Hydrobiologia vol. 44, 2—3 pag. 161—176, 1974.

Some Observations on two Populations of Dalyellia Viridis (G. Shaw) (Turbellaria: Neorhabdocoela) Living in Temporary Habitats in England

by

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Abstract

Certain aspects of the biology of two populations of *D. viridis* living in Massam's Slack North and a drainage ditch skirting the Hightown Road, Lancs. were studied. The habitats are described; both are devoid of water for several months during the summer/autumn. Sampling techniques are described.

Changes in the numbers and size-structure of both populations were studied. After the re-flooding of the habitats, one to a few months elapsed before hatching of cocoons of *D. viridis* occurred; in both habitats hatching occurred earlier after the drought in 1970 than after the dry period in 1969; hatching ceased by April in the drainage ditch (Hightown) and bij May in Massam's Slack. In both populations animals were still growing into the larger size-categories when the habitats became dry, in June in the case of Massam's Slack and in May in the case of the drainage ditch (Hightown).

Cocoon formation started when animals reached a length of 2.0 mm. The maximum number of cocoons observed was 24. Cocoon size varied from 245 x 127 mm to 294 x 137 mm.

When first formed the penis stylet does not possess handles; as the stylet grows so the handles, the lateral distal branches, and spines increase in size. The total length of stylet varied from 74 to 370 μm according to the size of specimen examined; the average, minimum and maximum lengths recorded in specimens in the 3.0 mm size-group was 338 μm, 313 μm and 370 μm respectively.

The data gleaned on the above aspects of the biology of *D. viridis* in the present study are compared with some available information presented in previous publications by continental workers.

Introduction

During a study of the general bottom fauna of Massam's Slack

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Received January 13, 1973

North (see BEVERCOMBE, COX, THOMAS & YOUNG, 1973), which lies in the Nature Conservancy's Ainsdale Sand Dunes National Nature Reserve, Lancashire (GRID O.S. Ref. 34 281100) opportunity was taken of making a few observations on the substantial population of *Dalyellia viridis* (G. SHAW) which existed in the slack. Less detailed observations were also made on a population of the same species which occurred an a drainage ditch skirting the Hightown Road almost at its junction with the Formby By-Pass Road, Lancashire (GRID O.S. Ref. 34 307049).

The first record of the species was made in England by SHAW (1791) who named it *Hirudo viridis*, Recently, YOUNG (1970) has provided information on the occurrence and distribution of the species in the British Isles. Information on aspects of the structure and ecology of the species on the continent has appeared in several publications, and these have been summarised by LUTHER (1955).

In this paper some detailed information on the anatomy and ecology of the species in England is presented.

HABITATS

Massam's Slack North has been described in detail in BEVERCOMBE et al (1973). Briefly, the slack runs in a North to South direction, parallel and close to the coastline, and is separated from the sea by a low dune ridge which was artificially created by the erection of fences and the planting of Marram Grass, *Amnophila arenaria* (L) LINK, in the later part of the 19th century in an attempt at back-shore reclamation. The slack is usually submerged for, on average, about nine months of the year, and it is dry in late summer; the duration of the dry period depends on rainfall. Sometimes water persists in the drainage ditches which skirt the slack to the East and South but in some years these too dry out. In the wettest season the water may lie in the slack up to a depth of 61 cms. Analyses of the water in the slack made from March to July, (see BEVERCOMBE et al, 1973) indicated that the conductivity (μ mho) of the water varied from 744.2 to 872.2 and the pH from 7.5 to 8.3.

In the summer months there is a dense growth of aquatic macrophytes both in the slack and in the skirting drainage ditch, and these have been listed by BLANCHARD (1952). ROUND (1958) has studied the algae and aquatic mosses in the slack.

The drainage ditch skirting the Hightown Road is about 1.0 to 1.5 meters wide. The depth of water in the ditch varies according to rainfall, but it is usually dry for 4 to 5 months during the summer/autumn. Occasionally the ditches are dredges but this is infrequent,

and usually during the spring/early summer *Phragmites* and other smaller aquatic macrophytes, algae and mosses are present. The chemistry of the water was not studied but the water is certainly "hard".

Methods

For the study of the zoobenthic fauna (including *D. viridis*) of the slack four different sampling sites were established: these were approximately 150, 240, 310 and 410 metres respectively North-east from Fisherman's Path which separates Massam's Slack North from Massam's Slack South (see Fig. 1 in Bevercombe et al, 1973). At each of the sites three samples were taken; one from the drainage ditch and two from the slack. Thus, a total of 12 samples were taken on each sampling occasion. The dominant vegetation at each of the sites was identified as follows: Site 1 – *Scirpus tabernaemontani* c.c. Gmel, *Typha latifolia* L. and *Oenanthe fistulosa* L: Site 2 – *Veronica anagaelis – aquatica* L; Site 3 – *Scirpus tabernaemontani* c.c. Gmel, *Scirpus maritimus* L. and *Hydrocotyle vulgaris* L; and Site 4 – *Carex disticha* Huds., *Typha latifolia* L., and *Iris pseudacorus* L.

Two "bin" samples were taken at random from the slack and one five-minute sweep was made in the drainage ditch. The "bin" (see Dunn, 1961) consisted of a galvanised iron cylinder, 22.5 cms in diameter and 57.5 cms in height, open at both ends, and enclosing an area of slack of 398 sq. cm. The bin, which had a serrated bottom rim, was pressed and rotated into the substratum by means of two handles at the top of the bin. A hand-net (23.6 meshes/cm) was used to agitate the substratum enclosed by the bin and to remove the organisms from it. The ditch samples were collected by a larger F.B.A. hand-net (23.6 meshes/cm). The contents of the bag-nets in both methods were placed at intervals into polythene basins containing water. All samples, after removal of large pieces of vegetation, were poured into 3-litre, screw-top, glass jars for transportation back to the laboratory where they were left to stand overnight.

The same sampling procedure as outlined for obtaining samples from the ditch skirting Massam's Slack North was adopted for obtaining samples from the drainage ditch skirting the Hightown Road.

After standing over-night, all the samples in the glass-jars were examined for Microturbellaria, which were removed by the methods outlined in Young (1970).

Samples were taken from the slack in Nov. 1969, Feb. to May, 1970, and Dec. 1970. It is pertinent to mention that the slack was

TABLE I

To show the numbers and percentages of D. viridis in the various size (length) categories in each of the monthly samples collected from Massam's Slack. The total number of specimens obtained each month is also indicated. The temperature (°F) of the water in the slack when the samples were taken each month is also indicated.

Length in mm	Nov 1969	Dec-Jan 69-70	Feb 38°F		Mar 40°F		April 47°F		May 56°F		June-Sep	Oct-Nov	Dec 38°F	
			No.	%	No.	%	No.	%	No.	%			No.	%
0.75	-	Water present but no samples taken.	-	-	20	12	31	4	-	-	Dry	Water present but no samples taken.	249	10
1.0	-		1	100	27	16	40	5	-	-			538	22
1.25	-		-	-	26	15	42	5	-	-			612	25
1.5	-		-	-	35	21	63	8	26	4			586	24
1.75	-		-	-	30	18	119	15	73	10			294	12
2.0	-		-	-	30	18	156	19	98	14			170	7
2.25	-		-	-	-	-	168	21	149	21			-	-
2.5	-		-	-	-	-	184	23	135	19			-	-
2.75	-		-	-	-	-	-	-	143	20			-	-
3.0	-		-	-	-	-	-	-	87	12			-	-
Totals	0		1	100	168	100	803	100	711	100			2449	100

"dry", in the sense that water was not detectable or visible on the surface of the ground, for three months (Aug. to Oct. inclusive) in 1969 and for four months (June to Sept. inclusive) in 1970. In 1969 the skirting drainage ditch may or may not have become dry, but certainly in 1970 the ditch was also dry for at least four months.

Samples were taken from the ditch skirting the Hightown Road from Jan. 1970 to April 1971. The ditch was dry for six months (May to Oct. inclusive) in 1970, and from May to Sept. inclusive in 1971. However, no samples were taken after April 1971.

Results

Changes in numbers and size-structure of the populations.

Population in Massam's Slack.

Table I indicates the total numbers of specimens of *D. viridis*, collected from all 4 sites by both sampling methods, for each month during the investigation. No specimens were recorded in Nov. 1969, the first month when water was present in the slack after the drought from Aug. to Oct. inclusive. Unfortunately no samples were taken in Dec. 1969 and Jan. 1970 when water continued to be present in the slack. In Feb., one small specimen was obtained; from March to May the numbers increased. From June to Sept. inclusive the slack was dry. Again, unfortunately, samples were not taken in Oct. and Nov. when the slack had re-flooded. In Dec. a substantial number of specimens were obtained, in fact over 3 times the number recorded in May prior to the drought. It should be stated that *D. viridis* was obtained from all the sites in the slack. A single factor analysis of variance for the species for the single samples taken from the ditch sites for March, April and May suggested that the differences between sites are not significant.

Table I also indicates the numbers and percentages of *D. viridis* in the various size (length) categories in each of the monthly samles. The length of each of the animals was measured to the nearest 0.25 mm while it was moving naturally over the bottom of a glass petri-dish, containing a little pond water and placed on a sheet of graph paper marked off in millimeters. It is obvious from Table I that the animals, from Feb. to May, gradually grew up into the larger size-categories, and that hatching of young from cocoons had ceased by May. The maximum length recorded was 3.0 mm but it is possible that, had the drought not intervened in June, the animals might have grown larger, as Young (1970) has recorded animals in

TABLE II

The numbers and percentages of D. viridis in the various size (length) categories in each of the monthly samples collected from the ditch by Hightown Road. The total number of specimens obtained each month is also indicated.

Length	Jan.		Feb.		March		April		May-Oct.	Nov.		Dec.		Jan.		Feb.		March		April		May-Sept.	Oct.
in mm.	No.	%	No.	%	No.	%	No.	%		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%		
0.75	-	-	14	21	31	10	-	-	Dry	-	-	5	50	11	21	20	11	10	2	-	-	Dry	
1.0	-	-	21	30	43	14	20	5		-	-	5	50	14	27	27	15	43	9	-	-		Water
1.25	-	-	19	27	56	18	40	10		-	-	-	-	15	29	35	19	68	12	20	3		present
1.5	-	-	15	22	80	26	32	8		-	-	-	-	12	23	45	25	53	11	65	10		no
1.75	-	-	-	-	56	18	32	8		-	-	-	-	-	-	35	19	106	22	65	10		samples
2.0	-	-	-	-	43	14	61	15		-	-	-	-	-	-	20	11	92	19	79	12		taken
2.25	-	-	-	-	-	-	81	20		-	-	-	-	-	-	-	-	68	14	92	14		
2.5	-	-	-	-	-	-	69	17		-	-	-	-	-	-	-	-	53	11	137	21		
2.75	-	-	-	-	-	-	29	7		-	-	-	-	-	-	-	-	-	-	98	15		
3.0	-	-	-	-	-	-	40	10		-	-	-	-	-	-	-	-	-	-	98	15		
Totals	0	0	69	100	309	100	404	100		0	0	10	100	52	100	182	100	483	100	654	100		

other habitats in England upto a length of 3.5 to 4.0 mm. In Dec. 1970 after the drought from June to Sept. inclusive, animals were concentrated in the lower size-categories. The maximum size recorded was 2.0 mm, but only a few specimens (7%) occurred in this size category.

Population in the drainage ditch skirting the Hightown Road.

Table II indicates the total number of specimens of *D. viridis* collected from the ditch in one five-minute sweep during each month of the investigation. No specimens were recorded in Jan. 1970; in Feb., *D. viridis* was obtained and the numbers increased till April. From May till Oct. inclusive the ditch was without water. In Nov. 1970, no *D. viridis* were found but in Dec. a few specimens were obtained; there-after numbers increased till April 1971. The ditch was dry from May to Sept., but no samples were taken after this when water returned in Oct.

Also indicated in Table II are the numbers and percentages of *D. viridis* in the various size (length) categories in each of the monthly samples. In 1970, the animals gradually grew into the larger size-categories from Feb. to April, and hatching of young animals from cocoons ceased in April. In 1971, the Microturbellaria grew into the

TABLE III

To show the numbers of D. viridis of different lengths containing cocoons, in the April and May samples taken from Massam's Slack.

	April		May	
Animal size in mm.	No. of animals	No. of animals with cocoons	No. of animals	No. of animals with cocoons
0.75	31	0	0	0
1.0	40	0	0	0
1.25	42	0	0	0
1.5	63	0	26	0
1.75	119	0	73	0
2.0	156	2	98	8
2.25	168	10	149	81
2.5	184	158	135	135
2.75	0	0	143	143
3.0	0	0	87	87

larger size-categories from Dec. to April, and hatching ceased in April. In both years the maximum length of D. *viridis* recorded was 3.0 mm, but, again, perhaps if the dry conditions had not set in in May of each year the animals may have achieved a larger size.

Cocoons.

The frequency and size of cocoons in specimens of *D. viridis* were studied in the population from Massam's Slack only. Cocoons first appeared in animals in April. Table III indicates that cocoon production begins when the animals reach a length of 2.0 mm, though only 1.3% and 8%, in April and May respectively, of animals in this size-group contained cocoons. In March, in fact, none of the animals of 2.0 mm in size contained cocoons. Practically all of the animals of 2.5 mm in length (86% in April and 100% in May) contained cocoons; in May all the animals of 2.75 and 3.0 mm in length had cocoons. Table IV shows the numbers of cocoons observed inanimals of different sizes in the April and May samples. The trend appears to be that animals produce more cocoons as they increase in size. The maximum number of cocoons recorded was 24 and these occurred in animals of length 2.75 and 3.0 mm obtained in May.

To investigate overall variability in cocoon size, a total of 808 cocoons taken from animals ranging from 2.0 to 3.0 mm in length and collected in the April and May samples, were measured. Table V indicates the various dimensions obtained. The cocoons are approximately oval in outline. The dimensions varied from 245 μm (max. length) x 127 μm (max. width) to 294 μm x 137 μm. To exam-

TABLE IV

The average numbers of cocoons in D. viridis of different lenghts in the April and May samples taken from Massam's Slack.

Average numbers of cocoons		
Size category	April	May
2.0 mm	1	1.5
2.25	1.2	3.6
2.5	3.8	8.4
2.75	—	16.4
3.0	—	19.1

TABLE V

Variability in cocoon size based on 808 cocoons in specimens of D. viridis ranging from 2.0 to 3.0 mm in the April and May samples from Massam's Slack.

Cocoon size in µm.			Number of cocoons
Length	x	Max. width	
245	x	127	21
245	x	137	56
245	x	147	49
245	x	157	51
245	x	167	45
255	x	137	40
255	x	147	43
255	x	157	52
255	x	167	48
265	x	137	42
265	x	147	39
265	x	157	41
265	x	167	47
274	x	137	50
274	x	147	41
274	x	157	40
264	x	167	36
284	x	137	29
284	x	147	15
284	x	157	12
284	x	167	8
294	x	137	3
Total			808

ine variability in cocoon size within a single specimen, the 24 cocoons inside an animal of length 2.75 mm selected at random from the May sample, were measured. The dimensions of the cocoons are shown in Table VI; the cocoon size varied from 245 x 217 µm to 284 x 167 µm. There was no indication that first formed cocoons were larger or smaller than subsequent ones.

Penis stylet.

The development and variation in size of the penis stylet in *D. viridis* were studied in specimens from the Massam's Slack population only. Table VII reveals that the penis stylet first appears in animals 1.25 mm in length and all specimens with a length of 1.5

TABLE VI

The variability of cocoon size within a single specimen, based on 24 cocoons taken from one D. viridis of 2.75 mm in length obtained in the May sample from Massam's Slack.

Cocoon	Size of cocoon in microns		
	Length	x	Breadth
1	245	x	127
2	245	x	137
3	245	x	137
4	245	x	147
5	245	x	147
6	245	x	157
7	245	x	157
8	255	x	137
9	255	x	137
10	255	x	147
11	255	x	147
12	255	x	157
13	255	x	167
14	265	x	137
15	265	x	147
16	265	x	147
17	265	x	147
18	265	x	147
19	265	x	157
20	274	x	147
21	274	x	147
22	274	x	157
23	274	x	167
24	284	x	167

mm or over possessed one. Table VIII indicated average and extreme measurements of the penis stylet and its various parts in animals

TABLE VII

Presence of penis stylet in specimens of D. viridis of different size-categories, collected in monthly samples from Massam's Slack.

Size category	Feb.		March		April		May	
	No.	No. with stylet	No.	No. with stylet	No.	No. with stylet	No.	No. with stylet
0.75 mm	-	-	20	0	31	0	-	-
1.0	1	0	27	0	40	0	-	-
1.25	-	-	26	4	42	3	-	-
1.5	-	-	35	35	63	63	26	26
1.75	-	-	30	30	119	119	73	73
2.0	-	-	-	-	156	156	98	98
2.25	-	-	-	-	168	168	149	149
2.5	-	-	-	-	184	184	135	135
2.75	-	-	-	-	-	-	143	143
3.0	-	-	-	-	-	-	87	87

TABLE VIII

The average and extreme measurements (μm) of the penis stylet and its various parts (A – D) in specimens of D. viridis in different size-categories. Average and extreme numbers of spines on the lateral distal branches are also shown. A = total length from tip of handles to tip of spines; B = length of handles; C = length of lateral distal branches; D = length of lateral distal branches plus spines.

Size category	Measurement	Lengths of A	B	C	D	No. of spines
1.5 mm	Av.	166	53	102	129	10 + 11
	Min.	74	0	66	74	9
	Max.	239	78	138	166	14
2.0 mm	Av.	245	81	125	163	11 + 12
	Min.	211	50	115	140	10
	Max.	272	109	136	167	13
2.5 mm	Av.	296	134	128	164	11 + 12
	Min.	255	88	117	147	10
	Max.	324	167	147	170	13
3.0 mm	Av.	338	164	128	175	12 + 12
	Min.	313	147	117	157	11
	Max.	370	183	148	187	14

in different size-categories. A substantial number of animals in each size-category were examined. The information in Table VIII indicates that when the penis appears first, the handles or proximal stalks are absent. As the animals grow the handles of the stylet also increase in length. The two handles sometimes grow at different

speeds, but eventually reach approximately the same length. The measurements for handle length quoted in Table 8 are based on the largest handles. Continued growth of the lateral distal branches and spines also occurs. Whilst the average number of spines recorded for the 1.5 mm size group is slightly lower than for the other size-categories, it is assumed that the full compliment of spines is present on the formation of the stylet. It should be mentioned that the total length of the stylet (A), and of branches plus spines (D) will depend on the degree of compression of the coverslip on the specimens, when the stylet is being examined under a compound microscope. Maximum compression without disintegration of the specimens was used for the measurements in Table 8.

Discussion

First, consideration of the changes in numbers and size-structure of the two populations of *D. viridis* will be made. In 1970 in both habitats, i.e. Massam's Slack and the drainage ditch skirting the Hightown Road, cocoons started hatching in February. Admittedly, no sample was taken in Jan. from Massam's Slack, but in view of the fact that only one small specimen was recorded in the sample taken in Feb., it is almost certain that hatching started in the latter month. Hatching continued in Massam's Slack till April and in the drainage ditch (Hightown Rd.) till March. Both populations were in the process of increasing in average size (length) when the drought set in, i.e. in June in Massam's Slack and in May in the drainage ditch (Hightown Rd.). It is likely that the maximum possible length of animals in both populations was not achieved because of the intervention of the dry periods. Most likely, both populations had reached their greatest abundance as hatching had ceased in the month prior to the drought.

After the period of drought in 1970 (June to Sept. inclusive) no samples were taken from Massam's Slack, unfortunately, till Dec. In this month, however, large numbers of animals were obtained and these were spread over the size-categories 0.75 mm to 2.0 mm. inclusive. Thus, apparently, hatching started much sooner after the termination of drought in 1970 than after the finish of the dry period (Aug. to Oct. inclusive) in 1969. After the period of drought in 1970 (May to Oct. inclusive) animals were not found in the Nov. sample taken from the drainage ditch (Hightown Rd.) but some were found in the Dec. sample. Hatching continued till March, 1971 and this is similar to the situation in 1970. The average length of the animals increased till the drought started in May, 1971. Again, it is feasible

that the maximum possible length of the animals was not reached due to the occurrence of the drought, and again it is likely that the population had reached it greatest numerical level as hatching had ceased in the month before the drought set in. Thus, as in the Massam's Slack population hatching started sooner after the termination of the drought in 1970 than after the finish of the dry period in 1969.

The factors controlling hatching of the cocoons of *D. viridis* are not known. Certainly, in both populations, as stated above, hatching started earlier after the termination of the dry period in 1970 than after the finish of the dry period in 1969. It is pertinent to mention that YOUNG (in preparation) has recorded the occurrence of a diapause in the cocoons of *Phaenocora typhlops* VEJDOVSKY (Turbellaria; Neorhabdocoela), and that a period of low temperature is the necessary stimulus for diapause development. However, to reiterate, no attempt had been made to investigate the conditions necessary for the hatching of the cocoons of *D. viridis*.

Previous records of *D. viridis* from Britain have been made in Jan., April, May, July, Sept., Oct., and Nov. (see YOUNG, 1970). In the Liverpool area it has been recorded from another two ponds and one ditch, all containing hard water, and all of which dry out in the summer months. On the European continent SCHULTZE (1851) for example, also found young animals in Dec. and ripe animals from March to May; MIDDELHOEK (1948) found ripe animals in April in a marsh at Lattrop, which dried out in summer. HEIN (1926) indicated the life-span of *D. viridis* in culture to be 92 to 109 days, while in natural conditions it is probably 4 to 5 months. The latter statement is certainly in agreement with data gleaned from the two populations in the present study. In fact, of course, the life-span of animals in both populations was probably not achieved due to the intervention of the droughts.

With regard to cocoon formation it was found that this starts when animals reach a length of 2.0 mm (certainly in the April and May samples from Massam's Slack), and that animals produce more cocoons as they increase in size. The maximum number of cocoons observed was 24, and these occurred in the largest animals (2.75 to 3.0 mm in length) in the May sample from the slack. Continental workers have found populations in which mature *D. viridis* have harboured many more than 24 cocoons in their body; thus, for example, MIDDELHOEK (1948) found that in a population of *D. viridis* living in a march at Lattrop, large, mature specimens in April contained from 22 to 110 cocoons per animal, and each cocoon contained 4 to 12 embryos; nevertheless MIDDELHOEK (loc. cit.) indicates that previous literature suggests that 42 cocoons per animal

is the greatest number hitherto recorded. It is possible that, had the population in Massam's Slack been able to persist in the absence of a drought, specimens harbouring a larger number of cocoons might have been observed. Cocoons are released, of course, when the animals die.

Based on an examination of 808 cocoons in specimens (2.0 to 3.0 mm in length) from the April and May samples from Massam's Slack, cocoon size varied from 245 μm (max. length) x 127 μm (max. width) to 294 μm x 137 μm. Comparing these figures with measurements gleaned from continental populations, it is seen that SEKERA (1903; 1907; 1912), for example, found a variation from 220 x 120 μm to 340 x 190 μm, and an average size of 280 x 160 μm or 290 x 140 μm. SEKERA (loc. cit.) also stated that generally the first formed eggs are larger than those formed subsequently. In the present study there was no evidence of this.

The formation and variation in size of the penis stylet in *D. viridis* were examined in specimens from Massam's Slack. It was found that handles or proximal stalks are absent when the penis is first formed. As the penis grows the handles, the lateral distal branches, and spines increase in size. These observations suggest that the range of measurements for the size of the penis stylet and its parts in various species of Micro-turbellaria, quoted in the literature, could be due to the measurements having been made, in some instances perhaps, in animals which had not fully matured.

The average length of the penis stylet in specimens in the 1.5 mm, 2.0 mm, 2.5 mm and 3.0 mm size-groups were 166 μm, 245 μm, 296 μm and 338 μm respectively; the minimum and maximum lengths of the stylet in these size-categories were 74 to 239 μm, 211 to 272 μm, 255 to 324 μm and 313 to 370 μm respectively. The average lengths of the handles of the penis stylet in specimens in the 1.5 mm, 2.0 mm, 2.5 mm and 3.0 mm size-categories were 53 μm, 81 μm, 134 μm and 164 μm, respectively; the minimum and maximum lengths of the handles in these size-categories were 0 to 78 μm, 50 to 109 μm, 88 to 167 μm, and 147 to 183 μm respectively. The number of spines on each lateral distal branch varied from 9 to 14.

Comparing these data with information gleaned from continental studies, then LUTHER (1955), for example, on an examination of a few specimens in Pisa, Italy, recorded a penis length of 315 μm, handles of 170 μm and largest spines of 130 μm; the number of spines on the lateral distal branches numbered 10 to 15, mostly 12 to 13. Comparing the Massam's Slack data with similar observations on the penis stylet in *D. viridis* in four other habitats (includes the drainage ditch (Hightown Rd.) and those listed on p. 171) in the

Liverpool area, YOUNG (1970) has found that in specimens of 2.5 to 4.0 mm length the stylet ranged from 282 to 390 μm in length with an average of 330 μm; the number of spines on the lateral distal branches varied from 10 to 14.

ACKNOWLEDGEMENTS

The authors are grateful to the Nature Conservancy for permission to carry out the study in the Ainsdale Sand Dunes National Nature Reserve, and to Mr. NEIL A. ROBINSON, Assistant Regional Officer, Lancashire, for his cooperation concerning many matters during the investigation. Thanks are also due to Mrs. J. H. Harris and Mr. J. Gittins, University of Liverpool for technical assistance.

ZUSAMMENFASSUNG

Gegenstand der Untersuchung sind bestimmte Aspekte in der Biologie zweier Populationen von *D. viridis*, die in Massam's Slack North und in einem Entwässerungsgraben entlang der Hightown Road in Lancashire leben. Ihre Lebensräume werden beschrieben: beide sind mehrere Sommer- und Herbstmonate über ohne Wasser. Es werden die Methoden der Probenauswahl erläutert.

Veränderungen in Anzahl und Grössenstruktur beider Populationen wurden untersucht. Nach erneuter Überflutung der Lebensräume vergingen ein bis zwei Monate, bevor *D. viridis* aus den Kokons schlüpften. In beiden Lebensräumen fand das Schlüpfen nach der Dürre von 1970 früher statt als nach der sommerlichen Trockenperiode 1969. Im Entwasserungsgraben (Hightown) war das Schlüpfen im April, in Massam's Slack im Mai beendet. Die Tiere beider Populationen wuchsen immer noch weiter zu den grösseren Grössenordnung, nachdem die Wohngebiete trocken wurden, im Fall von Massam's Slack im Juni, im Entwässerungsgraben (Hightown) im Mai.

Die Bildung von Kokons begann, wenn die Tiere eine Länge von 2,0 mm erreicht hatten. Die Höchtszahl von beobachteten Kokons betrug 24. Die Grösse der Kokons schwankte zwischen 245 x 127 μm und 294 x 137 μm.

Zu Beginn seiner Entwicklung besitzt der Penisanhang noch keine Stiele. Während der Anhang wächst, werden auch die Stiele, die seitlichen Aussenäste und die Stachel grösser. Die Gesamtlänge des Fortsatzes variierte zwischen 74 und 370 μm je nach Grösse des Untersuchungstiers. Bei Tieren der 3 mm grössen Gruppen betrug

die durchschnittliche, die minimale und die maximale Länge jeweils 338 μm, 313 μm und 370 μm.

Die zusammengetragenen Angaben zu den genannten Aspekten in der Biologie von *D. viridis* in der vorliegenden Untersuchung werden schliesslich verglichen mit einigem zugänglichen Informationsmaterial in früheren Veröffentlichungen kontinentaler Forscher.

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