oxford Junction, Cumberland Co. . . . .	..	100	..	..	..
" 11	Petite Riviere, Lunenburg Co.	42	..	58	..	..
" 15	Upper Sackville, Hfx. Co.	35	65	..	..	..
" 15	Middle Sackville, Hfx. Co.	35	65	..	..	..
" 19	Petite Riviere, Lunenburg Co.	75	..	..	..	25
" 22	Mount Denson, King's Co.	90	..	10	..	..

TABLE I—Continued.

DATE	PLACE	Per Cent of Total Number of Animals Obtained in Search				
		<i>Deroceeras</i> Reticulatum	<i>Deroceeras</i> Laeve	<i>Arion</i> Circumscriptus	<i>Arion</i> Hortensis	<i>Arion</i> Subtusous
Sep. 22	Aylesford, King's Co.	97	..	..	..	3
" 24	Petite Riviere, Lunenburg Co. ....	..	..	100	..	..
Oct. 1	Sheet Harbour, Hfx. Co.	90	..	5	..	5
" 1	Spry Bay, Hfx. Co. ....	..	20	80	..	..
" 1	Pleasant Bay, Hfx. Co. ....	..	100	..	..	..
" 1	Ship Harbour, Hfx. Co.	100	..	..	..	..
" 1	Lake Charlotte, Hfx. Co. ....	..	100	..	..	..
Nov. 6	Old Garden, Halifax north.	17	..	67	16	..
" 6	Garden, Dartmouth, Hfx. Co.	100	..	..	..	..
" 28	Garden, Halifax north.	25	..	18	57	..
	(3 albino)					
Dec. 7	Garden, Halifax.	92	..	8	..	..
1949						
Mar. 29	Fort Cambridge, Halifax.	80	..	20	..	..
Apr. 5	Garden, Hfx. south.	100	..	..	..	..
May 15	York Redoubt, Hfx. Co.	20	..	..	..	80
" 15	Bear Cove, Hfx. Co.	35	30	35	..	..
Jun. 14	East Chester, Lun. Co.	20	..	20	20	20
" 28	Hubley's, Hfx. Co.	75	1	9	..	15
Jul. 7	Maitland, Lun. Co.	30	20	20	..	30
" 7	Mossman, Lun. Co.	5	..	5	..	90
" 8	Pinehurst, Lun. Co.	30	10	60	..	..
" 8	Caledonia, Queen's Co.	37	1	2	..	60
" 8	New Germany, Lun. Co.	5	5	10	..	80
" 8	Waterville, Kings Co. ....	..	..	50	..	50
" 8	Gaspereau, Kings Co.	75	..	25	..	..
" 8	Newport, Hants Co.	40	..	30	..	30
" 8	Windsor, Hants Co.	60	..	20	..	20

TABLE I—Continued.

DATE	PLACE	Per Cent of Total Number of Animals Obtained in Search				
		Deroceras Reticulatum	Deroceras Laeve	Arion Circumscriptus	Arion Hortensis	Arion Subfuscus
1949						
Jul. 12	Lawrencetown, Hfx. Co.....	44	11	..	..	45
Aug. 10	Copper Lake, Antigonish Co.....	85	7	8	..	..
" 10	So. River Lake, Antigonish Co.....	40	..	..	..	60
" 10	Glencoe, Guys. Co.....	25	..	..	..	75
" 10	Grant Lake, Guys. Co.....	30	..	..	..	70
" 12	Aspen, Guys. Co.....	60	..	20	..	10
" 12	Denvar, Guys. Co.....	75	25	..	..	..
" 12	Eden Lake, Pictou Co.....	100	..	..	..	..
" 12	Glenelg, Guys. Co.....	75	..	25	..	..
" 12	Willowdale, Pictou Co.....	40	..	60	..	..
" 12	Stillwater, Guys. Co.....	..	..	100	..	..
" 12	Sherbrook, Guys. Co.....	95	..	5	..	..
" 12	Goldenville, Guys. Co.....	50	50	..	..	..
" 12	South Lochaber, Guys. Co.....	75	25	..	..	..
" 12	Eight Island Lake, Guys. Co.....	80	20	..	..	..
" 12	Country Harbour, Guys. Co.....	100	..	..	..	..
" 12	Storemont, Guys. Co.....	60	20	20	..	..
" 12	Loch Katrine east.....	25	..	..	..	75
" 12	Loch Katrine west.....	100	..	..	..	..
" 5	St. Margarets, Hfx. Co.....	20	..	5	..	75
Jul. 26	Petite Riviere, Lun. Co.....	50	40	5	..	5
" 9	West Dublin, Lun. Co.....	80	20	..	..	..
Aug. 12	Rocky Mt., Pictou Co.....	75	25	..	..	..
" 12	Garden of Eden, Pictou Ca.....	..	100	..	..	..
	Cape Breton					
Sep. 8	Port Hawkesbury.....	8	..	..	..	92
" 8	Port Hastings.....	79	..	..	..	21
" 8	Long Point.....	100	..	..	..	..

TABLE I—Continued.

Date	Place	Per cent of Total Number of Animals Obtained in Search					
		Deroceeras Reticulatum	Deroceeras Eaeve	Arion Circumscriptus	Arion Hortensis	Arion Subfuscus	
1949							
Sep. 8	Judique	98	2	..	..	..
" 8	Glencoe	25	75	..	..	..
" 8	Dunvegan	94	6	..	..	..
" 8	N. E. Margaree	99	1	..	..	..
" 8	Finlayson	80	20	..	..	..
" 9	Baddeck	98	..	2	..	..
" 9	New Ross	50	50	..	..	..
" 9	Boularderie Island	92	..	8	..	..
" 9	Louisburg	64	22	9	..	5	
" 10	Sydney River	93	..	..	..	7
" 10	East Bay	92	..	8	..	..
" 10	Big Pond	100	..	..	..	..
" 10	Irish Bay	100	..	..	..	..
" 10	Soldiers' Cove	100	..	..	..	..
" 10	River Bourgeois	50	..	..	..	50
" 10	Louisdale	100	..	..	..	..
" 10	Oban	30	70	..	..	..
" 10	The Points, West Bay	100	..	..	..	..
" 10	Marble Mountain	74	26	..	..	..
" 10	Malagawatch	87	9	1	..	3	
" 11	Whycocomagh	100	..	..	..	..
" 11	Melford	46	54	..	..	..
" 11	Glendale	90	5	5	..	..
" 11	Kingsville	20	7	2	..	71	
" 11	Mulgrave	75	..	..	..	25
" 11	Bayfield Road	96	4	..	..	..
" 11	Sutherland River	100	..	..	..	..
" 11	West River	68	32	..	..	..
" 11	Truro	100	..	..	..	..

CONCLUSION

In this paper we have attempted to set down the information which we have obtained by observation of certain land Gastropods of Nova Scotia. In addition to the five species described above, a possible sixth was observed by several people at French Village in Halifax Co. in the summers of 1945 and 1948, and at Grand Lake, Halifax Co., in the summer of 1947. This type, about 8.5 cm. long and pale creamy yellow in colour, has not as yet been collected and identified.

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EXPLANATION OF PLATE I

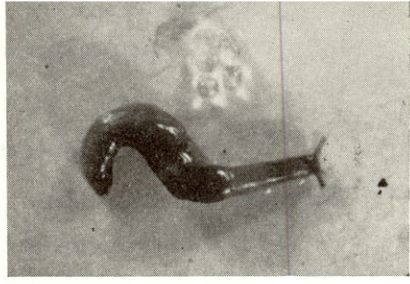
- A. *Deroceras reticulatum* with eggs
 B. *Deroceras laeve* with eggs
 C. *Arion circumscriptus* with eggs
 D. *Arion circumscriptus* showing humped position
 E. *Arion hortensis* dorsal view
 F. *Arion hortensis* ventral view
 G. *Arion subfuscus* with eggs
 H. *Arion subfuscus* showing humped position

KEY TO FIGURES 2, 4, 6, 8 AND 10

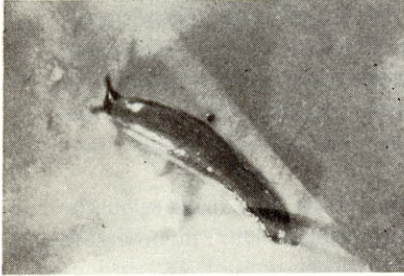
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|---------------------------|----------------------|
| a. —atrium | f.o. —free oviduct |
| s.r. —seminal receptacle | g.p. —genital pore |
| u.c. —uterine canal | e. —epiphallus |
| a.g. —albumen gland | v.d. —vas deferens |
| h.d. —hermaphroditic duct | p. —penis |
| o. —ovotestis | s.d. —spermatie duct |



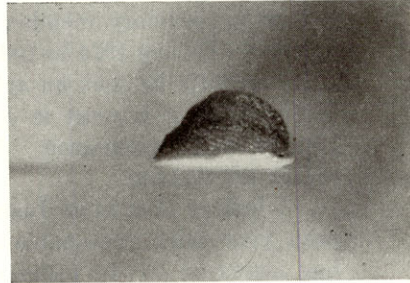
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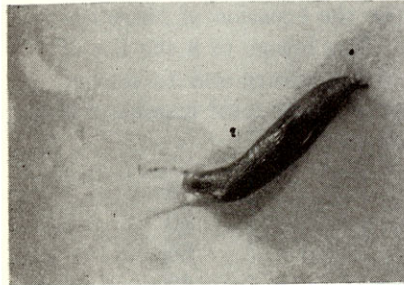
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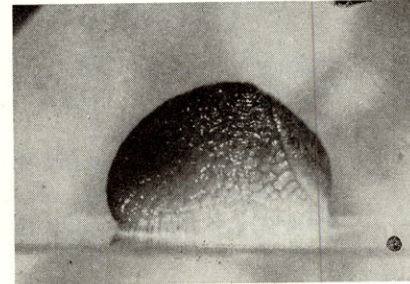
E



F



G



H

Plate 1