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Sultan Qaboos University Printing Press, Muscat - Sultanate of Oman, 2012

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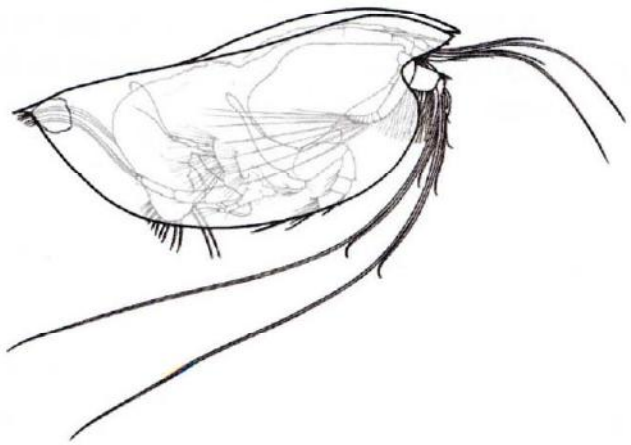
(With 41 pictures, 84 plates, 95 figures)



2012

Book Title: **Halocyprid Ostracods of the Arabian Sea Region**

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Cover design: Anna Drapun

Book design: Irina Prusova & Inna Drapun

Book assembly: Vladislav Malyshev

Publisher: Sultan Qaboos University - Academic Publication Board

Address: P.O Pox 17 Postal Code 123, Muscat, Al khoudh, Oman

The book has been refereed by the Academic Publication Board, Sultan Qaboos University

ISBN978-9948-16-424-1

The taxonomy and distribution of halocyprid ostracods from the Arabian Sea Region is reported, based upon samples collected in the Northwestern Indian Ocean within the framework of the Netherlands Indian Ocean Program (NIOP: 1992-1993), the U.S. Joint Global Ocean Flux Study (U.S. JGOFS: 1994–1996), and the U.S. Global Ocean Ecosystem Dynamics program (U.S. GLOBEC: 1995).

Forty-one species from the following genera belonging to the family Halocyprididae are described, illustrated, and representative photographs are presented: *Archiconchoecia, Alacia, Conchoecetta, Conchoecia, Conchoecilla, Conchoecissa, Discoconchoecia, Loricoecia, Mikroconchoecia, Orthoconchoecia, Paraconchoecia, Paramollicia, Platyconchoecia, Porroecia, Proceroecia, Pseudoconchoecia, Clausoecia, Kyrtoecia, Nasoecia* and *Euconchoecia.* For fourteen species, members of the genera *Macroconchoecia, Mollicia, Paraconchoecia, Metaconchoecia, Mülleroecia, Fellia, Halocypria* and *Halocypris,* only carapace outlines are presented. Keys to the subfamilies, tribes, genera and species, and patterns of horizontal and vertical distribution of each described species in the Arabian Sea Region are also given. The data on occurrence of halocyprid species at each of the stations during the investigation period and the depth ranges of halocyprid species found in the analyzed material but not described in the present book are listed in appendices.

Keywords: Ostracoda, Halocyprididae, Taxonomy, Distribution, Arabian Sea Region.

Acknowledgements

We thank our colleagues Martien A. Baars from the Netherlands Institute for Sea Research (Texel, the Netherlands), Peter B. Ortner formerly from the U.S. National Oceanographic and Atmospheric Administration's Atlantic Oceanographic and Meteorology Laboratory (Miami, USA) and now at The Rosenstiel School at the University of Miami (Miami, USA), and Karen Wishner from the University of Rhode Island for allowing us to work with some of their samples. Richard Barber, Carin Ashjian, Charles Flagg and Louis Codispoti helped us understand the regional dynamics; Peter Lane (formerly with The Rosenstiel School, Miami, USA) provided excellent cooperation in both the field and laboratory work. We express our great appreciation to Martin V. Angel (Southampton, UK) for his support and valuable advice during the work on the descriptions of ostracod species.

We are indebted to our colleagues from the Institute of Biology of the Southern Seas (IBSS, Ukrainian Academy of Science, Sevastopol, Ukraine): Irina Prusova for her close cooperation during the entire period of the manuscript preparation; Valentina Moryakova for her help in the sample analyses; Olga Akimova for her help in obtaining the necessary literature. Special thanks are due to the administration of the IBSS, especially its deputy director Alexander Boltachev, for supporting and encouraging this work.

We also owe a considerable debt of gratitude to both of our reviewers.

Funding for the fieldwork and sample analyses was provided by the Netherlands Marine Research Foundation (SOZ), the U.S. National Science Foundation (NSF) and the U.S. Office of Naval Research (ONR). Ship operation support came from SOZ, NSF and ONR.

CONTENTS

INTRODUCTION

"Planktonic ostracods constitute an appreciable part of marine zooplankton, especially in tropical and subtropical oceans. This group from the Indian Ocean has not been studied in detail although extensive studies have been made on them from other oceans, particularly the Atlantic. Müller's report (1906) based on the "Valdivia" material was the first study on planktonic ostracods from the Indian Ocean. Cannon (1940) gave a list of planktonic ostracods collected during the John Murray Expedition. Later, Leveau (1969), George (1969, 1971, 1976 and 1977), George, Purushan and Madhupratap (1975) and James (1972 and 1973) reported on this group. Poulsen's studies (1962, 1965, 1969 and 1973) on the Dana material are very exhaustive but the expedition covered limited areas of the Indian Ocean." (Cited from George & Nair, 1980, p. 29). This report by George & Nair (1980) is one of few investigations showing the distributions of Indian Ocean ostracod species (thirty-two species) in the Arabian Sea Region and other areas of the northern Indian Ocean. Their data are based on tows in the upper water layer, and unfortunately descriptions of species are absent in this work.

In the 1990's, a series of multidisciplinary oceanographic expeditions were carried out in the Northwestern Indian Ocean by the Netherlands (Netherlands Indian Ocean Program, NIOP: 1992–1993), the United Kingdom (Arabesque: 1994), Germany (Joint Global Ocean Flux Study, JGOFS: 1995, 1997), Pakistan (North Arabian Sea Environmental and Ecological research, NASEER: 1992–1994), India (JGOFS: 1995–1997) and the United States (JGOFS: 1994–1996; Global Ocean Ecosystems Dynamics Program, GLOBEC: 1995). These investigations have resulted in more than 120 publications that address different aspects of the biogeochemistry and physical forcing of the Arabian Sea Region (Watts et al., 2002). Data on halocyprid ostracods, based on the zooplankton materials collected during these expeditions, has not been published earlier.

The goals of this work are to report halocyprid ostracod species identified from the zooplankton samples collected in the Arabian Sea Region within the framework of the NIOP (1992–1993), the U.S. JGOFS (1994–1996) and the U.S. GLOBEC (1995), and to produce a scholarly up-dated, yet easy-to-use identification guide for halocyprid ostracods of the Arabian Sea Region.

Taxonomic analyses of the samples were made at the Institute of Biology of the Southern Seas (IBSS) of the National Academy of Sciences of Ukraine. A total of 889 samples have been analyzed and sixty-six species of halocyprid ostracods have been identified (six of them only to the genus status). Unfortunately, because of different reasons, not all halocyprid species are described and illustrated in this book. For forty-one species, a short description, detailed original line drawings and photographs of female and male (only male or female in four species) are given. For the fourteen other species, only carapace outlines are presented. Keys to the subfamilies, tribes, genera and species, and maps and diagrams demonstrating horizontal and vertical occurrence of the described species in the investigated area are also provided. The data on occurrence of halocyprid species at each of the stations during the investigation period and the depth ranges of species found in the analyzed material but not described in the present book are listed in appendices.

MATERIALS AND METHODS

Sampling data

The reported material is based on samples collected within the framework of the Netherlands Indian Ocean Program (NIOP; Project B: Monsoons and pelagic systems; aboard the R/V *Tyro* during the cruise B2 in 1993), the U.S. Joint Global Ocean Flux Study (U.S. JGOFS; aboard the R/V *Thomas G. Thompson* during the cruises TN039, TN043, TN045, TN050 and TN054 in 1994–1995) and the U.S. Global Ocean Ecosystems Dynamics Program (GLOBEC; Arabian Sea Expedition; aboard the NOAA ship R/V *Malcolm Baldrige* during the cruises MB9503 and MB9506 in 1995) in the Northwestern Indian Ocean. Locations of sampling stations are shown in Fig. 1. Pertinent data for the samples are given in Table 1.

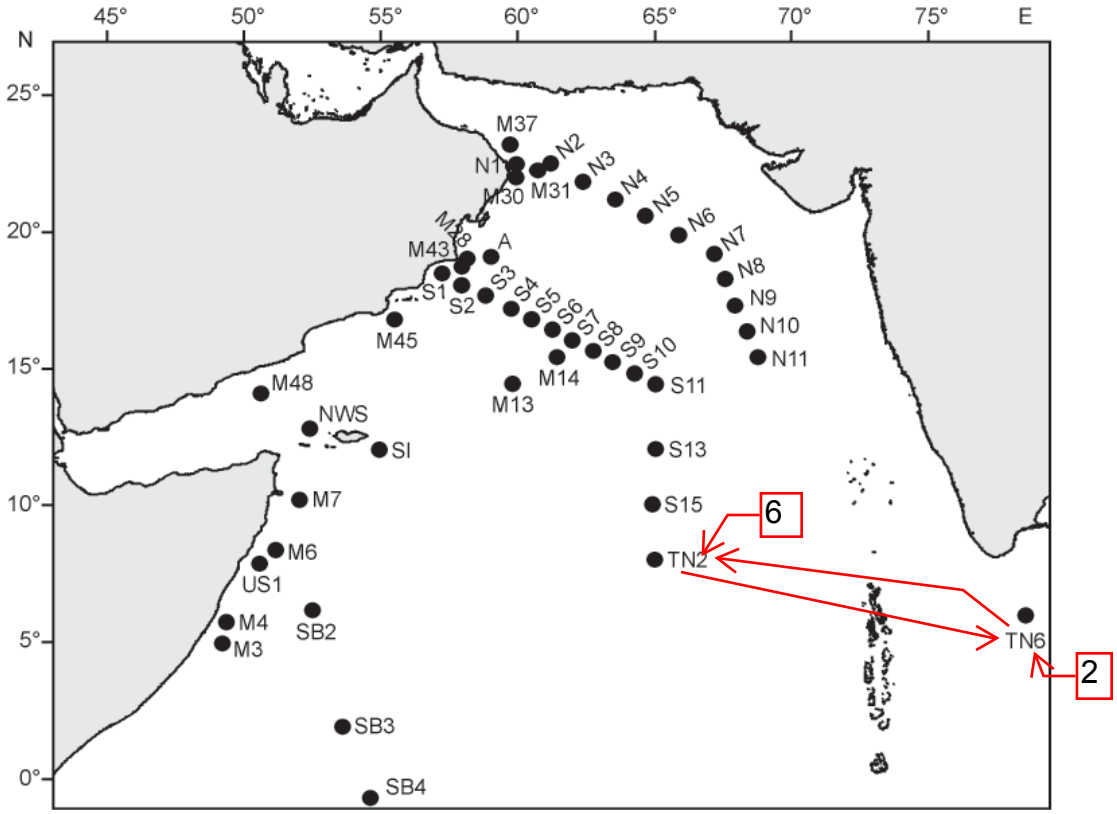


Fig. 1. Locations of sampling stations. Abbreviations are explained in Table 1.

In the NIOP cruise, zooplankton were sampled by a Hydrobios Multinet equipped with nets of mesh size 200 μm (Table 1). In Multinet sampling, target depths were usually 500–200, 200–150, 150–100, 100–50 and 50–0 m. (Baars, 1994).

In the U.S. JGOFS cruises, zooplankton sampling was accomplished using a 1m^2 MOCNESS (Multiple Opening/Closing Net and Environmental Sensing System), a 0.25 m^2 MOCNESS and Bongo nets. The 1m^2-mouth area MOCNESS and 0.6 m-diameter Bongo net frame were fitted with 153 μm mesh nets, while the 0.25 m^2-mouth area MOCNESS was fitted with 64 μm mesh nets. In the 1m^2-mouth area MOCNESS sampling, target depths on the cruise TN039 were usually 1500–1000, 1000–500, 500–300, 300–200, 200–150, 150–100, 100–50 and 50–0 m; on the cruises TN043, TN045, TN050 and TN054 target depths were 1000–900, 900–800, 800–700, 700–600, 600–500, 500–400, 400–300, 300–250, 250–200, 200–150, 150–100, 100–75, 75–50, 50–25 and 25–0 m. Standard sampling depths during the

Table 1. Summary of the sampling data: List of the stations from which material was analyzed.

Cruise / Net type / Net mesh	Station	Standard station	Station symbol in Fig.1	Tow No	Latitude (N)	Longitude (E)	Date (mm.dd)	Local time (start)	Depth of tow (m, max)	Qty of samples
							1993			
Tyro B2 /	SB4		SB4		–01.10	54.54	01.12	17:40	497	4
Multinet /	SB3		SB3		01.90	53.60	01.13	14:45	500	5
200 µm	SB2		SB2		06.26	52.51	01.16	16:00	488	5
	SB2		SB2		06.26	52.51	01.16	19:45	504	4
	US1		US1		07.83	50.56	01.18	19:00	501	5
	US1		US1		07.83	50.56	01.19	06:45	497	5
	SI		SI		12.04	54.95	01.24	15:30	493	5
	SI		SI		12.04	54.95	01.24	19:30	495	5
	NWS		NWS		12.86	52.44	01.26	06:10	494	5
							1994			
TN039 /	2		TN2	1	06.00	78.54	09.23	16:34	997	8
MOCNESS 1m^2 /	6		TN6	2	08.04	64.99	09.26	22:49	1465	8
153 µm	8	S15	S15	3	10.04	65.02	09.27	15:52	1500	8
	10	S13	S13	4	12.09	65.03	09.28	10:52	1492	8
	12	S11	S11	5	14.50	65.01	09.29	05:33	1500	8
	14	N11	N11	6	15.42	68.74	09.30	08:59	1496	8
	16	N9	N9	7	17.36	67.92	10.01	02:19	1500	8
	18	N7	N7	8	19.05	67.00	10.01	17:34	997	8
	18	N7	N7	9	19.04	67.00	10.02	05:43	1000	8
	21	N4	N4	10	21.16	63.50	10.04	04:44	1500	8
	23	N2	N2	11	22.42	61.17	10.05	10:11	1500	8
							1995			
TN043 /	2	N2	N2	1	22.49	61.18	01.09	05:52	102	4
MOCNESS 1m^2 /	7	N7	N7	2	19.15	67.25	01.12	12:12	600	9
153 µm	7	N7	N7	3	19.13	67.16	01.12	23:13	301	7
	11	N11	N11	4	15.48	68.76	01.13	11:44	374	8
	13	S15	S15	5	10.01	64.90	01.17	12:26	294	8
	13	S15	S15	6	10.00	64.90	01.17	22:06	299	8
	17	S11	S11	7	14.45	65.00	01.20	20:35	298	8
	17	S11	S11	8	14.52	65.05	01.21	13:13	299	8
	21	S7	S7	9	16.11	62.10	01.23	21:04	303	8
	21	S7	S7	10	16.10	62.12	01.24	12:13	303	8
	26	S4	S4	12	17.32	59.81	01.27	11:51	298	8
	26	S4	S4	13	17.47	59.87	01.28	22:12	298	8
	27	S3	S3	14	17.82	58.98	01.28	21:44	300	8
	27	S3	S3	15	17.75	58.94	01.29	10:04	297	8
	28	S2	S2	16	18.12	58.09	01.29	21:55	299	8
	28	S2	S2	17	18.14	58.04	01.30	12:28	298	8
TN043 /	2	N2	N2	1	22.48	61.18	01.09	10:00	183	1
BONGO /	4	N4	N4	2	21.19	63.55	01.10	11:33	201	1
153 µm	6	N6	N6	3	19.89	65.89	01.11	12:33	250	1
	9	N9	N9	4	17.30	67.93	01.14	08:09	200	1
	15	S13	S13	5	12.07	64.99	01.19	15:33	288	1
	18	S10	S10	6	14.84	64.25	01.22	10:01	174	1
	19	S9	S9	7	15.28	63.52	01.22	18:32	262	1
	20	S8	S8	8	15.64	62.77	01.23	04:48	268	1
	21	S7	S7	9	16.03	62.02	01.23	16:57	204	1

Table 1 – continued

Cruise / Net type / Net mesh	Station	Standard station	Station symbol in Fig.1	Tow No	Latitude (N)	Longitude (E)	Date (mm.dd)	Local time (start)	Depth of tow (m, max)	Qty of samples
							1995			
TN043 /	24	S6	S6	10	16.43	61.24	01.26	00:28	230	1
BONGO /	25	S5	S5	11	16.80	60.50	01.26	11:31	196	1
153 µm	26	S4	S4	12	17.37	59.80	01.27	18:35	178	1
	27	S3	S3	13	17.70	59.85	01.28	16:33	218	1
	28	S2	S2	14	18.07	57.99	01.30	08:37	214	1
	29	S1	S1	15	18.45	57.32	01.31	17:13	74	1
TN045 /	7	N7	N7	2	19.26	67.05	03.18	11:37	299	8
MOCNESS 1m^2 /	7	N7	N7	3	19.25	67.16	03.18	20:56	299	8
153 µm	13	S15	S15	5	10.08	64.77	03.24	18:11	295	8
	17	S11	S11	6	14.49	64.93	03.26	11:29	295	5
	17	S11	S11	7	14.60	64.99	03.26	22:14	199	6
	21	S7	S7	10	16.06	61.83	03.30	12:21	296	8
	21	S7	S7	11	15.99	62.00	03.31	22:57	200	6
	26	S4	S4	12	17.30	59.82	04.02	12:00	299	8
	26	S4	S4	13	17.25	59.77	04.03	17:50	1008	16
	27	S3	S3	14	17.64	58.91	04.05	23:54	296	8
	28	S2	S2	15	18.07	57.89	04.06	10:42	295	8
	28	S2	S2	16	18.07	57.89	04.06	20:05	1244	15
TN045 /	2	N2	N2	1	22.50	61.17	03.15	09:06	236	1
BONGO /	3	N3	N3	2	21.83	62.40	03.16	01:41	212	1
153 µm	4	N4	N4	3	21.18	63.55	03.16	11:17	246	1
	5	N5	N5	4	20.57	64.67	03.17	02:53	204	1
	6	N6	N6	5	19.88	65.88	03.17	12:25	256	1
	7	N7	N7	6	19.20	67.17	03.19	15:06	212	1
	8	N8	N8	7	18.27	67.57	03.20	03:51	238	1
	9	N9	N9	8	17.30	67.93	03.20	12:03	234	1
	10	N10	N10	9	16.35	68.35	03.21	03:17	216	1
	11	N11	N11	10	15.38	68.75	03.21	13:43	202	1
	15	S13	S13	11	12.07	65.00	03.25	10:58	330	1
	19	S9	S9	12	15.25	63.50	03.29	10:23	206	1
	27	S3	S3	14	17.68	58.83	04.05	07:14	220	1
MB9503 /	3		M3		05.00	49.08	05.04	17:49	1820	8
MOCNESS 1m^2 /	4		M4		05.68	49.41	05.05	11:20	1600	8
153 µm	6		M6		08.43	51.07	05.06	18:26	1100	7
	7		M7		10.20	52.03	05.08	10:18	1810	8
	8		M7		10.18	52.04	05.08	17:47	1430	7
	9		M7		10.01	52.14	05.09	11:07	1220	7
	13		M13		14.53	59.81	05.12	18:06	1990	8
	14		M14		15.53	61.45	05.13	16:56	100	7
	18		M14		15.50	61.43	05.14	10:54	165	8
	19		M14		15.58	61.51	05.14	15:43	162	7
	20		M14		15.55	61.43	05.14	20:34	157	8
	21		M14		15.49	61.46	05.15	01:13	99	8
	22		M14		15.48	61.46	05.15	05:41	156	8
	28		M28		18.91	58.21	05.19	12:12	1290	8
	29		M28		18.91	58.19	05.19	18:37	1210	7
	30		M30		22.00	59.93	05.20	22:18	1010	7

Table 1 – continued

Cruise / Net type / Net mesh:	Station	Standard station	Station symbol in Fig.1	Tow No	Latitude (N)	Longitude (E)	Date (mm.dd)	Time (start)	Depth of tow (m, max)	Qty of samples
							1995			
MB9503 / MOCNESS 1m² / 153 µm	31		M31		22.23	60.72	05.21	06:24	1300	8
	32		M31		22.27	60.74	05.21	22:22	1300	8
	33		M31		22.24	60.72	05.22	14:29	252	6
MB9506 / MOCNESS 1m² / 153 µm	37		M37		23.17	59.74	07.31	22:33	1000	8
	43		M43		18.72	58.00	08.05	10:36	990	8
	45		M45		16.77	55.47	08.06	18:28	1250	8
	46		M45		16.77	55.43	08.07	10:35	1240	8
	48		M48		14.08	50.67	08.08	23:46	1200	8
	49		M48		14.08	50.69	08.09	06:24	1140	8
	54		M14		15.43	61.48	08.16	20:16	151	6
	55		M14		15.44	61.48	08.17	03:55	149	7
	57		M14		15.45	61.59	08.17	15:29	149	8
	60		M14		15.44	61.54	08.18	09:47	148	8
	62	S7	S7		16.00	61.99	08.19	05:55	1210	8
TN050 / MOCNESS 1m² / 153 µm	3	N3	N3	1	21.76	62.37	08.20	08:26	397	8
	7	N7	N7	2	19.09	67.12	08.23	13:00	294	8
	7	N7	N7	3	19.02	67.12	08.23	21:00	300	8
	13	S15	S15	4	09.89	64.80	08.28	12:03	298	8
	13	S15	S15	5	09.90	64.80	08.29	21:35	300	8
	21	S7	S7	8	15.87	61.89	09.04	12:39	290	8
	24	S4	S4	10	17.16	59.76	09.07	12:25	296	8
TN050 / MOCNESS 0.25 m² / 64 µm	7	N7	N7	32	19.18	67.21	08.23	05:19	200	8
	7	N7	N7	33	19.11	67.23	08.23	16:53	200	8
	13	S15	S15	34	09.98	64.89	08.28	15:41	200	8
	13	S15	S15	35	09.95	64.89	08.29	04:25	200	8
	17	S11	S11	36	14.40	64.99	09.01	04:19	200	8
	17	S11	S11	37	14.44	65.00	09.01	15:53	200	8
	21	S7	S7	38	16.01	61.99	09.04	16:27	200	8
	21	S7	S7	39	15.95	61.96	09.05	04:19	200	8
	24	S4	S4	40	17.19	59.76	09.07	16:22	200	8
	24	S4	S4	41	17.15	59.76	09.08	03:25	200	8
	26	S2	S2	42	18.08	58.04	09.10	15:28	200	7
	26	S2	S2	43	18.10	58.07	09.11	03:14	200	8
TN050 / BONGO / 153 µm	2	N2	N2	1	22.51	61.17	08.19	07:59	198	1
	3	N3	N3	2	21.83	62.40	08.20	03:16	262	1
	4	N4	N4	3	21.34	63.56	08.20	21:31	184	1
	5	N5	N5	4	20.56	64.67	08.21	12:25	244	1
	6	N6	N6	5	19.88	65.88	08.22	02:53	228	1
	11	N11	N11	6	15.36	68.73	08.24	02:22	228	1
	15	S13	S13	7	12.05	64.99	08.31	05:10	203	1
	19	S9	S9	8	15.25	63.50	09.03	09:08	245	1
	25	S3	S3	9	17.65	58.87	09.09	14:37	204	1
	27	S1	S1	10	18.51	57.31	09.12	14:46	50	1
	28	extra	A	11	18.64	57.76	09.12	18:32	221	1
	29	extra	A	12	18.89	58.59	09.13	01:15	208	1
	30	Arabesque	A	13	19.01	59.03	09.13	06:35	205	1
	31	extra	A	14	20.39	59.07	09.13	18:04	248	1

Table 1 – continued

Cruise / Net type / Net mesh:	Station	Standard station	Station symbol in Fig.1	Tow No	Latitude (N)	Longitude (E)	Date (mm.dd)	Time (start)	Depth of tow (m, max)	Qty of samples
							1995			
TN054 /	2	N2	N2	1	22.53	61.19	12.01	13:26	295	8
MOCNESS 1m² /	7	N7	N7	2	19.30	67.23	12.04	12:33	299	8
153 μm	7	N7	N7	3	19.32	67.24	12.04	21:22	299	8
	11	N11	N11	4	15.72	68.70	12.07	23:50	51	2
	13	S15	S15	5	10.13	64.97	12.10	10:43	299	8
	17	S11	S11	7	14.56	65.05	12.14	11:07	297	8
	17	S11	S11	8	14.57	65.06	12.14	19:10	300	8
	21	S7	S7	9	16.14	62.07	12.17	19:31	300	8
	21	S7	S7	10	16.14	62.09	12.19	10:41	300	8
	24	S4	S4	11	17.32	59.88	12.20	19:06	300	8
	24	S4	S4	12	17.30	59.90	12.22	06:02	298	8
	26	S2	S2	13	18.14	58.13	12.23	11:14	298	8
	26	S2	S2	14	18.27	58.13	12.23	19:40	300	8
TN054 /	1	N1	N1	1	22.40	59.90	11.30	17:49	157	1
BONGO /	2	N2	N2	2	22.51	61.17	12.01	05:36	221	1
153 μm	4	N4	N4	3	21.19	63.52	12.02	16:47	208	1
	6	N6	N6	4	19.90	65.88	12.03	21:30	155	1
	9	N9	N9	5	17.31	67.93	12.06	20:37	199	1
	11	N11	N11	6	15.39	68.77	12.08	09:59	200	1
	15	S13	S13	7	12.08	65.00	12.13	00:16	212	1
	19	S9	S9	8	15.27	63.50	12.16	20:36	179	1
	25	S3	S3	9	17.68	58.82	12.22	17:46	239	1
	27	extra	A	10	17.79	57.78	12.25	07:23	203	1
	30	S1	S1	11	18.49	57.31	12.26	02:26	89	1

0.25 m²-mouth area MOCNESS tows were 200–150, 150–100, 100–80, 80–60, 60–40, 40–20, 20–10 and 10–0 m. The target depth for all Bongo tows was 200 m.

In the GLOBEC cruises, zooplankton sampling was accomplished using a 1m²-mouth area MOCNESS equipped with 153 μm mesh nets. Target depths on the cruises MB9503 and MB9506 were 250-200, 200-150, 150–100, 100–80, 80–60, 60–60, 50–40, 40–20, 20–10, 10–0 m and 2000–1500, 1500–1250, 1500–1000, 1250–1000, 1000–750, 1000–500, 750–500, 500–300, 300–150, 150–100, 100–50, 50–0 m.

All plankton collections were preserved in a 4% buffered formaldehyde-seawater solution.

Laboratory analysis

The samples were split one to six times, depending on the amount of plankton present, using a Folsom Plankton Sample Splitter at the Rosenstiel School of Marine and Atmospheric Science (RSMAS) in Miami, Florida, USA.

Taxonomic analyses of the samples were made at the Institute of Biology of the Southern Seas (IBSS) of the National Academy of Sciences of Ukraine in Sevastopol. A total of 889 samples have been analyzed (Table 1). For calculation of abundance of the species, in most samples, all the specimens of ostracods, adults and juveniles, were identified and counted. In some samples, only the organisms larger than 1.0–1.5 mm were taken into account in a whole sample; smaller sized individuals were counted in a smaller subsample (most often in 1/5 (20 ml), sometimes in 1/10 (10 ml), part of a sample diluted up to 100 ml) collected by a 5 ml Stempel pipette. Identifications were performed with the aid of Leningrad Optics-Mechanics Company (LOMO) MBR-9 stereomicroscopes using different magnifications depending on the sizes of the individuals being identified.

For anatomical examination, the formalin-fixed specimens of the adult females and males were immersed in a 50:50 solution of glycerine and distilled water on glass slides, then measured and dissected. All these operations were made with the use of a LOMO MBR-9 stereomicroscope.

All line drawings were made from glycerine-mounted specimens using a camera lucida on a Leica DM LS2 compound microscope. In the illustrations, some minor details, such as hair and spinules that are not referred to in the species descriptions, are often omitted, and some structures, such as long setae, that are difficult to show in their entirety are only partly illustrated.

Photographs were made with a Canon PowerShot A520 camera. Most halocyprid ostracods have delicate, transparent carapaces and a dark body inside. The specimens of some species were stained by a solution of 1% chlorazol black E (SBE) dissolved in 70% ethanol to provide a better image of the carapace margins.

Taxonomic identification of the halocyprid species is based mainly on the following taxonomic papers and monographs: Angel (1969a, b; 1970; 1971; 1981; 1982; 1999), Chavtur & Angel (2011), Chavtur & Stovbun (2003; 2008a, b), Deevey (1968a; 1970; 1974; 1978; 1982), Deevey & Brooks (1980), Ellis (1984), George (1979), Gooday (1981), Kock (1992), Martens (1979), Müller (1906), Poulsen (1969b; 1973), Skogsberg (1920).

Data analysis: Maps and diagrams

The maps demonstrating horizontal occurrence of every described species are based on the data of all the samples that have been analysed (i.e., 889 samples).

The diagrams showing vertical occurrence of every described species are based on the data of all the stratified tows (110 tows, excluding Bongo sampling; see Table 1). Since target sampling depths varied in the different cruises, the following layers, more or less appropriate to standard ones, were used in the diagrams: see Table 2. In the second column of the table, the numbers of tows through the corresponding layers during the investigation period are presented. For example, the layer 50–100 m was sampled in all 110 tows listed in Table 1. Each diagram shows the vertical distribution of the number of records of a species as a percentage of the total number of tows in the corresponding layers. The deeper layers were less sampled, and the corresponding data were less representative than from the upper layers.

Table 2. The total numbers of tows in the corresponding layers used in the analysis of vertical occurrence of the described species.

Layer, m	Number of tows in the corresponding layer
0–50	107
50–100	110
100–150	106
150–200	99
200–250	85
250–300	83
300–500	43
500–750	32
750–1000	32
1000–1250	19
1250–1500	13

MORPHOLOGY OF THE HALOCYPRID OSTRACODS

The most detailed description of the morphology and functions of the appendages of halocyprid ostracods can be taken from Skogsberg (1920), Iles (1961), Angel (1999), and also the web-Atlas of Atlantic Planktonic Ostracods (Angel et al., 2008). In the present book, the brief description of the morphology and the main taxonomic characters of the ostracods belonging to the family Halocyprididae are based heavily on these sources in addition to our own observations of large number of individuals from collections made in the Arabian Sea Region in the 1990s (Table 3). Also, the new notions of morphology of the fifth and sixth limbs are used in the descriptions of these appendages (Kornicker, 2003).

The members of the subfamily Conchoeciinae, having the largest number of species, are represented here as the example of halocyprid morphology.

The ostracod body is entirely inside a **bivalve carapace** (Figs 2, 3). The dorsal margins of both carapace valves are joined, and this hinged part of the margin is straight. This is one of the main distinctive characters of the family. Anteriorly, the carapace is developed into the rostrum. The shapes of carapaces, the absence or presence of the varying spines, tubercles and sculptures on the carapace surface are important features used in defining the species and genera of the halocyprids.

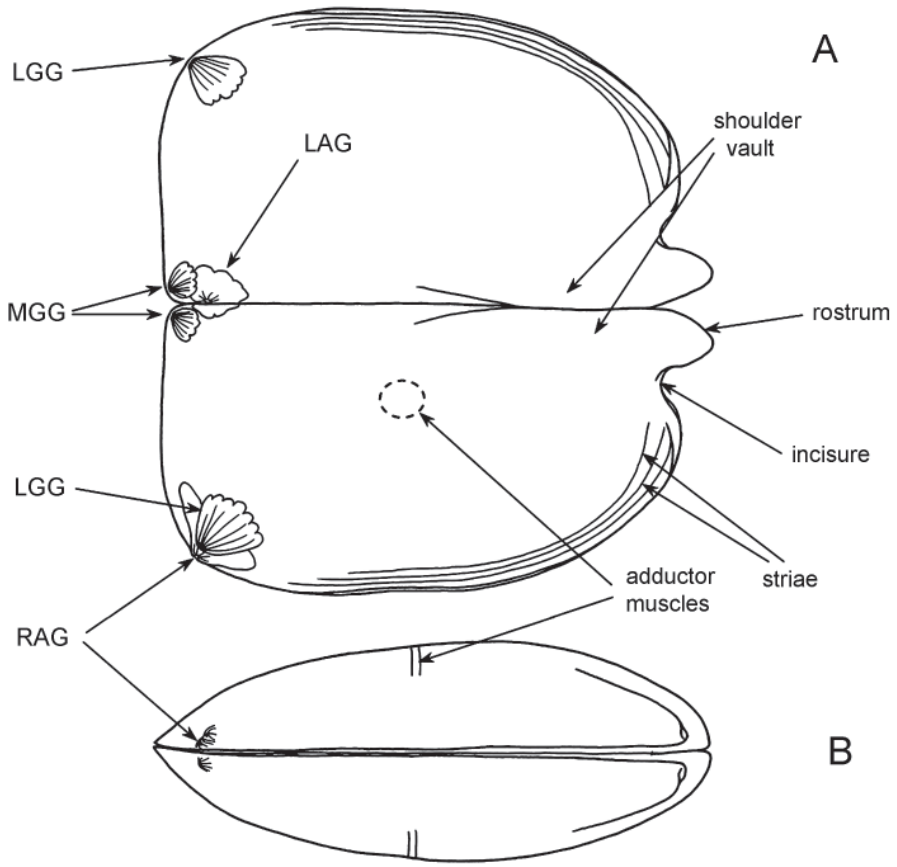


Fig. 2. **Carapace** of a halocyprid ostracod. **A** – both valves outside; **B –** ventral.
RAG **–** right asymmetrical gland; LAG **–** left asymmetrical gland; LGG **–** group of lateral glands; MGG **–** group of male glands. Modified from Angel (1999).

Along the free margins of the carapace there are many glandular cells. Some of them are united in more or less large groups (Fig. 2). First of all, in the Conchoeciinae there are two groups of glands located on each carapace valve asymmetrically, the **left** and **right asymmetrical glands** (**LAG** and **RAG**). In the Euconchoeciinae and Archiconchoeciinae these glands are

placed symmetrically (*Euconchoecia*: Pl. 79C) or almost symmetrically (*Archiconchoecia*: Pl. 1D) on both valves but the names "LAG" and "RAG" are used in these cases too. The main feature of these compound glands is that all their glandular cells have a common pore (opening). All ostracods of the family Halocypprididae have LAG and RAG, and locations of these glands are very important taxonomic characters. In most species the left asymmetrical gland opens on the dorsal margin of the left carapace valve near the posterior dorsal corner. In some species it is more or less moved forward along the dorsal margin, and can open even on the rostrum (*Nasoecia*: Pl. 77D). The usual position of the right asymmetrical gland is nearly to the posterior ventral corner of the right carapace valve, but in some cases it is moved forward along the ventral margin and can open even on the anterior margin below the rostral incisure (*Conchoecilla*: Pls 3A, 20A).

In addition to the LAG and RAG there are other groups of glands, the **lateral gland groups** (**LGG**) and the **male gland groups** or medial-dorsal glands (**MGG**). These groups of glands have essential distinctions from the asymmetrical glands. Each glandular cell in an LGG or MGG group has a single opening located close to others. Also, LGG and MGG are usually placed symmetrically on each carapace valve. In the tribe Conchoeciini of subfamily Conchoeciinae, all males have MGGs which are always located on the posterior margins of valves just below posterior dorsal corners. LGGs are usually opening either on the posterior margins of the carapace below the posterior dorsal corners or near the posterior ventral corners. The right ventral LGG is placed either on the posterior margin just above the RAG or just over RAG (as in Fig. 2). Some species have both dorsal and ventral LGGs. The locations of the different kinds of glands are important taxonomic characters.

The ostracod body has an unpaired frontal organ, seven paired appendages, and an unpaired copulatory appendage in males. The body ends in the caudal furca. In contrast to myodocopids the eyes are always absent on the body of halocyprid, and this is one more important distinctive feature of the family.The arrangement of the appendages within the carapace of the adult halocyprid ostracod is shown in Fig. 3.

The **frontal organ** (**FO**) (Figs 3, 4) is an unpaired appendage that is placed between the right and left antennules. In most cases, the frontal organ is sexually dimorphic. Usually it has two parts, stem and capitulum; in some species (usually in females) FO with no clear division on stem and capitulum (for example, as in *Discoconchoecia discophora* in Pl. 24D).

The **first antennae** or antennules (**An1**) (Figs 3, 4) are uniramous and sexually dimorphic. Two terminal segments bear long setae. The number of setae is varied in different subfamilies. In species of the subfamily Conchoeciinae, there are five terminal setae. Some of them are thin-walled and always bare, and named "sensory setae". The female has four sensory setae (a- to d-setae), the male only two (a- and c- setae). Other setae may carry different spines, hairs or teeth, or none of these. The lengths and armature of setae are important in the taxonomic analysis. The second segment of first antenna has, always in males and often in females, a dorsal seta. In males this seta is hook-like and turned around the frontal organ.

The **second antennae** or antennae (**An2**) (Figs 3, 5) are biramous. Each antenna has a very large protopodite (usually larger in males) with powerful muscles that provide the basic function of the second antennae, swimming. The exopodite has one elongated segment and eight short segments (Fig. 5B); each short segment has a long plumose swimming seta; the terminal exopodite segment usually has two additional shorter setae. The endopodite is placed on the inner side of the protopodite disto-ventrally (Fig. 5A); it is strongly sexually dimorphic. In the Conchoeciinae the basal segment of the endopodite usually is similar in both sexes: flattened, broad, and with two processes on the anterior side. The distal process bears two relatively short setae (a- and b- setae). The proximal one, so named "processus mamillaris", has a conical shape and no setae. In the males the endopodite is

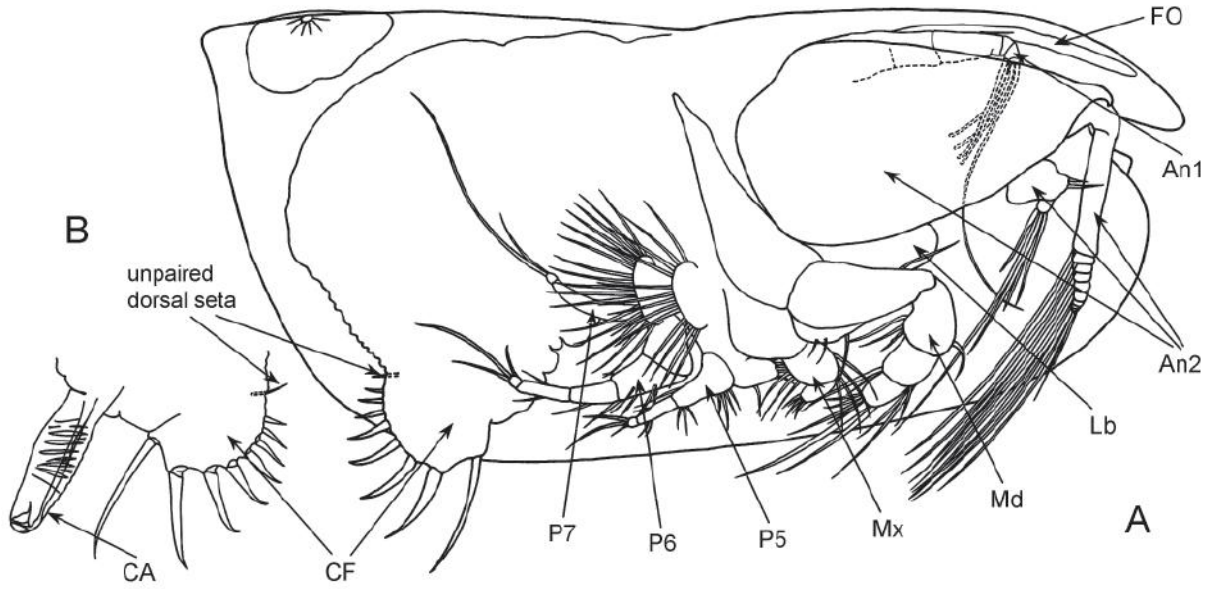


Fig. 3. **Arrangement of the appendages** within the carapace of the adult halocyprid ostracod. **A** – female without right valve of carapace; **B** – posterior part of the male body.
FO – frontal organ; An1 – first antenna; An2 – second antenna; Lb – labrum; Md – mandible; Mx – maxilla; P5 – fifth limb; P6 – sixth limb; P7 – seventh limb; CF – caudal furca; CA – copulatory appendage.

three-segmented (Fig. 5C). The second segment is furnished with five setae: c- and d- setae are usually rather short (sometimes one of them is far longer than other, as in Fig. 5C), e-seta is extremely short, f- and g- setae are the longest. The third segment usually with a hook-like appendage named “hook appendage” or “clasping organ” (“clasper”). Right hook appendage is usually larger than left. There are three setae (h- to j-) near the base of hook appendage which are always shorter than f- and g- setae. In the females these three setae represent the third segment that is fused with the second (Fig. 5A: Enp2+3); c- and d- setae are usually absent (except in rare cases); e-seta is always absent; f- and g- setae are usually relatively shorter than in the males.

The **labrum** or upper lip (**Lb**) (Figs 3, 6) is located in front of the mouth between the antennal protopodites. The posterior edge of the hyaline membrane is useful in defining the species and genera. Also, our observations show that the outline of the labrum’s dorsal projection (Fig. 6A) can be used as one of the distinctive characters of a species or genus.

The **mandibles** (**Md**) (Figs 3, 7A, B) demonstrate slight sexual dimorphism. In the male, the basis of the mandible is usually more elongated than in the female. Also, the dorsal seta on the first segment of the male’s endopodite is often plumose, but in the female it is non-plumose. The protopodite of the mandible has well-developed coxal and basal segments; ventrally the coxa and the basis form the endites with toothed edges. Besides the toothed edge, the coxal endite has two toothed plates, named “distal and proximal tooth-lists”, and a masticatory pad. All these structures are used in the grinding of food items. Poulsen (1973) has used these in taxonomic analyses, but in many species they are difficult to distinguish due to their extremely small size. In this book these structures were not used in the descriptions of species, while there are drawings of these in some species (for example, in Pls 8I, 10J). The mandible’s exopodite usually is reduced to a small peg with a long plumose seta. The endopodite is well developed. Its first segment carries from one to four ventral setae, and the numbers and lengths of these setae are important taxonomic characters. Also, the relative length of the longest terminal seta is a useful taxonomic feature.

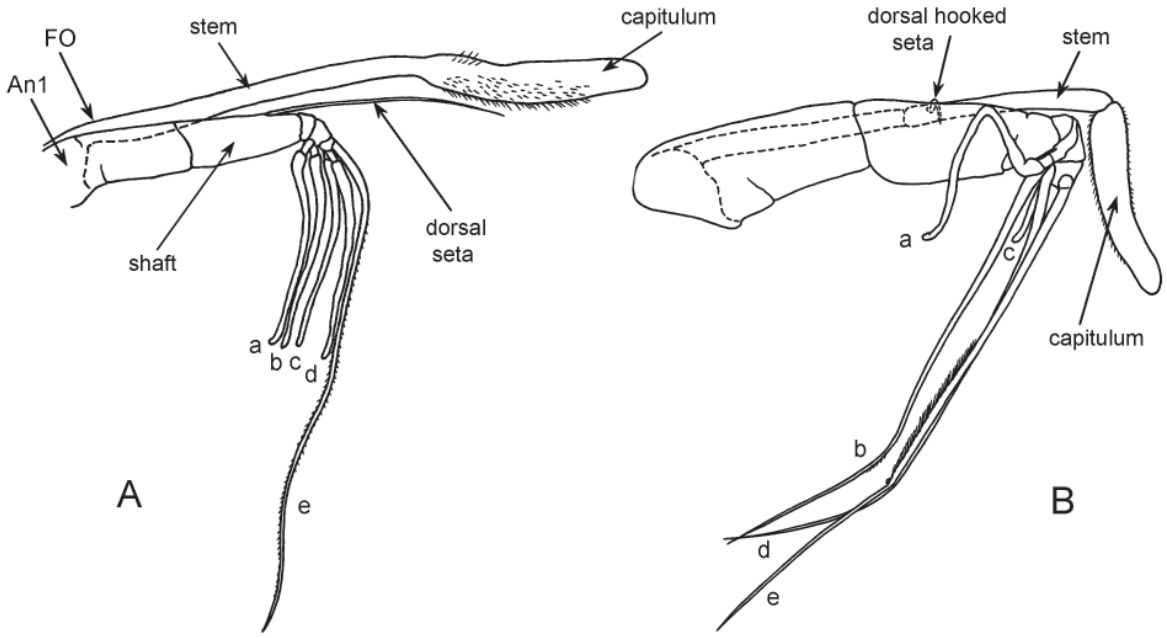


Fig. 4. Limbs of the halocyprid ostracods: **frontal organ** (FO) and right **first antenna** (An1). **A** – female; **B** – male. a–e – nomenclature of setae.

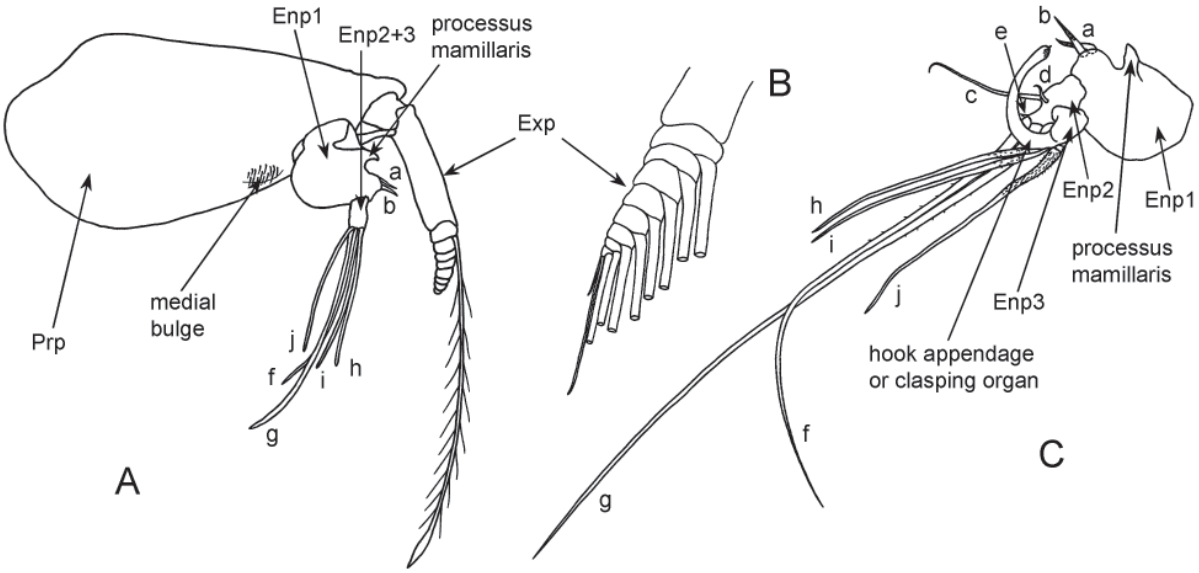


Fig. 5. Limbs of the halocyprid ostracods: **second antenna**. **A** – female, left An2 inside; **B** – distal part of Exp; **C** – male, right Enp.
Prp – protopodite; Exp – exopodite; Enp1–3 – segments of endopodite; Enp2+3 – fused 2nd and 3rd segments of endopodite; a–j – nomenclature of setae.

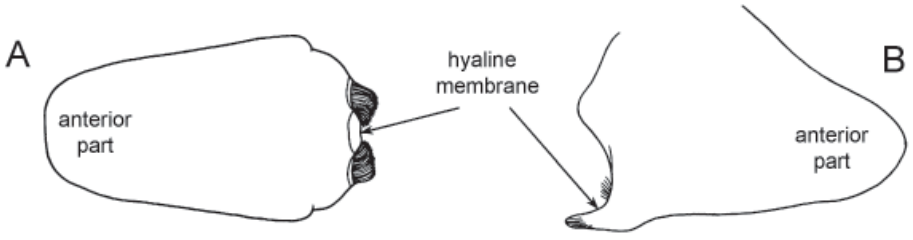


Fig. 6. **Labrum**. **A** – dorsal projection; **B** – lateral projection.

The **maxillae** (**Mx**) (Figs 3, 7C) are uniramous, not sexually dimorphic, and only slightly variable among the different genera. The endopodite has only two segments. Main taxonomic characters are: the number of setae on anterior side of the first segment, a seta on maxilla's basis and its armature, the spines near distal edge of first endopodite segment.

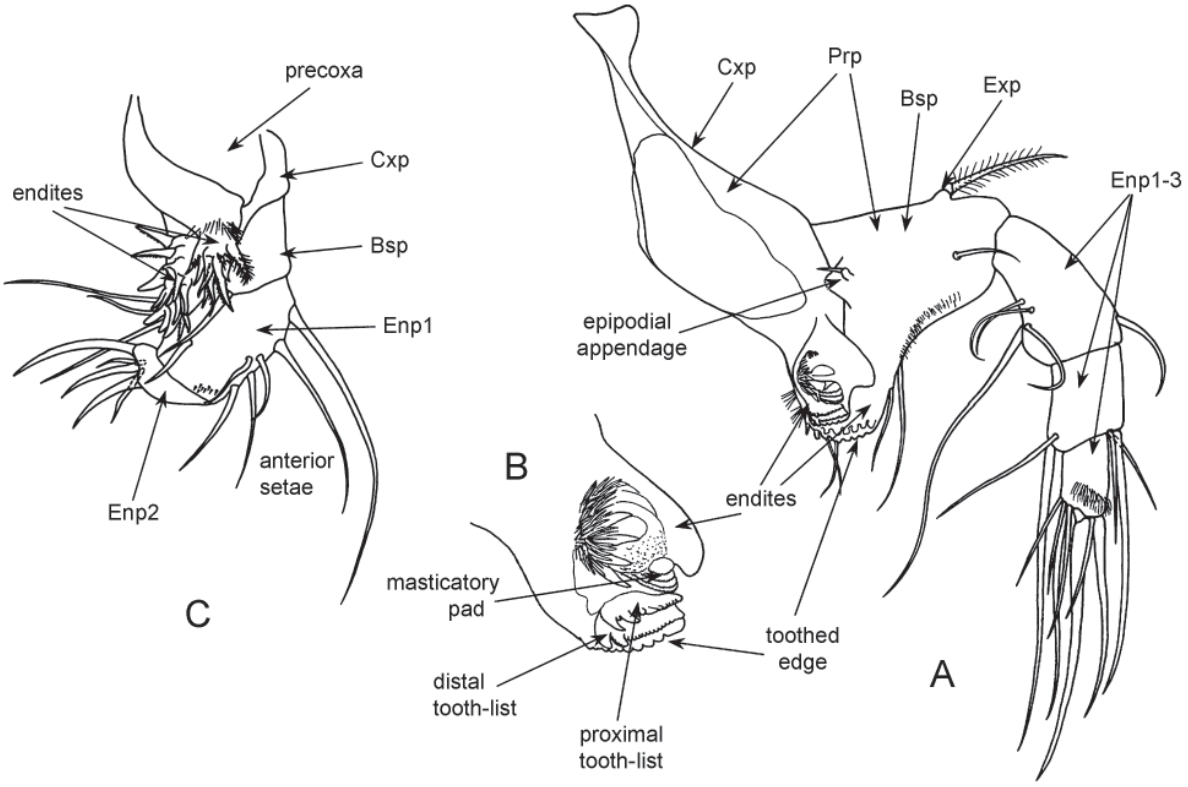


Fig. 7. Limbs of the halocyprid ostracods. **A –** left **mandible** inside; **B** – coxal endite (higher magnification). **C –** left **maxilla** inside.
Cxp – coxa; Bsp – basis.

The **fifth limbs** (**P5**) (Figs 3, 8A) show a little sexual dimorphism. The exopodite is represented by a single, long, usually non-plumose seta (Kornicker, 2003). The endopodite two-segmented. The following main characters are useful in defining the species and genera: number of setae in proximal and distal groups on the ventral side of the basis; the relative lengths of endopodite terminal setae; the number of setae which are located more or less close to the end of slightly prolonged antero-ventrally part of third coxal endite (ventral group of setae, Fig. 8A). The fifth limb has an epipodite with three groups of setae: usually the proximal group has four long plumose setae, the medial group has five setae, and the distal group has four long setae and one additional short non-plumose seta. But in some cases the number of setae in groups can be different (for example, in Fig. 8A medial group has six setae).

The **sixth limbs** (**P6**) (Figs 3, 8B, C) are strongly sexually dimorphic in the Conchoeciinae. The endopodite is three-segmented in both sexes. The basis is smaller in female, and usually has five ventral setae, a dorso-lateral seta and a dorsal (disto-dorsal) seta. The latter is a vestige of exopodite (Kornicker, 2003). All these setae and setae on the first and second endopodite segments are often reduced in males. On the contrary the male terminal segment has very long setae that protrude beyond the posterior margin of the carapace, usually near the male gland groups. These setae are usually plumose, but in some cases one of them is thinner and without long hairs (as in *Conchoecissa plinthina* in Pl. 23R). The female has three relatively short, claw-like terminal setae. The sixth limb has epipodite with three groups of setae, as in the fifth pair of limbs, but these groups usually have five, five and six long plumose setae in the each group.

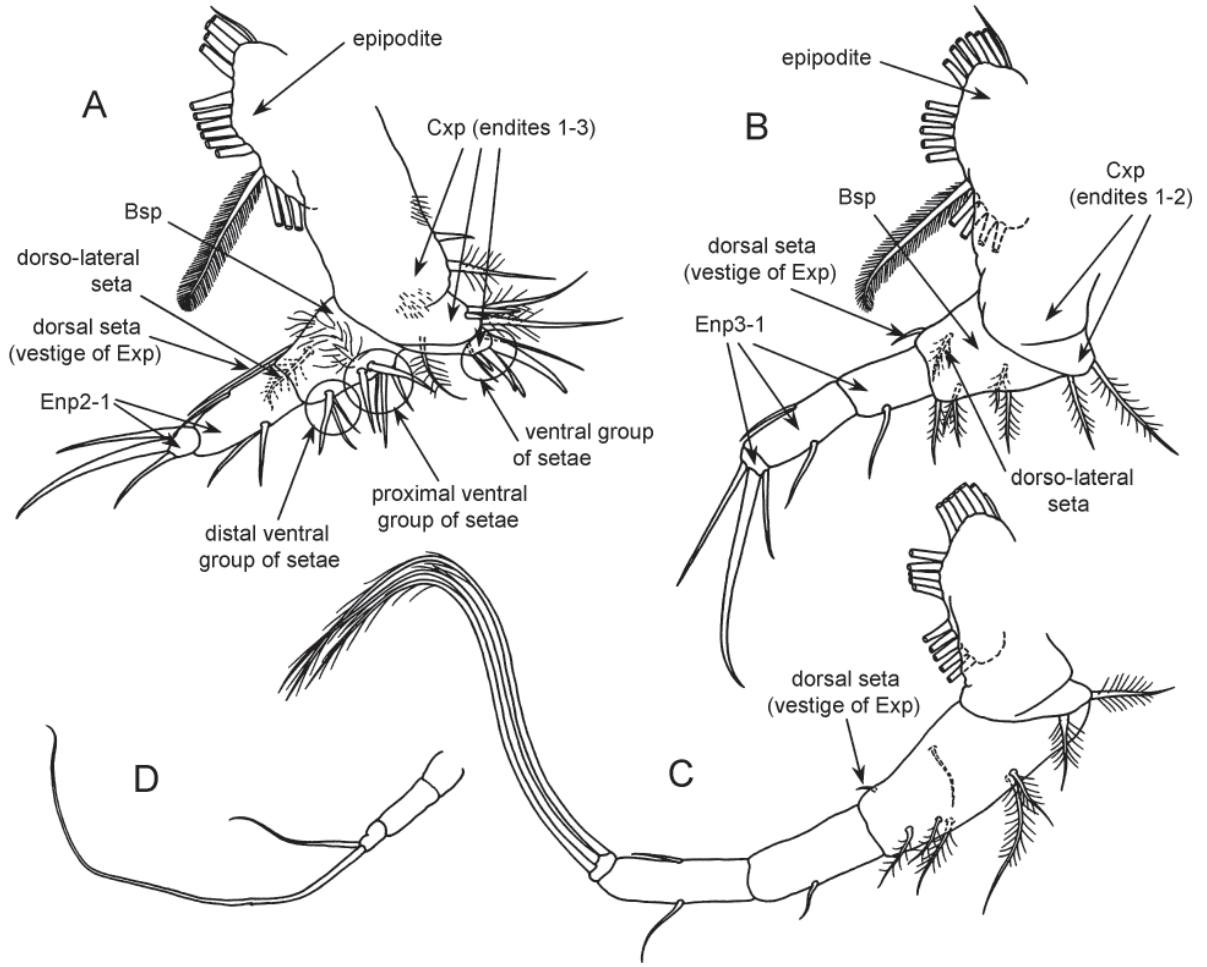


Fig. 8. Limbs of the halocyprid ostracods. **A** – left **fifth limb** inside. Left **sixth limbs** inside: **B –** female; **C** – male. D **– seventh limb**.

The **seventh limbs** (**P7**) (Figs 3, 8D) are strongly reduced, having two or three segments. The terminal segment usually bears two setae in which one is longer than the other.

The **caudal furca** (**CF**) (Fig. 3) of adult specimens consists of two plates each with 6–8 claws (always eight claws in the Conchoeciinae). In many species, behind the claws there is an unpaired dorsal seta. The number of claws is usually the distinctive character of the juvenile instars. A new pair of claws is added at each instar.

The main distinctive character of the adult males is the presence of a **copulatory appendage** (**CA**) (Fig. 3B). It is an unpaired flattened structure which is located near the base of the caudal furca on the left side of ostracod's body. In the males of all species described in this book, the copulatory aappendages are always viewed from their left side, as in Fig. 3B.

ABBREVIATIONS

used in the descriptions, figures and keys

L – carapace length

H – carapace height

H_{ant} – height of anterior half of carapace

H_{post} – height of posterior half of carapace

LAG – left asymmetrical gland

RAG – right asymmetrical gland

MGG – group of male (medial-dorsal) glands

LGG – group of lateral glands

PDC – posterior dorsal corner of carapace

PVC – posterior ventral corner of carapace

FO – frontal organ

An1 – first antenna (antennula)

An2 – second antenna (antenna)

Lb – labrum (upper lip)

Md – mandible

Mx – maxilla

P5 – fifth limb

P6 – sixth limb

P7 – seventh limb

CA – copulatory appendage

CF – caudal furca

Prp – protopodite

Cxp – coxa (coxale, coxopodite); Cxp1–3 – coxal endites

Bsp – basis (basale, basipodite)

Exp – exopodite

Enp – endopodite; Enp1–3 – segments of endopodite

N – number of individuals

SYSTEMATIC ACCOUNT [1]

Kingdom	**Animalia**
Philum	**Arthropoda**
Subphilum	**Crustacea** Brünnich, 1772
Class	**Ostracoda** Latreille, 1802
Subclass	**Myodocopa** Sars, 1866
Order	**Halocyprida** Dana, 1853
Suborder	**Halocypridina** Dana, 1853
Superfamily	**Halocypridoidea** Dana, 1853
Family	**Halocyprididae** Dana, 1853

Table 3. Total list of halocyprid species identified in the investigated region with their size and abundance characteristics.

Taxon	L (mm)		N (ind.)		
	females	males	females	males	juveniles
Subfamily **Archiconchoeciinae** Poulsen, 1969					
Archiconchoecetta bispicula (Deevey, 1978)	0.94–0.97	0.80	2	3	16
Archiconchoecia (*A.*) *striata* Müller, 1894*	0.50–0.59	0.52–0.64	8033	5354	24350
Archiconchoecinna cuneata (Müller, 1908)	–	0.80	0	1	0
Archiconchoecissa cucullata (Brady, 1902)	1.75–1.98	1.60–2.08	14	9	104
Subfamily **Conchoeciinae** Müller, 1912					
Tribe **Conchoeciini** Chavtur & Angel, 2011					
Alacia alata (Müller, 1906) *	2.01–2.36	1.73–2.08	80	104	822
Alacia leptothrix (Müller, 1906) *	3.30–3.35	–	2	0	0
Conchoecetta acuminata Claus, 1890 *	2.74–2.91	2.08	2	1	13
Conchoecetta giesbrechti (Müller, 1906) *	1.77–2.45	1.58–2.05	1085	1377	11679
Conchoecia lophura Müller, 1906 *	2.55–2.72	2.08–2.45	14	12	191
Conchoecia macrocheira Müller, 1906 *	–	3.10	0	1	7
Conchoecia magna Claus, 1874 *	1.56–1.87	1.46–1.65	407	470	5244
Conchoecilla daphnoides Claus, 1890 *	3.30–3.77	2.22–2.36	5	10	35
Conchoecissa imbricata (Brady, 1880) *	2.78–3.02	2.55–2.64	2	3	32
Conchoecissa plinthina (Müller, 1906) *	5.28	4.53–4.83	1	2	8
Conchoecissa symmetrica (Müller, 1906)	3.68	–	1	0	5
Discoconchoecia discophora (Müller, 1906) *	1.23–1.42	1.08–1.23	443	290	1588
Discoconchoecia aff. *elegans* (Sars, 1865) *	1.18–1.37	1.22–1.28	22	14	94
Discoconchoecia tamensis (Poulsen, 1973) *	0.97–1.18	1.04–1.18	2725	1355	15200
Loricoecia loricata (Claus, 1894) *	1.60–1.84	1.46–1.60	18	15	45
Macroconchoecia caudata (Müller, 1891) **	–	2.91(5.65***)	0	1	8
Mikroconchoecia curta s.l. (Lubbock, 1860) *	0.75–0.94	0.71–0.92	188	249	2129
Mikroconchoecia stigmatica (Müller, 1906) *	0.94–1.04	1.07–1.13	7	7	9
Mollicia acanthophora (Müller, 1906) **	2.97–3.16	2.88	3	1	0
Mollicia mollis (Müller, 1906)	3.16–3.21	2.59–2.92	2	3	3
Orthoconchoecia atlantica (Lubbock, 1856) *	3.07–3.73	3.07–3.54	112	134	834
Orthoconchoecia bispinosa (Claus, 1890)	1.84–2.08	1.65	3	1	10
Orthoconchoecia secernenda (Vavra, 1906)	2.26–2.31	–	3	0	406
Orthoconchoecia striola s.s. (Müller, 1906) *	2.12–2.48	1.98–2.26	32	50	

[1] Classification from WoRMS (http://www.marinespecies.org/aphia.php?p=taxdetails&id=2) (high taxa) and (Angel et al., 2008).

Table 3 – continued

Taxon	L (mm)		N (ind.)		
	females	males	females	males	juveniles
Paraconchoecia allotherium (Müller, 1906) *	1.51–1.70	1.42–1.51	19	21	****
Paraconchoecia cophopyga (Müller, 1906) **	–	3.10	0	1	0
Paraconchoecia echinata (Müller, 1906) *	1.89–2.06	1.65–1.79	17	14	42
Paraconchoecia inermis Claus, 1890 *	1.96–2.15	1.87–2.03	6	2	5
Paraconchoecia mamillata (Müller, 1906) **	1.60–1.79	1.42–1.58	16	10	45
Paraconchoecia oblonga Claus, 1890, form A *	1.51–1.77	1.32–1.44	16	26	120
Paraconchoecia oblonga Claus, 1890, form B *	1.65–1.75	1.42–1.51	6	9	
Paraconchoecia spinifera Claus, 1890 **	1.89–2.03	1.92	5	1	33
Paramollicia dichotoma (Müller, 1906) *	2.17–2.45	1.84–1.93	11	7	15
Platyconchoecia prosadene (Müller, 1906) *	2.36–2.78	2.06–2.29	12	56	505
Porroecia parthenoda (Müller, 1906) *	1.54–1.77	1.42–1.60	56	31	350
Porroecia porrecta (Claus, 1890) *	1.23–1.51	1.13–1.32	2469	2247	13400
Porroecia spinirostris (Claus, 1874) *	1.07–1.23	0.92–1.07	109	71	420
Proceroecia brachyaskos (Müller, 1906) *	1.23–1.32	1.08–1.16	16	23	34
Proceroecia brachyaskos (Müller, 1906), deep form	1.46–1.56	1.27	3	1	4
Proceroecia decipiens (Müller, 1906) *	1.32–1.58	1.13–1.30	462	442	3459
Proceroecia macroprocera (Angel, 1971) *	1.23–1.35	1.11–1.23	166	195	51100
Proceroecia microprocera (Angel, 1971) *	0.90–1.08	0.83–0.97	13800	9100	
Proceroecia procera (Müller, 1894) *	1.10–1.21	0.99–1.08	106	75	
Pseudoconchoecia concentrica (Müller, 1906) *	1.23–1.51	1.18–1.46	314	223	2124
Tribe **Metaconchoeciini** Chavtur & Angel, 2011					
Clausoecia pusilla (Müller, 1906) *	0.75–0.96	0.71–0.87	324	205	1039
Kyrtoecia kyrtophora (Müller, 1906) *	0.78–0.85	0.74–0.83	61	59	140
Metaconchoecia spp. 1+2 **	0.94–1.18	0.94–1.18	1734	1236	4760
Metaconchoecia sp. 3 **	0.81–0.92	0.80–0.92	1596	1172	4750
Muelleroecia macromma (Müller, 1906)	0.94	–	1	0	2
Muelleroecia sp. 1 **	0.94–1.04	0.88–0.99	78	67	154
Muelleroecia sp. 2 **	1.27–1.35	1.23–1.27	5	2	7
Nasoecia nasotuberculata (Müller, 1906) *	0.80–0.90	0.75–0.85	41	25	161
Subfamily **Euconchoeciinae** Poulsen, 1969					
Bathyconchoecia sp. (L 0.75–0.85 mm)	–	–	0	0	2
Euconchoecia cf. *aculeata* (Scott, 1894) *	0.85–1.08	0.85–0.99	5158	2604	71660
Euconchoecia aff. *aculeata elongata* Müller, 1906 *	1.11–1.60	1.02–1.30	7946	5158	
Euconchoecia cf. *chierchiae* Müller, 1891 *	1.23–1.51	1.23–1.35	21	10	183
Subfamily **Halocypridinae** Claus, 1890					
Fellia bicornis (Müller, 1906) **	1.91	–	1	0	4
Fellia cornuta (Müller, 1906)	3.02	–	1	0	0
Halocypris inflata (Dana, 1849) **	1.42–1.70	1.27–1.49	27	60	417
Halocypris pelagica Claus, 1890 **	1.23–1.35	1.08–1.18	4	11	
Halocypria globosa Claus, 1874 **	2.22	1.75–1.84	1	2	35

* species described and illustrated in this book;

** species in which only the carapace outlines are presented herein;

*** L with rostral and dorsal spines;

**** juveniles of *P. allotherium* were considered together with those of *P. oblonga*.

Family **Halocyprididae** Dana, 1853

The family Halocyprididae is divided into five subfamilies (Angel, 1999). The members of four subfamilies have been found in the investigated material: Archiconchoeciinae Poulsen, 1969; Conchoeciinae Müller, 1912; Euconchoeciinae Poulsen, 1969 and Halocypridinae Claus, 1890 (Table 3, Appendices 1, 2).

Key to the four subfamilies of **Halocyprididae** *:

1	Terminal segments of An1 with 6 and more setae	2
1a	Terminal segments of An1 with 5 setae	3
2	Terminal segments of An1 with 6 setae (as in Pl. 1E)	**Archiconchoeciinae**
2a	Terminal segments of An1 with 20–30 (as in Pl. 79E) or more than 100 sensory and other setae	**Euconchoeciinae**
3a	FO and An1 exhibit sexual dimorphism (Fig. 4); An2 Enp1 with a tubercle (processus mamillaris) on its anterior margin (Fig. 5)	**Conchoeciinae**
3 a	FO and An1 are similar in both sexes; An2 Enp1 without processus mamillaris	**Halocypridinae**

Subfamily **Archiconchoeciinae** Poulsen, 1969

After the revision made by Chavtur & Stovbun (2003) the subfamily Archiconchoeciinae, which earlier than 2003 was monogenetic, has been divided into seven genera and two subgenera.

The members of four genera have been found in the analyzed material: *Archiconchoecetta* Chavtur & Stovbun, 2003; *Archiconchoecia* Müller, 1894; *Archiconchoecinna* Chavtur & Stovbun, 2003 and *Archiconchoecissa* Chavtur & Stovbun, 2003 (Table 3, Appendices 1, 2).

Only one of these genera, *Archiconchoecia*, is represented herein. For descriptions of the remaining genera and also their members listed in Table 3, see Chavtur & Stovbun (2003) and Deevey (1968a, 1978).

Genus ***Archiconchoecia*** Müller, 1894

Small species (0.50–0.85 mm) with carapaces having characteristic shape: posterior and ventral margins strongly arched especially in females; there is a distinct notch on each of the valves mid-dorsally. RAG and LAG placed on the upper half of the posterior margin (Chavtur & Stovbun, 2003).

Subgenus ***Archiconchoecia* (*Archiconchoecia*)** Chavtur & Stovbun, 2003

Carapace less than 0.7 mm, rostrum small, rostra incisure absent, hook appendages on the male An2 with pointed tips (Chavtur & Stovbun, 2003).

Only *A.* (*A.*) *striata* Müller, 1894 has been found in the analyzed material (Table 3, Appendix 2).

* Herein and in all remaining keys, the underlined words refer to the halocyprid body parts whose characters are used in the identification of taxa.

Archiconchoecia (*Archiconchoecia*) *striata* Müller, 1894

(Pict. 1; Pls 1, 2; Figs 9, 10)

For synonymy before 1906, see Müller, 1906a.
Archiconchoecia striata: Müller, 1906a, p. 45, pl. VII figs 13–17; Deevey, 1968a, p. 23, fig 4; George, 1979, p. 123, figs 1–15; Martens, 1979, p. 309, fig. 4; Angel, 1999, pp. 819, 836, fig. 9.15.
Archiconchoecia (*Archiconchoecia*) *striata*: Chavtur & Stovbun, 2003, p. 145, 156.

Pict. 1. ***Archiconchoecia* (*Archiconchoecia*) *striata***. **A** – female; **B** – male.

Females. L = 0.50–0.59 mm (0.55 ± 0.01 mm; N = 460); H/L = 67.5 ± 2.4% (N = 20).

Plate 1**A**–**N**. Carapace (**A**–**D**): posterior and ventral margins strongly arched; there is a distinct notch on each of valves mid-dorsally; rostrum short; both asymmetrical glands open on posterior margin: RAG at approximately 1/3 of H from dorsal margin, LAG somewhat closer to PDC; surface of carapace with concentric striation and covered with rare hairs. FO (**E**, **F**): short; undifferentiated on stem and capitulum; its tip usually rounded, with tiny papilla. An1 (**E**): 6-segmented (George, 1979; Chavtur & Stovbun, 2003) but no clear differentiation between 2nd and 3rd segments in Arabian Sea specimens; 2nd segment has long, spinose dorsal seta, and ventrally a row of long hairs directed distally; two terminal segments bear 6 equall in lenght sensory setae with pointed tips and without any spines. An2 (**G**–**I**): inner surface of Prp bare; Exp1 with tiny hairs on its anterior side; long seta on Exp2 about 1.5 times longer than Prp; End1 with distinct short spines on its posterior side, and with curved, rather long a- and b- setae; typical processus mamillaris absent but in its place there is a small swelling; all setae on Enp2+3 about equal. Lb (**J**): dorsal projection almost round with 2 rounded processes anteriorly; hyaline membrane with almost straight edge. Md (**K**): Bsp shortened; Exp not developed, in its place usually there are 2 plumose setae, sometimes 1 (or 1 seta on right Md and 2 setae on left one); Enp1 has non-plumose dorsal seta and 2 ventral setae. Mx (as in male in Pl. 2K): Bsp with a short single seta furnished with a few long hairs near its base; Enp1 has 6 setae on anterior side (5 of them plumose), 3 setae on posterior side (one of them plumose), 1 laterally, and long hairs near distal edge; Enp2 with 5 setae and long hairs disto-ventrally. P5 (**L**): Cxp3 with 6 setae (one of them plumose, placed a little away from others) in ventral group; Bsp with 4 setae in proximal ventral group (one of them plumose), 1 seta in distal ventral group, 1 plumose dorso-lateral and 1 dorsal (vestige of Exp) extending beyond the end of limb; Enp1 has long dorsal seta, 2 short ventral and a few long hairs proximo-ventrally. P6 (**M**): Cxp2 bears 1 long plumose seta and 1 extremely short seta; Bsp has 3 ventral setae, 1 dorso-lateral (all setae plumose), and a few long hairs proximo-ventrally; dorsal seta (vestige of Exp) on Bsp missing; Enp2 with very long dorsal seta. P7 (as in male in Pl. 2N): with 2 rather short terminal setae. CF (**N**): has 6 long weak claws; unpaired dorsal seta present.

Males. L = 0.52–0.64 mm (0.58 ± 0.02 mm; N = 370); H/L = 58.5 ± 1.9% (N = 21).

Plate 2**A**–**O**. Carapace (**A**–**C**): more elongated than in female; ventral margin less arched; MGGs absent. FO (**D**): similar to that in female but longer, with rounded tip. An1 (**D**): as in

female but relatively larger. An2 (**E**–**G**): rather long c- and d- setae present; e-seta missing; g-seta only slightly longer than other setae; both hook appendages strongly curved, tapered distally; their lengths about equal; right appendage with distinct swelling in its mid-part. Lb (**H**): in dorsal projection more elongated than in female. Md (**I**, **J**): Bsp more elongated than in female; Enp1 with 4 ventral setae. Mx (**K**), P5 (**L**), P6 (**M**), P7 (**N**), CF: similar to those in female. CA (**O**): flattened and large; with widened mid-part; strongly narrowed distally.

Remarks. Chavtur & Stovbun (2003) divided the genus *Archiconchoecia* into two subgenera. Arabian Sea specimens belong to the subgenera *A.* (*Archiconchoecia*), and closer to *A.* (*A.*) *striata* Müller, 1894 (Chavtur & Stovbun, 2003: p. 145), but differ from it by missing lens-like structure near ventral margin.

Distribution. *Archiconchoecia* (*Archiconchoecia*) *striata* is recorded generally from The Atlantic and Indian oceans (42°S–45°N); shallow mesopelagic species (Angel et al., 2008). In the investigated area, *A.* (*A.*) *striata* was found at all stations (Fig. 9), in all tows except one. It was one of the most abundant species (Table 3). Maximum abundances were recorded at depths 50–150 m (Fig. 10).

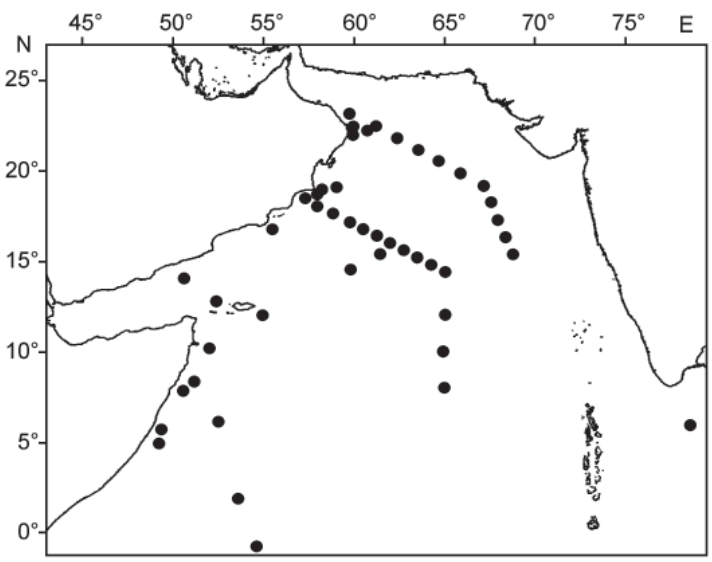


Fig. 9. Occurrence of ***Archiconchoecia* (*Archiconchoecia*) *striata*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

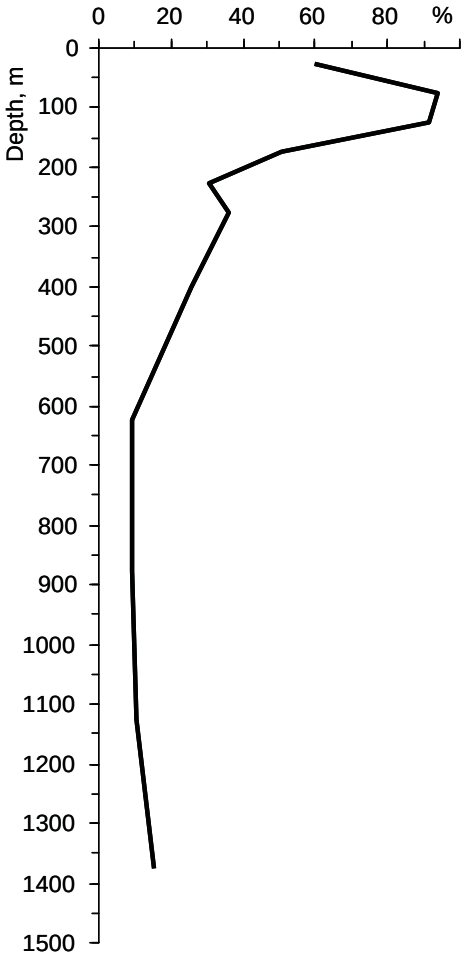


Fig. 10. Occurrence of ***Archiconchoecia* (*Archiconchoecia*) *striata*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

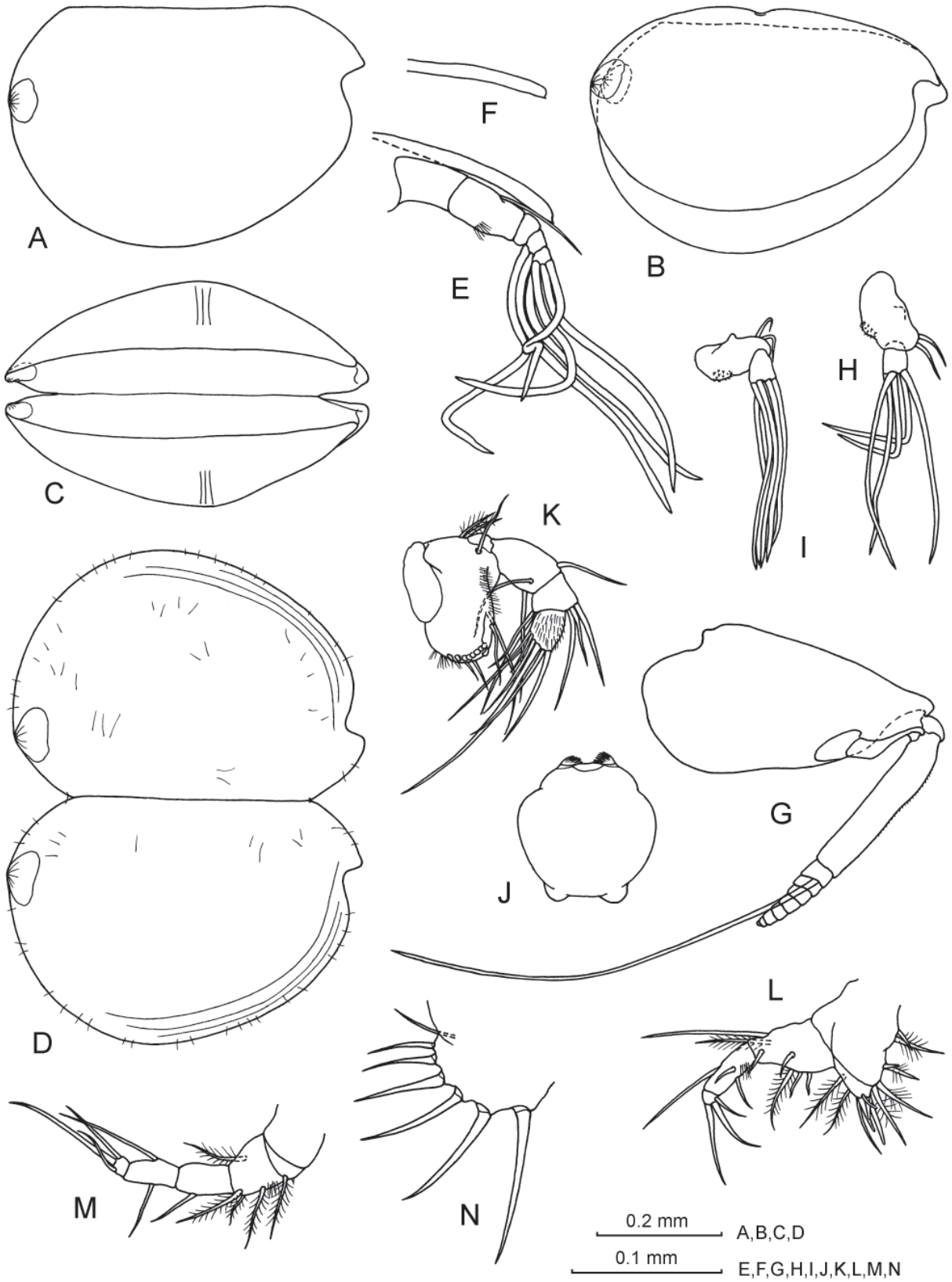


Plate 1. ***Archiconchoecia* (*Archiconchoecia*) *striata***, female. Carapace: **A** – lateral; **B** – ventro-lateral; **C** – ventral; **D** – both valves outside. **E** – FO and An1. **F** – other specimen: capitulum of FO. An2: **G** – Prp and Exp; **H** – left Enp inside; **I** – right Enp outside. **J** – Lb. **K** – Md without Cxp. **L** – P5. **M** – P6. **N** – CF.

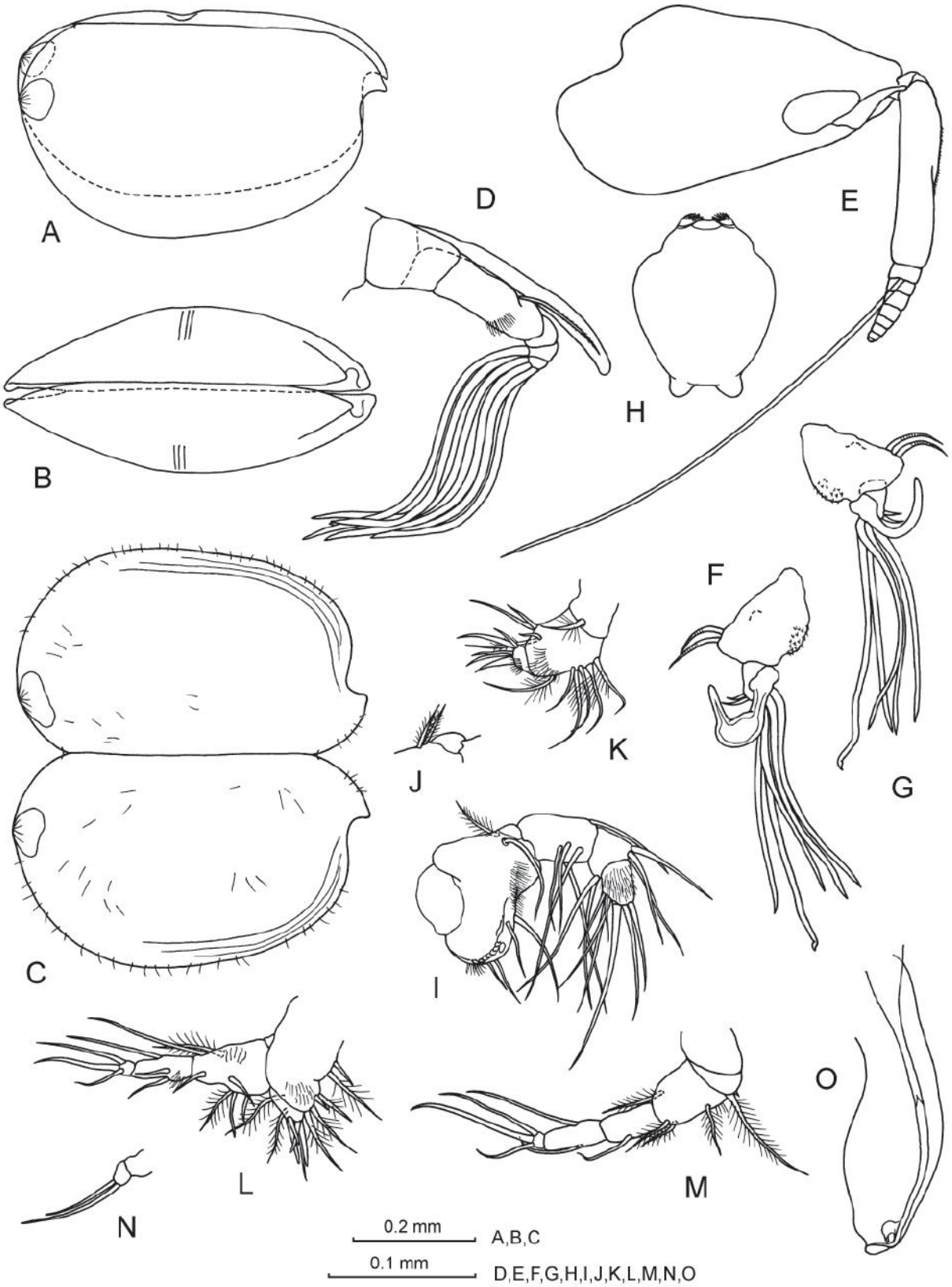


Plate 2. ***Archiconchoecia* (*Archiconchoecia*) *striata***, male. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside. **D** – FO and An1. An2: **E** – Prp and Exp; **F**, **G** – left and right Enps. **H** – Lb. Md: **I** – Bsp, Exp and Enp; **J** – other specimen: Exp. **K** – Mx. **L** – P5. **M** – P6. **N** – P7. **O** – CA.

Subfamily **Conchoeciinae** Müller, 1912

After the revision made by Chavtur & Angel (2011) the subfamily Conchoeciinae has been divided into two tribes: Conchoeciini and Metaconchoeciini.

Key to the tribes of **Conchoeciinae**:

1 LAG is located in posterior part of carapace, more or less close to PDC;
RAG usually more or less close to PVC, sometimes strongly moved anteriorly,
in one genus (*Conchoecilla*) on anterior margin; MGGs present;
Mx Enp1 with 5–6 setae on anterior side ……..……..……..…..... **Conchoeciini**

1a LAG opens on the anterior third of dorsal margin or on rostrum;
RAG more or less close to PDC; MGGs absent;
Mx Enp1 with 4 anterior setae ……..……..…..... **Metaconchoeciini**

Tribe **Conchoeciini** Chavtur & Angel, 2011

The species of the following 17 genera of the tribe Conchoeciini have been found in the investigated material: *Alacia* Poulsen, 1973; *Conchoecetta* Claus, 1890; *Conchoecia* Dana, 1849; *Conchoecilla* Claus, 1890; *Conchoecissa* Claus, 1890; *Discoconchoecia* Martens, 1979; *Loricoecia* Poulsen, 1973; *Macroconchoecia* Granata & Caporiacco, 1949; *Mikroconchoecia* Claus, 1890; *Mollicia* Poulsen, 1973; *Orthoconchoecia* Granata & Caporiacco, 1949; *Paraconchoecia* Claus, 1890; *Paramollicia* Poulsen, 1973; *Platyconchoecia* Poulsen, 1973; *Porroecia* Martens, 1979; *Proceroecia* Kock, 1992; *Pseudoconchoecia* Claus, 1890 (Table 3, Plates 3–7, Appendices 1, 2).

The key to all genera of the tribe Conchoeciini identified in the investigated material is below. This key is based mainly on the features of species (the members of Conchoeciini genera) that are described in this book, primarily on characteristics of their carapaces. The members of genera *Macroconchoecia* and *Mollicia* are not described in detail here but there are the drawings of their carapaces.

Key to the genera of **Conchoeciini:**

1 RAG is located on anterior margin of carapace (Pl. **3A**) ……..……..…. ***Conchoecilla***

Other features. LAG opens on posterior margin below PDC; PDCs strongly extended (right longer than left) and pointed; carapace surface diagonally striated. (Pl. 20A, C).

1a RAG is located in posterior part of carapace ……..…..…..……..……. 2

2 Both PVCs with more or less developed tubercles; RAG opens at apex
of right tubercle (Pl. **3B**) ……..…….. ***Conchoecissa***

Other features. Rostrum elongated, pointed; PDCs of both valves with distinct spines (left longer than right); posterior and dorsal margins of carapace form acute angle; carapace surface strongly reticulate.

2a Both PVCs without tubercles ……..……...…….……. 3

3 Carapace with striking sculpture mainly of rows of squares or rectangles;
in some species with spines like those of *M. caudata* (Ellis, 1984)
(Pl. **3C**) ……..…...……..... ***Macroconchoecia***

3a Carapace with another sculpture or without it ……...….. 4

4 Posterior margins of carapace with LGGs near PVCs 5

4a Posterior margins of carapace without LGGs near PVCs* 10

5 Each carapace valve with 2 LGGs near PVC (just above RAG on right valve) (Pl. **4A**) ..... ***Alacia***

5a Each carapace valve with 1 LGG near PVC 6

6 RAG strongly moved anteriorly (Pl. **4B)** ..... ***Platyconchoecia***

Other features. Md Exp large, elongate, leaf-like and without seta; ventral seta on P6 Cxp2 has strongly expanded basis; 7th and 8th claws of CF weakest and longer than shortest 6th claw. (Pls 52J, L, O, P, 53M, P, Q, T).

6a RAG slightly moved dorsally or in usual place near PVC 7

7 L usually > 2 mm; RAG slightly moved dorsally; females have LGGs near PDCs 8

7a L < 2 mm; RAG placed near PVC; LGGs near PDCs absent 9

8 L usually < 3 mm; carapace elongated, H/L < 50% (Pl. **4C**) ..... ***Paramollicia***

8a L > 3 mm; carapace shortened, H/L > 50% (Pl. **4D)** ..... ***Mollicia***

9 Right LGG placed just over RAG, not on posterior margin (Pl. **4E**) ..... ***Loricoecia***

9a Right LGG placed on posterior margin just above RAG (Pl. **5A**) ..... ***Pseudoconchoecia***

10 Carapace globular, H/L > 60% (Pl. **5B**) ..... ***Mikroconchoecia***

Other features. Rostrum more or less bent downward in females, it's almost straight in males; LAG opens just at PDC; 3 or 4 sensory setae on female An1 and a-seta on male An1 are bifurcate; male An1 e-seta has a single row of small pegs. (Pls 32E, F, 33D, E, F, 34D, E, 35C, D, E).

10a Carapace more elongated; H/L < 55% 11

11 Carapace thick; its posterior margin usually slightly uneven due to the presence of larger medial gland cells (Pl. **5C**) ..... ***Orthoconchoecia***

Other features. In males An2 Enp2 with exceptionally long c-seta (Pls 37H, 39H); females have in its place a seta not shorter than Enp2 (Pls 36G, 38G).

11a Carapace less thick; its posterior margin even 12

Other features. In males An2 Enp2 with relatively short c- and d- setae; in females usually c- and d- setae absent or far shorter than Enp2 (as in Pl. 24F).

12 Dorsal and posterior margins of carapace form more or less acute angle, forward posterior margin sloped; PDCs usually without spines (Pl. **5D**) ..... ***Conchoecetta***

Other features. In both sexes An2 Enp with short (~ 1/3 of longest g-seta in females, ~ 1/5 in males) and thin h-, i- and j- setae having clearly differing lengths (Pls 11G, 12E, 13I, 14G).

* In one case the carapace valves have LGGs near PVCs (Pl. 6A, *C. lophura*) but these are small and consist of only a few gland cells.

12a Angle between dorsal and posterior margins of carapace close to right or obtuse; right PDC with spine or without it, left one always without spine ……..……..…....13

Other features. In both sexes An2 Enp with h-, i- and j- setae having similar lengths; in females these setae relatively long, not shorter than 1/2 of longest g-seta.

13 Carapace rather short (H ~ 50% L), laterally shaped as rectangle with broadly rounded corners; both PDCs always without spines; RAG always in usual place near PDC (Pl. 6A, B) …….…….....14

Other features. b-seta on male An2 Enp1 with long hairs near its base (as in Pl. 57I).

13a Carapace elongated (H/L<50%), its anterior part tapered anteriorly; right PDC with more or less developed spine or without it, sometimes 1–2 additional small spines present; RAG either near PDC or moved forward (Pl. 7A–C) ……...……..….....15

Other features. b-seta on male An2 Enp1 without long hairs.

14 Mean H/L slightly more than 50% (Pl. **6A**) ……..…….. ***Conchoecia***

Other features. Capitulum of female FO turned downward (Pls 15E, D, 18C, D); male An2 Enp3 with bare j-seta (Pls 16H; 17H; 19I).

14a Mean H/L slightly less than 50% (Pl. **6B**) …..……..…….. ***Porroecia***

Other features. Female FO straight (Pls 54C, 56C, 58C); male An2 Enp3 has j-seta with short hairs on its base (Pls 55G, 57H, 59G, H).

15 Carapace with distinct anterior-ventral striation (Pl. **7A**) ……..……...……. ***Paraconchoecia***

Other features. In females: FO clear divided on stem and capitulum; An1 e-seta has long hairs on proximal half of anterior side (Pls 40D, 42D, 44C, 46D, 48D); in males: FO capitulum elongated, without long hairs ventrally; ventral terminal seta on P6 thinner and without long hairs (Pls 41D, O, 43D, 45D, 47D, Q, 49D, N).

15a Carapace delicate, usually without striae (Pl. 7B, C) ..……..……..…..... 16

Other features. In females: FO with no clear division on stem and capitulum; An1 e-seta without long hairs on proximal half of anterior side (as in Pl. 24D, 64E); in males: capitulum of FO either short and usually bare (as in Pl. 25D), or elongated and with long hairs ventrally (as in Pl. 65E); all 3 terminal setae on P6 with long hairs distally.

16 RAG always located in usual place near PVC (Pl. **7B**) ……....……..…..…… ***Discoconchoecia***

Other features. In females: FO relatively short, not more then 1.5 times longer than An1, and bare (Pls 24D, 26D, 28D);
in males: instead of spine comb, An1 e-seta has a characteristic oval plate formed of long hairs cemented together (Pls 25E, 27F, 29G).

16a RAG most often moved anteriorly (Pl. **7C**) .....…...……..…… ***Proceroecia***

Other features. In females: FO long, not less than 2 times longer than An1, usually with short hairs distally (Pls 60E, 62D, 64E, 66D, 68D); in males: An1 e-seta has a comb of paired spines (Pls 61F, 63F, 65G, 67F, 69G).

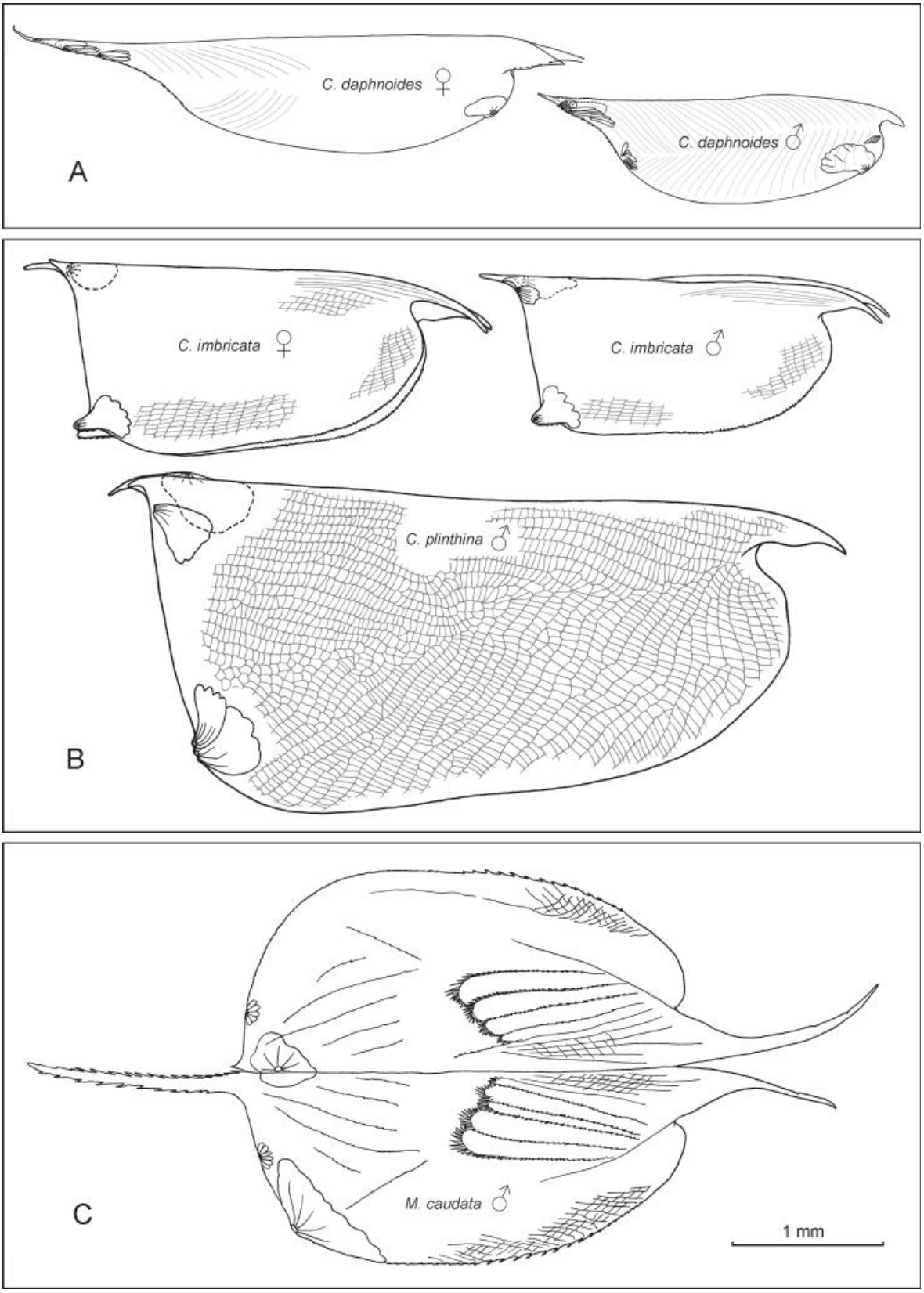


Plate 3. Carapace outlines of the members of different genera in the tribe **Conchoeciini**. **A** – *Conchoecilla*. **B** – *Conchoecissa*. **C** – *Macroconchoecia*.

All drawings in the Plates 3–7 are represented in the same scale.

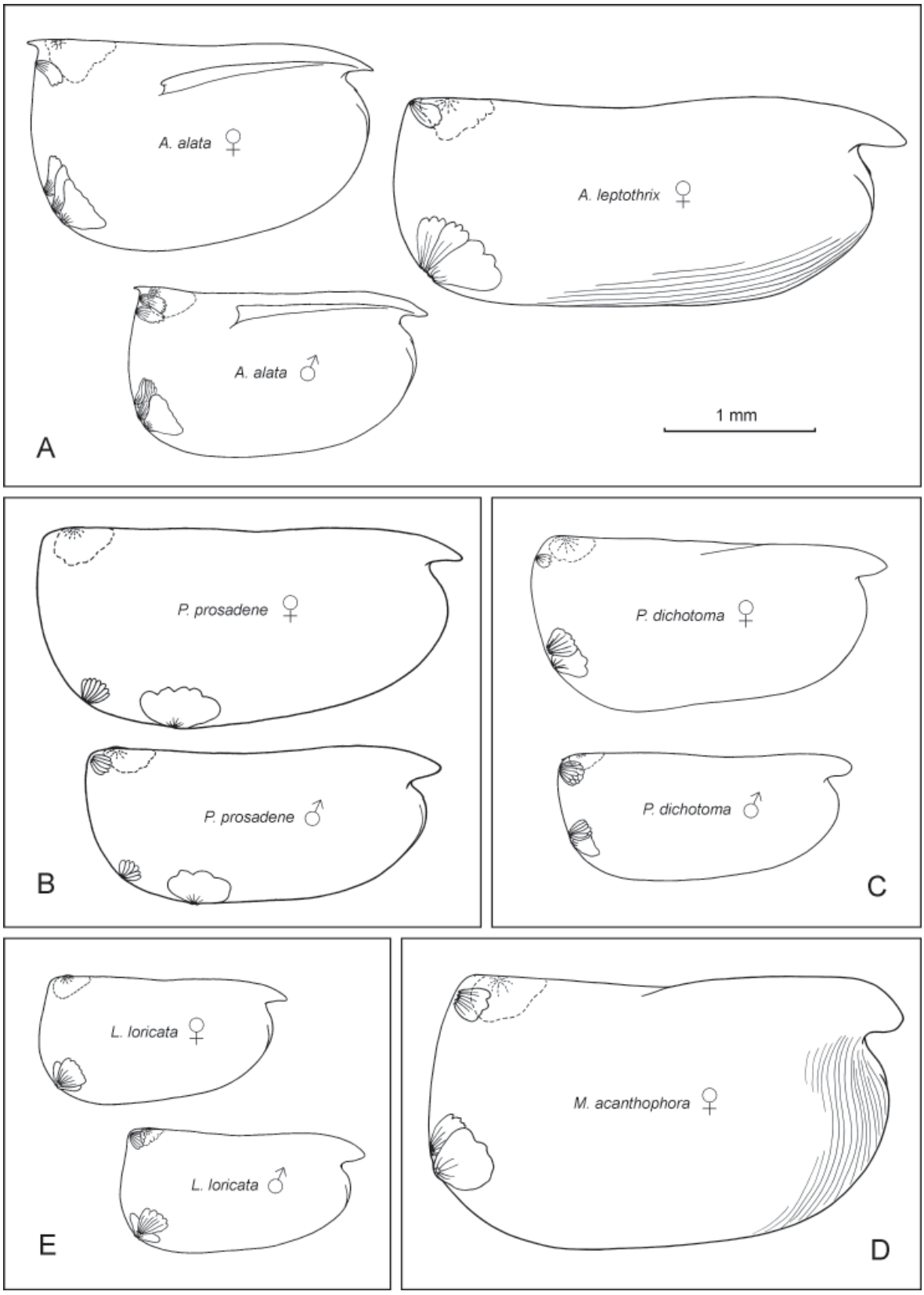


Plate 4. Carapace outlines of the members of different genera in the tribe Conchoeciini. **A** – *Alacia*. **B** – *Platyconchoecia*. **C** – *Paramollicia*. **D** – *Mollicia*. **E** – *Loicoecia*.

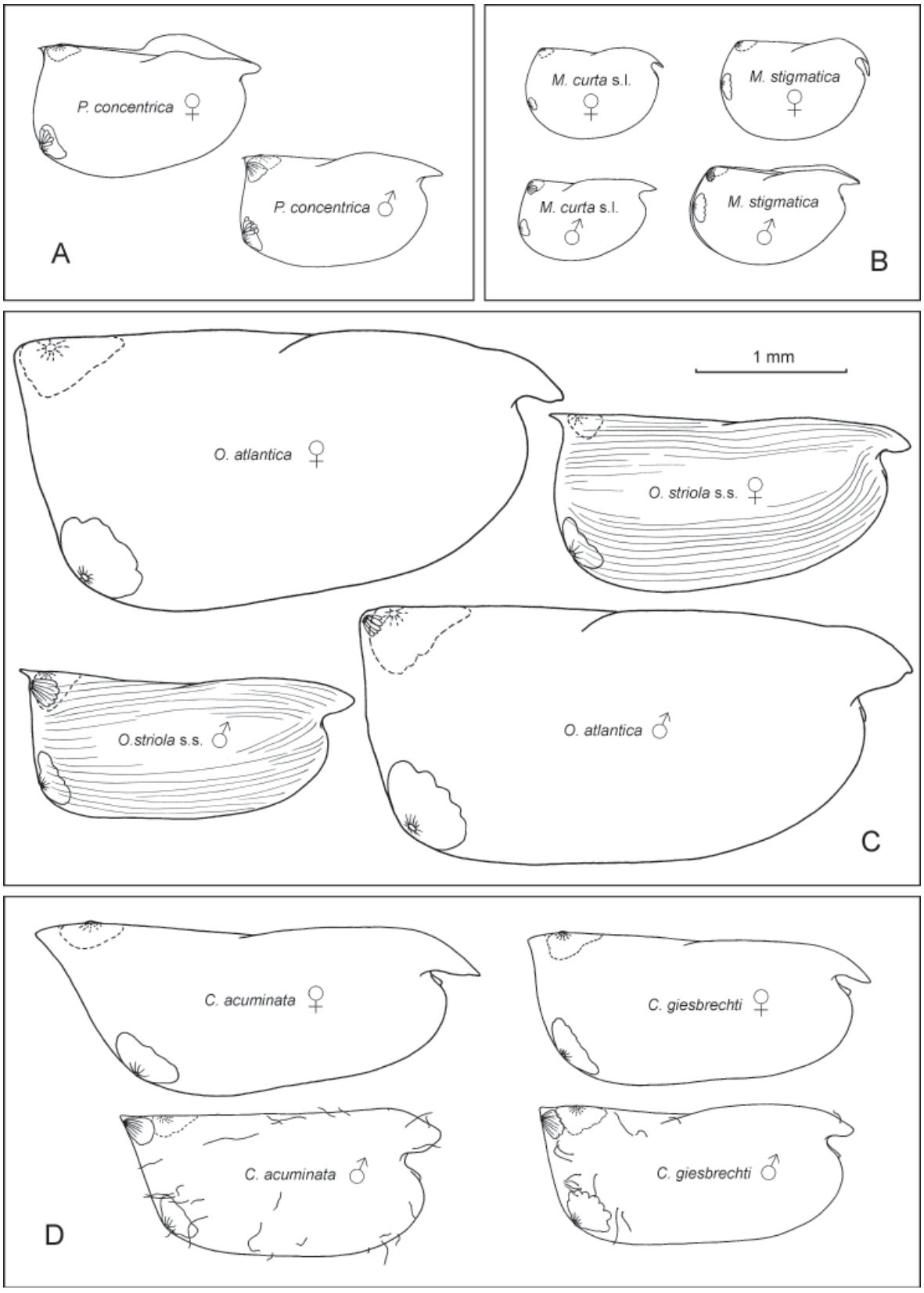


Plate 5. Carapace outlines of the members of different genera in the tribe Conchoeciini. **A** – *Pseudoconchoecia*. **B** – *Mikroconchoecia*. **C** – *Orthoconchoecia*. **D** – *Conchoecetta*.

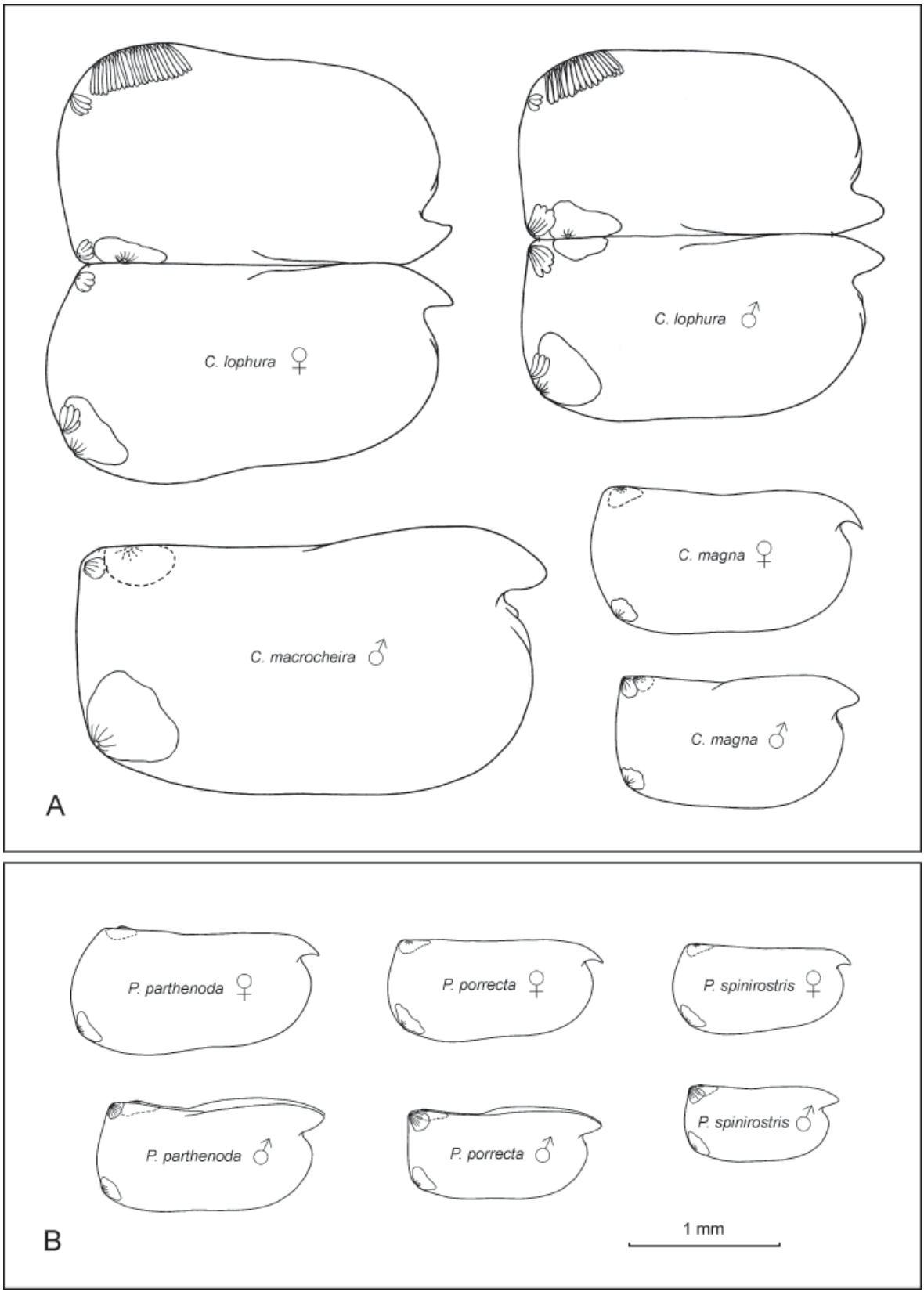


Plate 6. Carapace outlines of the members of different genera in the tribe Conchoeciini. **A** – *Conchoecia*. **B** – *Porroecia*.

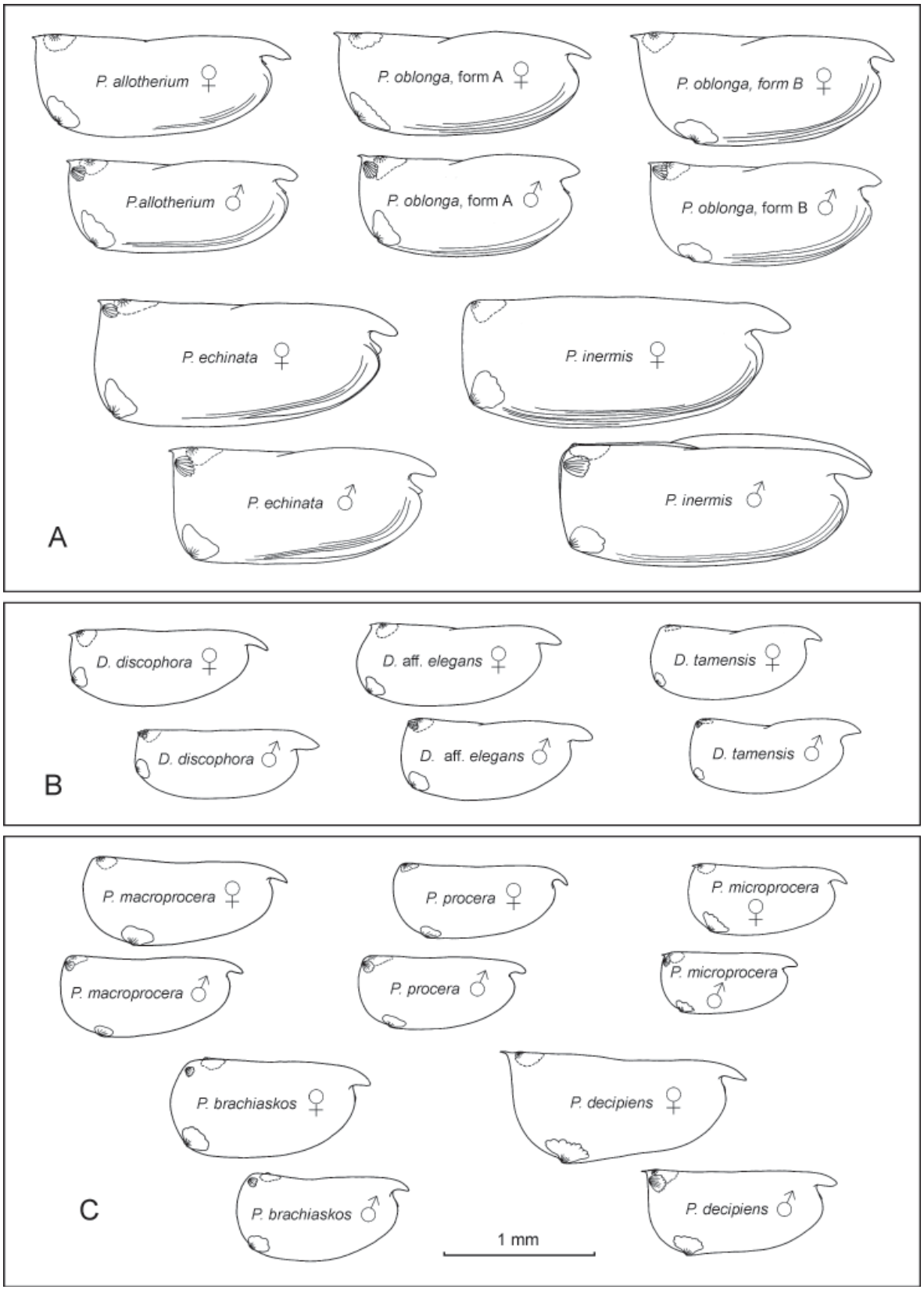


Plate 7. Carapace outlines of the members of different genera in the tribe Conchoeciini. **A** – *Paraconchoecia*. **B** – *Discoconchoecia*. **C** – *Proceroecia*.

Genus ***Alacia*** Poulsen, 1973

The main genus character is the presence of 2–4 LGGs on each valve of carapace or only on left one in both sexes (Poulsen, 1973). There is an opinion that "the present genus is almost certainly artificial and will need to be split up" (Angel et al., 2008).

Two species of the genus *Alacia* have been found in the analyzed material: *A. alata* (Müller, 1906) and *A. leptothrix* (Müller, 1906) (Table 3, Appendix 2). Both are described here (only female in *A. leptothrix*).

Key to the species of ***Alacia*** (adult females and males):

1 L < 2.5 mm; H/L > 50%;
carapace with wing-like extensions of shoulder vaults ending in pointed angle;
its surface without distinct striation;
both PDCs has pointed spines;
lengths of all claws on CF evenly decrease from 1st to 8th
(Pls 4A, 8A–C, N, 9A–D) ..... ***A. alata***

1a L > 3 mm; H/L < 50%;
carapace with no wing-like extensions of shoulder vaults;
its surface with distinct striae along ventral margin;
both PDCs rounded, with no spines;
5th–8th claws on CF much shorter and weaker than firsts
(Pls 4A, 10A–C, O) ..... ***A. leptothrix***

Alacia alata (Müller, 1906)

(Pict. 2; Pls 8, 9; Figs 11, 12)

Conchoecia alata Müller, 1906a, p. 121, pl. XXIX figs 1–10.
Alacia alata alata: Poulsen, 1973, p. 196, fig. 102.
Alacia cf. *alata*: Martens, 1979, p. 362.
Alacia alata: Angel, 1999, pp. 819, 835, fig. 9.25; Chavtur & Rzhanikova, 2004, p. 238, fig. 1I, J.

Pict. 2. ***Alacia alata***. **A** – female; **B** – male.

Females. L = 2.01–2.36 mm (2.20 ± 0.08 mm; N = 70); H/L = 57.8 ± 2.3% (N = 33).

Plate 8**A**–**N**. Carapace (**A**–**C**): slightly tapered anteriorly; with pointed spines on both PDCs; both shoulder vaults have wing-like extensions pointing posteriorly; LAG and RAG in usual places; posterior margin of each valve with 3 LGGs: 1 LGG just below PDC; 2 others on posterior margin near PVC, just above RAG on right valve. FO (**D**): capitulum with strong spines on ventral surface and proximally on dorsal one; distal part of dorsal surface covered with tiny spines; tip broadly pointed. An1 (**D**): with rather long dorsal seta; shaft with tiny hairs on distal parts of 1st and 2nd segments and with longer ones on dorsal surface of 4th segment; e-seta bears short hairs along its posterior surface becoming shorter and denser more distally; sensory setae (a–d setae) ~ 3 times shoter than e-seta. An2 (**E**, **F**): Prp with medial bulge covered with hairs; Enp1 with a- and b- setae having very fine spines; Enp2+3 has c- or d- seta. Lb (**G**): dorsal projection almost rectangular. Md (**H**, **I**): Bsp with epipodial seta; Enp1 with 4 ventral setae (1 or more of shorter setae plumose) and non-plumose dorsal seta. Mx (**J**): Bsp with single seta not reaching distal edge of Enp1; Enp1 has 6 setae on anterior side, 3 setae on posterior, 1 laterally and a few short spines near distal edge. P5 (**K**): Cxp1 partly covered with rather long hairs; Cxp2 with small spines; Cxp3 has 6 setae in ventral group; Bsp with 7 setae in proximal ventral group (one of them very short and one plumose), 3 setae in distal group, 1 plumose dorso-lateral and 1 long dorsal (vestige of Exp). P6 (**L**): Cxp2 with 2 long plumose setae; Bsp with 5 long plumose ventral setae (most distal of them reaches almost middle of Enp2), plumose dorso-lateral seta and short dorsal seta (vestige of Exp). P7 (**M**): longer terminal seta ~ 3 times more than shorter seta; longer seta with spines proximally. CF (**N**): dorsal unpaired seta present; lengths of all claws evenly decrease from 1st to 8th.

Males. L = 1.73–2.08 mm (1.87 ± 0.07 mm; N = 72); H/L = 53.5 ± 2.0% (N = 35).

Plate 9**A**–**P**. Carapace (**A**–**D**): more elongated than in females, slightly tapered anteriorly; with pointed spines on both PDCs, and with wing-like extension of shoulder vaults; in addition to 3 pairs of LGGs (as in female), has MGG on each valve above posterior dorsal LGG. FO (**E**): capitulum with spines on ventral surface and proximally on dorsal, which are weaker than in female. An1 (**E**, **F**): shaft bare; armature of e-seta consists of ~ 45 densely sitting, “umbrella”-shaped

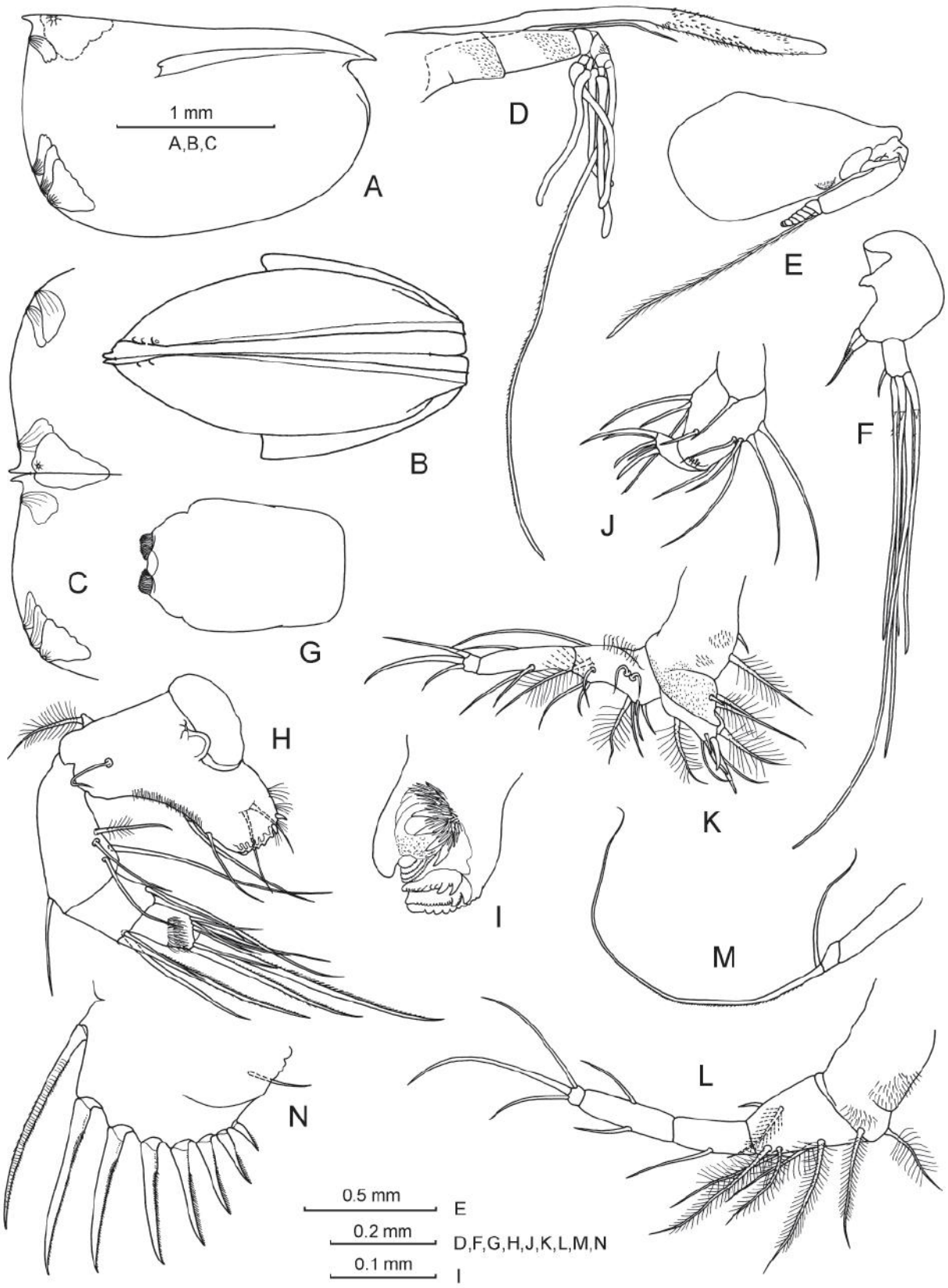


Plate 8. ***Alacia alata***, female. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: posterior margins. **D** – FO and An1. An2: **E** – Prp and Exp; **F** – Enp. **G** – Lb. Md: **H** – Bsp, Enp and Exp; **I** – coxal endite. **J** – Mx. **K** – P5. **L** – P6. **M** – P7. **N** – CF.

Plate 9. ***Alacia alata***, male. Carapace: **A** – lateral; **B** – dorso-lateral; **C** – ventral; **D** – both valves outside: posterior margins. **E** – FO and An1. **F** – An1: armature of e-seta. An2: **G** – Prp and Exp; **H** – left Enp; **I** – right Enp; **J** – left hook appendage. **K** – Lb. **L** – Md without Cxp. **M** – P5. **N** – P6. **O** – P7. **P** – CA.

(term of Poulsen, 1973), alternated spines; b- and d- setae bare. An2 (**G**–**J**): hook appendages strongly curved, its two arms form acute angle; e-seta present. Lb (**K**): in dorsal projection more elongated than in female; anterior part with rounded corners. Md (**L**): 3 shorter ventral setae and dorsal seta plumose. Mx, P5 (**M**), P7 (**O**), CF: similar to those in female. P6 (**N**): all setae on Cxp, Bsp and Enp1–2 shorter than in female; all 3 terminal setae on Enp3 about equal and with long hairs. CA (**P**): elongated, with 6–7 muscles, end rounded.

Distribution. *Alacia alata* is recorded from all oceans, generally in the tropical zone; often associated with upwelling centres; predominantly shallow mesopelagic species (Angel et al., 2008). In the investigated area, *A. alata* was found mainly from the upwelling zones along the shores of Somalia and Oman (Fig. 11), in 34% of tows. Maximum abundances were recorded at depths 150–300 m (Fig. 12).

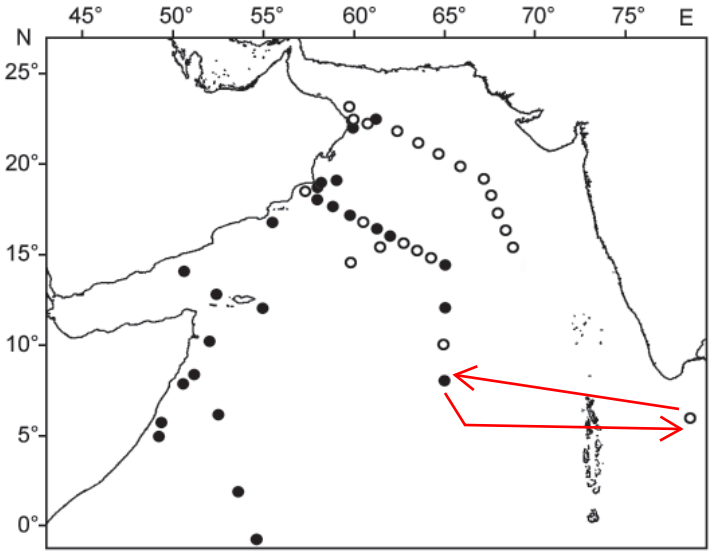


Fig. 11. Occurrence of ***Alacia alata*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

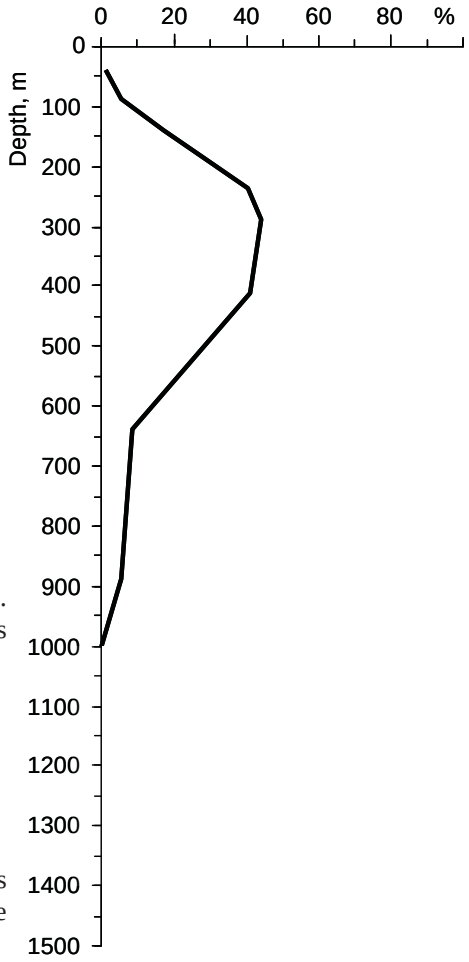
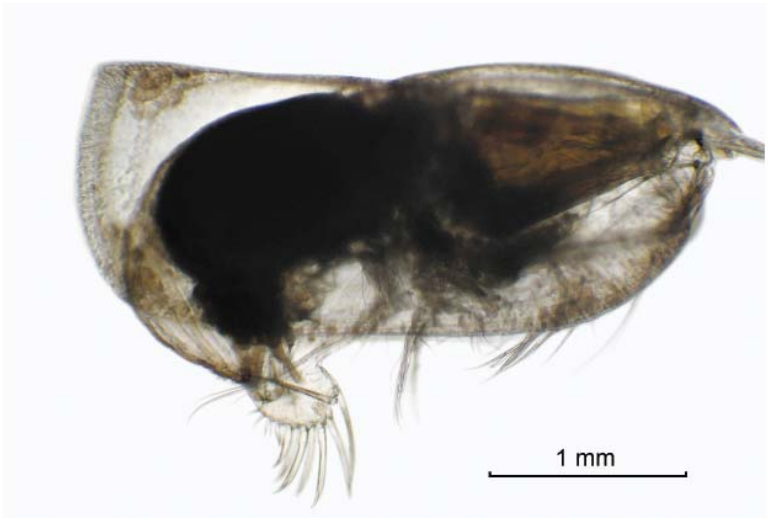


Fig. 12. Occurrence of ***Alacia alata*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

Alacia leptothrix (Müller, 1906)

(Pict. 3; Pl. 10; Fig. 13)

Conchoecia leptothrix Muller, 1906a, p. 122, pl. XXIX figs 20–26.
Alacia leptothrix: Poulsen, 1973, p. 202, fig. 106; Angel, 1999, pp. 819, 835, fig. 9.28 (male).



Pict. 3. ***Alacia leptothrix***. Female.

Females. L = 3.30–3.35 mm; H/L = 47.5 ± 1.5%; N = 2.

Plate 10**A**–**O**. Carapace (**A**–**C**): elongated; with distinct striae along ventral edge; PDCs rounded; H_{ant} ~ H_{post}; posterior edge of each valve with 3 LGGs: 1 LGG opens on PDC, 2 others near PVC, just above RAG on right valve; LAG and RAG in usual places. FO (**D**): ~ 2 times longer than An1; 2/3 ventral surface of capitulum and its dorsal surface proximally covered with spines; tip rounded. An1 (**D**): with long dorsal seta; 1st and 2nd segments have tiny hairs mainly on ventral surface; below sensory setae, e-seta with short spines along its posterior and partly anterior sides; sensory setae a little shorter than half e-seta. An2 (**E**, **F**): Prp with medial bulge covered with hairs; a- and b- setae on Enp1 bare; Enp2+3 without c- and d- setae. Lb (**G**): dorsal projection slightly tapered toward anterior edge that is rounded and covered with tiny spines. Md (**H**–**J**): epipodial appendage with large seta having a few short spines; Enp1 with 4 ventral setae and 1 dorsal seta; all setae non-plumose. Mx (**K**): Bsp with single seta not reaching distal edge of Enp1; Enp1 with 6 setae on anterior side, 3 on posterior, 1 laterally and 6 short spines near distal edge. P5 (**L**): Cxp3 with 6 setae in ventral group; Bsp with 6 setae in proximal ventral group (one of them plumose) and 3 in distal; lengths of 2 longer terminal setae on Enp2 about equal. P6 (**M**): Bsp with ventral setae, which are shorter than those in *A. alata* (Pl. 8L); most distal of them reaches base of Enp2; dorsal seta (vestige of Exp) very short. P7 (**N**): shorter terminal seta about half of longer one. CF (**O**): unpaired dorsal seta present; lengths of all claws unevenly decrease from 1st to 8th: 2nd and 3rd claws about equal, 4th about two thirds of 3rd, 5th–8th noticeable shorter and weaker than 1st to 4th claws.

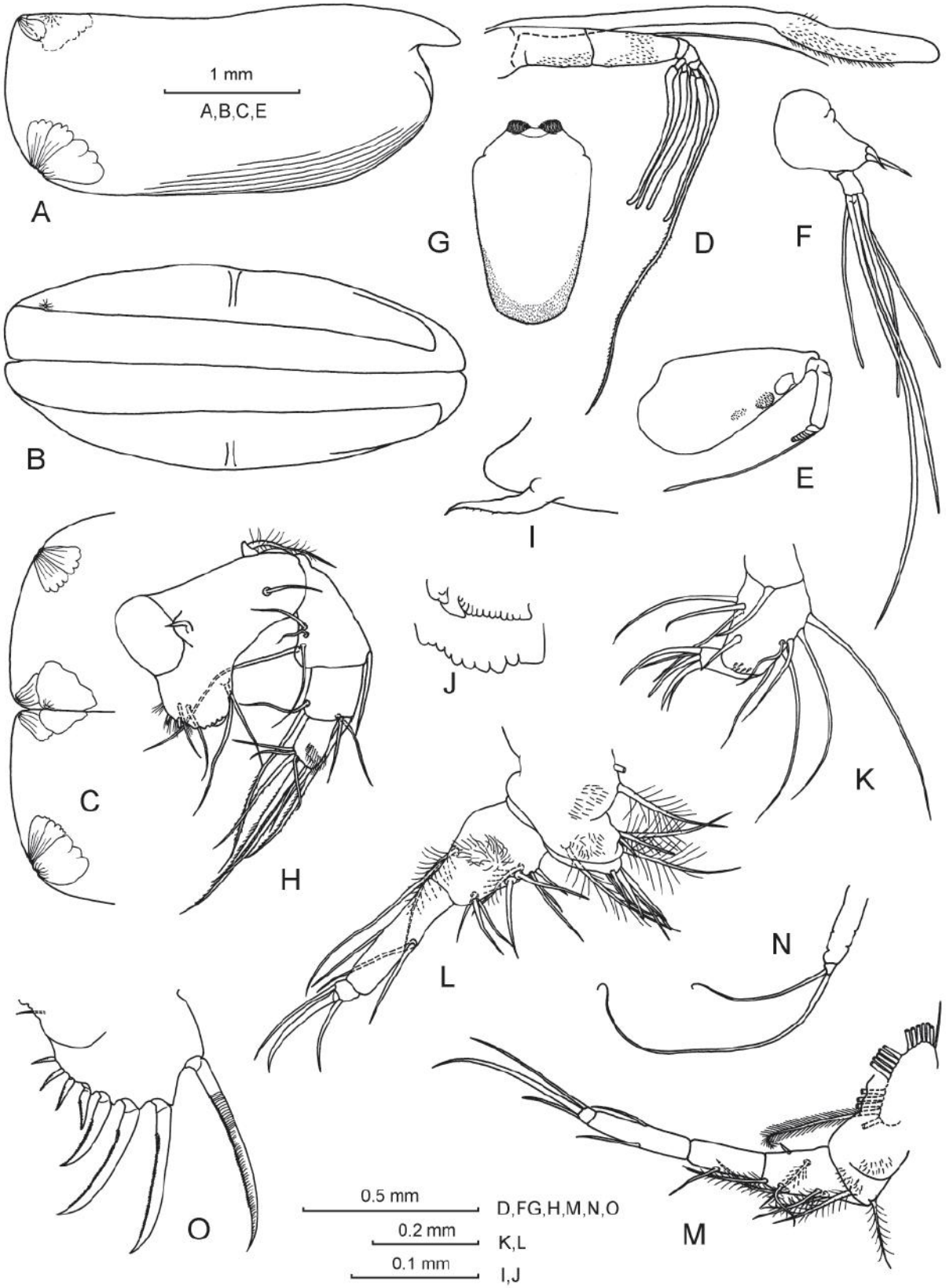


Plate 10. ***Alacia leptothrix***, female. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: posterior margins. **D** – FO and An1. An2: **E** – Prp and Exp; **F** – Enp. **G** – Lb. Md: **H** – Bsp, Exp and Enp; **I** – epipodial seta; **J** – coxal endite: toothed edge and distal tooth-list. **K** – Mx. **L** – P5. **M** – P6. **N** – P7. **O** – CF.

Distribution. The majority of records of *Alacia leptothrix* are from low latitudes in the Indian Ocean and Indonesian Sea. In the tropical Atlantic Ocean species is rare. The main vertical distribution is between 500 and 2000 m (Angel et al., 2008). In the investigated area, *A. leptothrix* was found only at two stations (Fig. 13) in the layer 250–500 m.

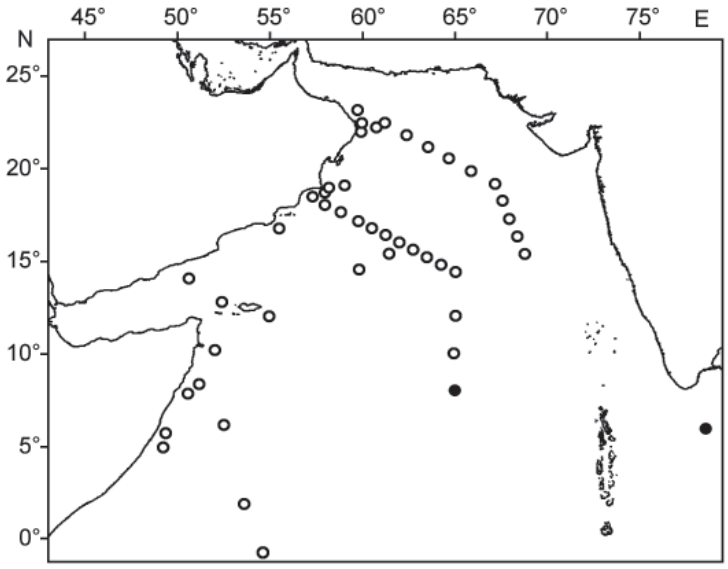


Fig. 13. Occurrence of ***Alacia leptothrix*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where females of species were found.

Genus ***Conchoecetta*** Claus, 1890

Dorsal and posterior margins of carapace form more or less acute angle, forward posterior margin sloped. In males, the surface of carapace covered with rare long hairs. Setae h-, i- and j- on An2 Enp are short and thin, and have clearly differing lengths (j-seta is shortest), especially in females. Juvenile specimens of this genus are distinguished from those of other halocyprids by having rostrum pointed in two places: as usual at the tip of rostrum and laterally (Poulsen, 1969, 1973; Deevey, 1968a).

There are two species in the genus *Conchoecetta*, and both species have been found in the analyzed material: *C. acuminata* Claus, 1890 and *C. giesbrechti* (Müller, 1906) (Table 3, Appendix 2). Both species are described below.

Key to the species of ***Conchoecetta***:

Adult females:

1 L > 2.5 mm;
carapace dorsal and posterior margins form acute angle 55–60°;
An2 Enp2+3 with j-seta having basal part not swollen
(Pls 5D, 11A, H) ..... ***C. acuminata***

1a L < 2.5 mm;
carapace dorsal and posterior margins form acute angle 78–80°;
j-seta on An2 Enp2+3 with bulbous basal part
(Pls 5D, 13A, J) ……..…….…….....….. ***C. giesbrechti***

Adult males:

1 L > 2 mm;
carapace dorsal and posterior margins form acute angle ~ 70°;
An1 e-seta has a comb with ~ 25 pairs of broad short spines;
An2 Enp3 with j-seta having basal part not swollen
(Pls 5D, 12A, C, F) ..... ***C. acuminata***

1a L usually < 2 mm;
carapace dorsal and posterior margins form acute angle 78–80°;
An1 e-comb with 33–37 pairs of broad short spines;
j-seta on An2 Enp3 with bulbous basal part
(Pls 5D, 14A, E, H) ……...……...…… ***C. giesbrechti***

Conchoecetta acuminata Claus, 1890

(Pict. 4; Pls 11, 12; Figs 14, 15)

For synonymy before 1906, see Müller, 1906a.
Conchoecia acuminata: Müller, 1906a, p. 76, pl. XV figs 17–23; Deevey, 1968a, p. 48, fig. 19; Poulsen, 1969a, p. 149, fig. 8a, c.
Conchoecetta acuminata: Poulsen, 1973, p. 59, fig. 28; Angel, 1999, pp. 819, 833, fig. 9.31.

Pict. 4. ***Conchoecetta acuminata***. Female.

Females. L = 2.75–2.90 mm; H/L = 39.0 ± 2.3%; N = 2.

Plate 11**A**–**P**. Carapace (**A**–**C**): elongated, tapered anteriorly; PDCs without spines; dorsal and posterior margins form acute angle 55–60°; RAG opens on PVC, LAG somewhat moved forward along dorsal margin. FO (**D**): no clear division into shaft and capitulum; the latter is bare, its tip with a rather long narrow finger-like process. An1 (**D**): 2nd segment with short dorsal seta; e-seta bears tiny spines along posterior side terminally; sensory setae ~ 3 times shorter than e-seta. An2 (**E**–**H**): inner side of Prp bare; processus mammillaris on Enp1 rounded; a- and b- setae bare; c- and d- setae missing; j-seta noticeably shorter than h- and i- setae, its basal part without bulge. Lb (**I**): dorsal projection tapered anteriorly, its anterior edge almost straight, with rounded corners that are covered with tiny spines. Md (**J**–**L**): epipodial appendage on Bsp with strong short seta; Enp1 arms non-plumose dorsal seta and 3 ventral setae. Mx (**M**): Bsp with single seta not reaching distal edge of Enp1; Enp1 has 6 short spines near distal edge. P5 (**N**): Cxp3 with 6 setae in ventral group; Bsp has 6 setae in proximal ventral group (one of them plumose) and 3 setae in distal group; epipodite with 4, 5 and 4 long plumose setae in each of three groups. P6 (**O**): Cxp2 bears 2 plumose setae; Bsp has short dorsal (vestige of Exp) and dorso-lateral setae, and rather long ventral setae (most distal of them reaches half Enp2); epipodite with 5, 5 and 6 long plumose setae in each of three groups. P7 (**P**): both terminal setae are bare.

Male. L = 2.10 mm; H/L = 43.2%.

Plate 12**A**–**Q**. Carapace (**A**): PDCs with no spines; dorsal and posterior margins form acute angle ~ 70°; MGGs present; surface with rarely placed long hairs. FO (**B**): capitulum with spines on proximal 2/3 of ventral surface and a few spines on dorsal surface proximally; its tip rounded. An1 (**B**, **C**): armature of e-seta has a comb with ~ 25 pairs of rather broad short spines directed proximally and one pair of spines directed distally just below the comb; in upper part of comb some of spines sit alternately; b- and d- setae with a few short hairs on level with distal part of e-seta comb. An2 (**D**–**G**): processus mammillaris on Enp1 rounded; a- and b- setae bare; e-seta not visible, possibly absent; h-, i- and j- setae have differing lengths; j-seta shortest and with basal part not swollen; each of hook appendages have 2 processes on inner surface of basal part and terminate in 2 tiny papillae. Lb (**H**): in dorsal projection more elongated than in female. Md (**I**, **J**): Enp1 with non-plumose dorsal seta. Mx (**K**): Enp1 has 7 short broad spines near distal edge. P5 (**L**): Bsp has 7 setae in proximal ventral group (6 setae in female).

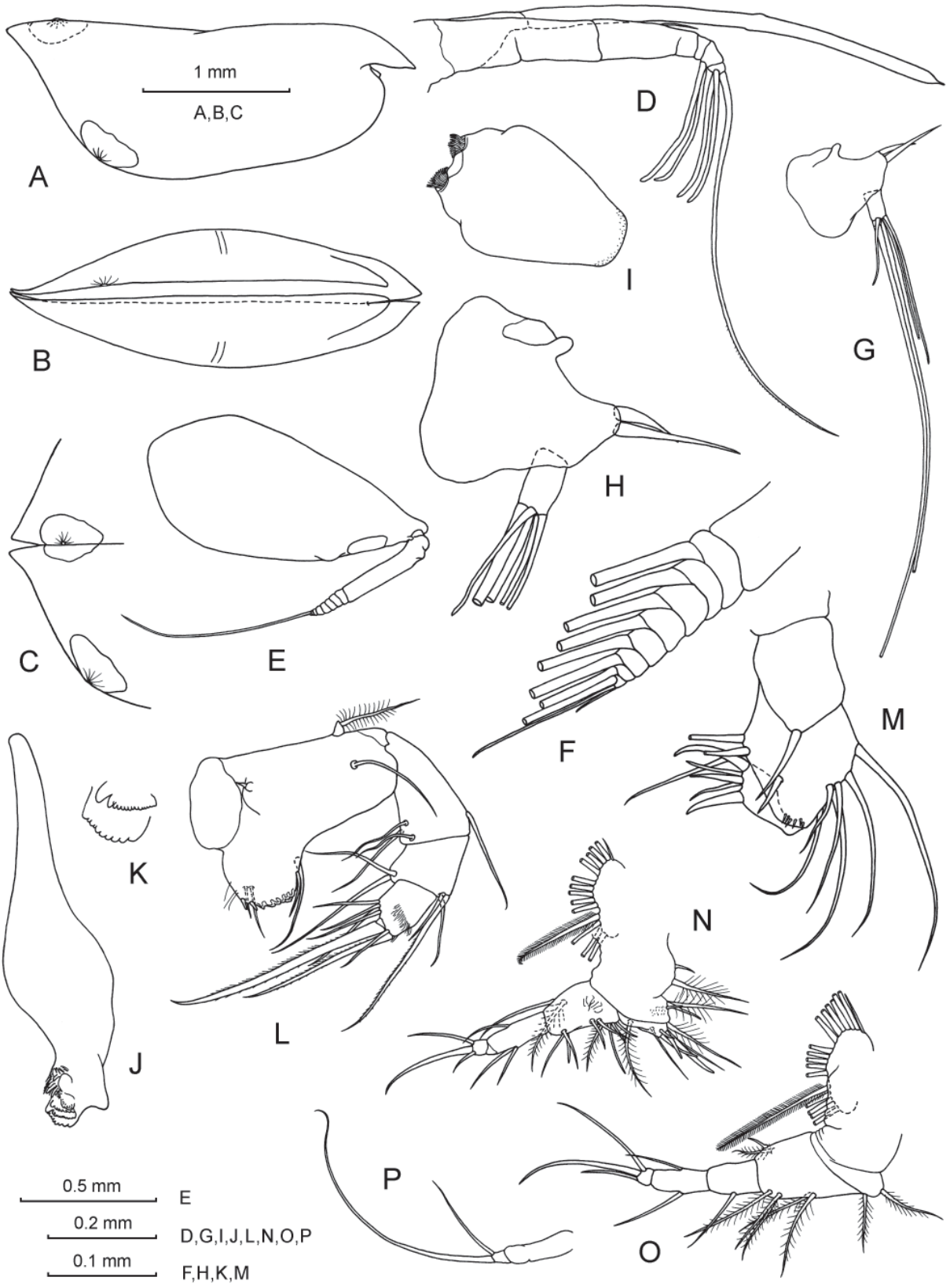


Plate 11. ***Conchoecetta acuminata***, female. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: PDCs. **D** – FO and An1. An2: **E** – Prp and Exp; **F** – Exp2–9; **G**, **H** – Enp. **I** – Lb. Md: **J** – Cxp; **K** – coxal endite: toothed edge and distal tooth-list; **L** – Bsp, Exp and Enp. **M** – Mx. **N** – P5. **O** – P6. **P** – P7.

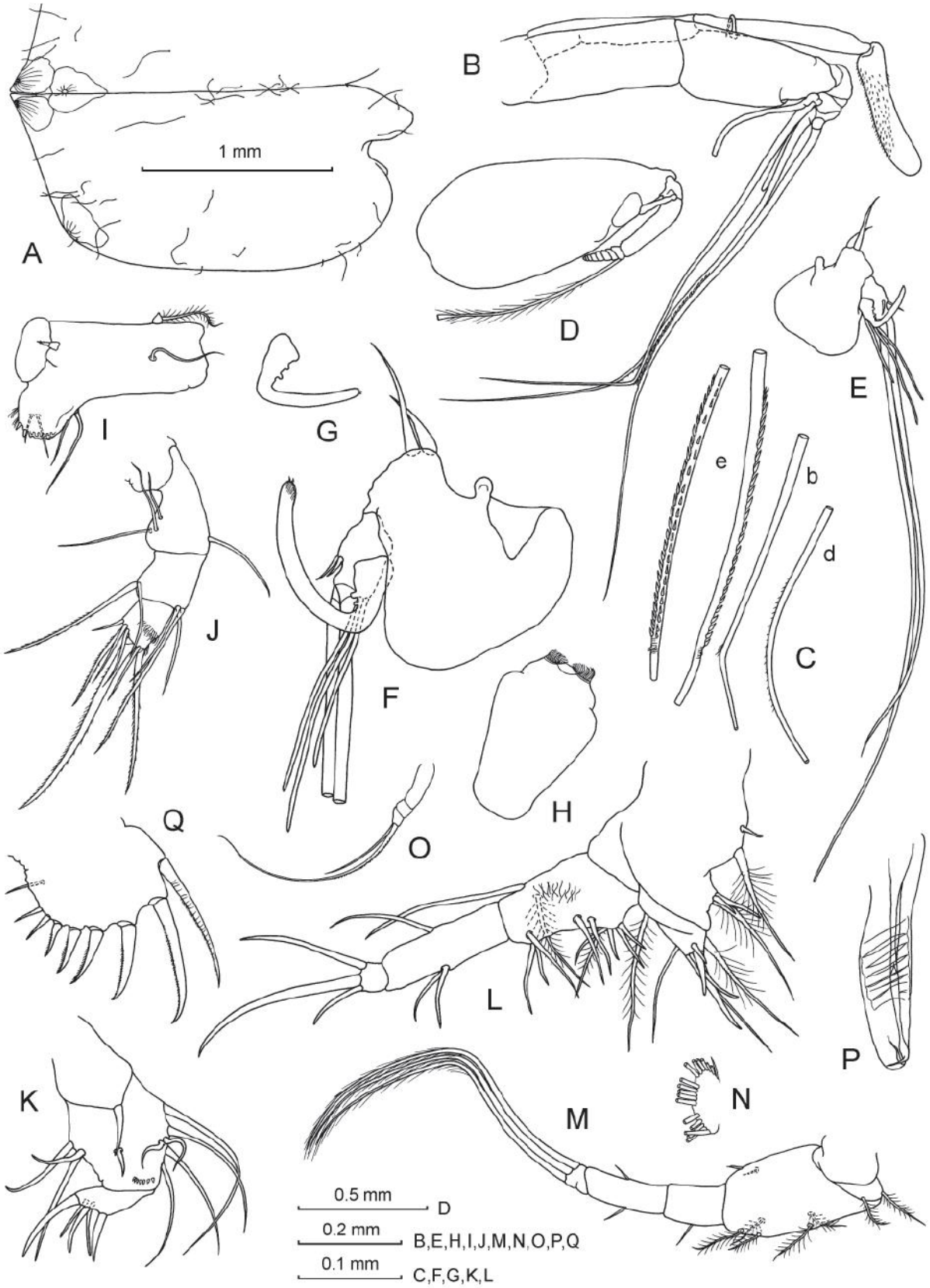


Plate 12. ***Conchoecetta acuminata***, male. Carapace: **A** – both valves outside. **B** – FO and An1. **C** – An1: armature of b-, d- and e- setae. An2: **D** – Prp and Exp; **E** – left Enp; **F** – right Enp; **G** – left hook appendage. **H** – Lb. Md: **I** – Bsp and Exp; **J** – Enp. **K** – Mx. **L** – P5. **M** – P6. **N** – P6: epipodite. **O** – P7. **P** – CA. **Q** – CF.

P6 (**M**, **N**): all setae on Bsp and Enp1–2 present but considerably shorter than in female; all terminal setae on Enp3 about equal and with long hairs. P7 (**O**): similar to that in female. CA (**P**): elongated, tapered to end that is rounded, has 8 muscle bands. CF (**Q**): unpaired dorsal seta present.

Distribution. *Conchoecetta acuminata* is recorded from all oceans (mostly from the latitudes <40°), but seldom in abundance; predominantly shallow mesopelagic species (Angel et al., 2008). In the Arabian Sea Region, *C. acuminata* was found in the southern part of the investigated area (Fig. 14), in 5% of tows. Single specimens of *C. acuminata* were recorded up to 750 m (Fig. 15), most often in the layer 50–100 m.

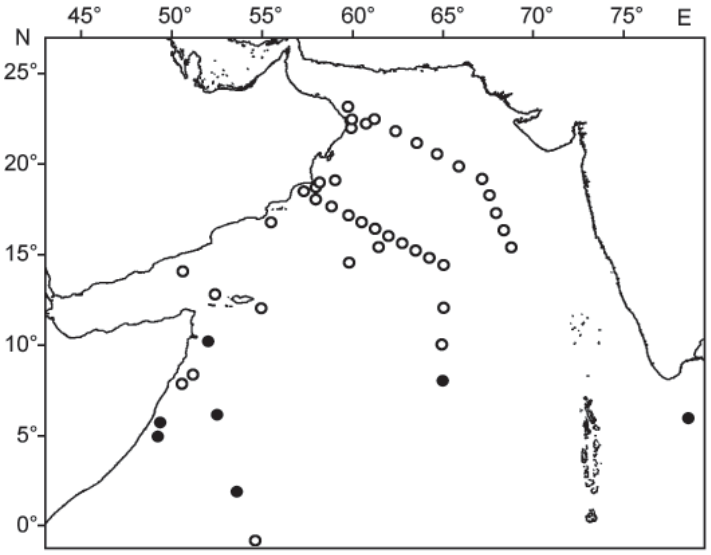


Fig. 14. Occurrence of ***Conchoecetta acuminata*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

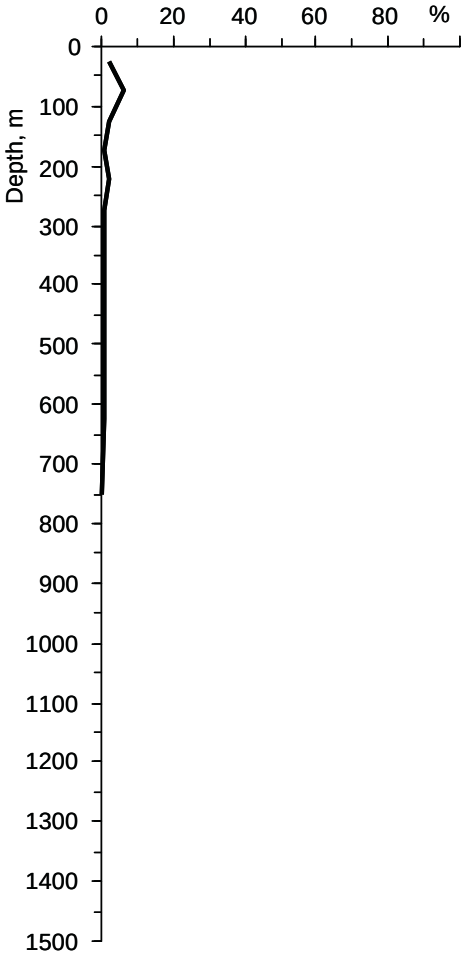


Fig. 15. Occurrence of ***Conchoecetta acuminata*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

Conchoecetta giesbrechti (Müller, 1906)

(Pict. 5; Pls 13, 14; Figs 16, 17)

Conchoecia giesbrechti Müller, 1906a, p. 75, pl. XV figs 1–16.
Conchoecia giesbrechti: Poulsen, 1969a, p. 150, fig. 8b, d–h.
Conchoecetta giesbrechti: Poulsen, 1973, p. 64, fig. 31; Angel, 1999, pp. 819, 833, fig. 9.32.

Pict. 5. ***Conchoecetta giesbrechti***. **A** – female; **B** – male.

Females. L = 1.77–2.45 mm (2.14 ± 0.12 mm; N = 487); H/L = 42.8 ± 1.7% (N = 77).

Plate 13**A**–**D**, **F**–**Q**. Carapace (**A**–**D**): elongated, slightly tapered anteriorly; usually PDCs with no spines, in some cases with a thin, weak, more or less long spine on right valve (**D**); dorsal and posterior margins form less acute (78–80°) angle than in *C. acuminata* (Pl. 5D); RAG opens on PVC, LAG somewhat moved forward along dorsal margin. FO (**F**, **G**): no clear division into shaft and capitulum; the latter with very short hairs on middle third of surface, tip either rounded or with a rather long narrow finger-like process. An1 (**F**): 2nd segment with short dorsal seta; 4th segment with hairs on its dorsal surface; e-seta bears tiny spines along anterior (on proximal part of seta) and posterior (below sensory setae) sides. An2 (**H**–**J**): Prp with medial bulge covered with tiny spines; processus mammillaris on Enp1 rounded; a- and b- setae bare; very short c- or d-seta present; j-seta with bulbous basal part and noticeably shorter than h- and i- setae. Lb (**K**): dorsal projection tapered anteriorly; its anterior edge straight, with rounded corners, which are covered with tiny spines. Md (**L**): epipodial appendage on Bsp has rather strong but short seta with toothed margins; Enp1 with non-plumose dorsal seta and 3 ventral setae. Mx (**M**): Bsp with single seta not reaching distal edge of Enp1; width of Enp1 about equal its length, near distal edge ~ 10 short spines. P5 (**N**): Cxp3 with 6 setae in ventral group; Bsp has 6 setae in proximal ventral group (one of them plumose) and 3 setae in distal group. P6 (**O**): Cxp bears 2 plumose setae; Bsp has short dorsal seta, dorso-lateral seta and rather long ventral setae; most distal ventral seta reaches half Enp2. P7 (**P**): longer terminal seta on end segment with a double series of tiny spines proximally. CF (**Q**): unpaired dorsal seta present.

Males. L = 1.58–2.05 mm (1.81 ± 0.08 mm; N = 403); H/L = 44.0 ± 1.7% (N = 55).

Plate 14**A**–**P**. Carapace (**A**–**C**): PDCs with no spines; dorsal and posterior margins form acute angle 78–80°; posterior surface with rarely placed long hairs, and a few hairs present near dorsal margin; MGGs present. FO (**D**): capitulum with small spines on proximal 2/3 of ventral surface and a few spines on dorsal surface proximally; tip rounded. An1 (**D**, **E**): armature of e-seta has a comb with 33–37 pairs of broad short spines directed proximally; in middle part of comb, spines larger than proximally and distally; b- and d- setae with a few very short hairs on level with distal part of e-seta comb; in addition, b-seta has a pad opposite mid-part of e-comb. An2 (**F**–**I**): processus mammillaris on Enp1 rounded; a- and b- setae bare; e-seta present; j-seta with bulbous basal part and shorter than h- and i- setae; g-seta very long, about 6 lengths of j-seta; each of hook appendages have 1–3 processes on inner surface of basal part and

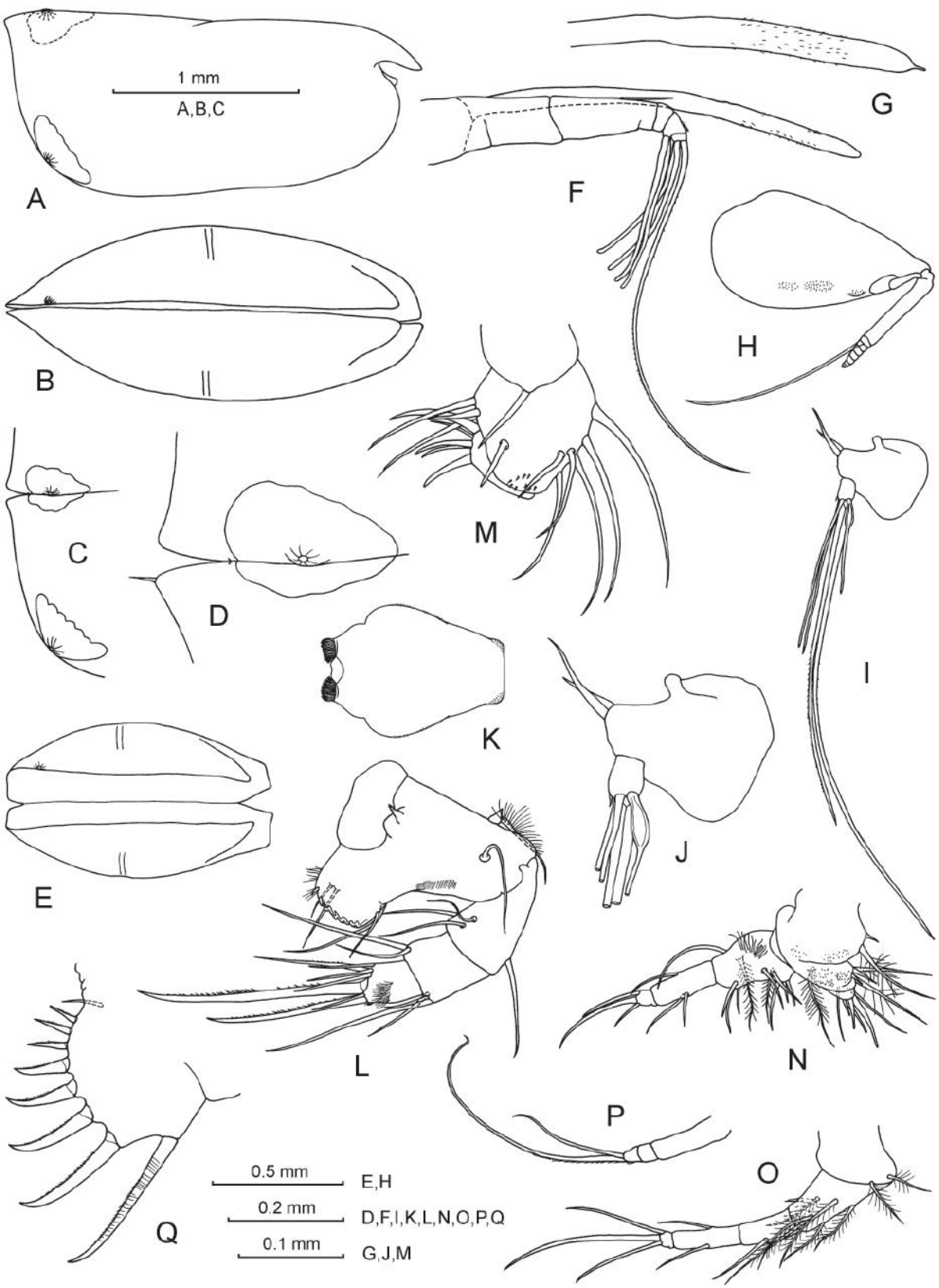


Plate 13. ***Conchoecetta giesbrechti***, adult female (excluding **E** – ventral view of juvenile). Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: posterior margins; **D** – other specimen: PDCs. **F** – FO and An1. **G** – other specimen: capitulum of FO. An2: **H** – Prp and Exp; **I**, **J** – Enp. **K** – Lb. **L** – Md without Cxp. **M** – Mx. **N** – P5. **O** – P6. **P** – P7. **Q** – CF.

Plate 14. ***Conchoecetta giesbrechti***, male. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside. **D** – FO and An1. **E** – An1: armature of b-, d- and e- setae. An2: **F** – Prp and Exp; **G**, **H** – left Enp; **I** – right hook appendage. **J** – Lb. Md: **K** – coxal endite: toothed edge, distal and proximal tooth-lists; **L** – Bsp, Exp and Enp. **M** – Mx. **N** – P5. **O** – P6. **P** – CA.

terminate in 2 tiny papillae. Lb (**J**): in dorsal projection narrower and more elongated than in female. Md (**K**, **L**): Enp1 with non-plumose dorsal seta. Mx (**M**): Enp1 has 8 short spines near distal edge. P5 (**N**): similar to that in female. P6 (**O**): all setae on Bsp and Enp1–2 present but considerably shorter than in female; all terminal setae on Enp3 about equal and with long hairs. P7, CF: similar to those in female. CA (**P**): elongated, tapered to end that is rounded, has 6–7 muscle bands.

Juveniles. In ventral view rostrum has laterally additional points placed almost on level with rostrum tips (Pl. 13**E**). In the closely related species *C. acuminata*, which has a more elongated rostrum (Pl. 11A, B), those points are placed more posteriorly (Poulsen, 1969a: fig. 8).

Remarks. Specimens of *C. giesbrechti* from the Arabian Sea Region differ from *C. giesbrechti giesbrechti* described by Martens (1979: p. 344, figs 22, 23) from samples collected off the Chilean coast by smaller sizes (in *C. giesbrechti giesbrechti* females 2.53–2.96 and males 2.29–2.54 mm) and the presence of 3 setae on Enp1 of Md (Pls 13L, 14K). Martens observed 2 setae (Martens, 1979: fig. 23e).

Distribution. *Conchoecetta giesbrechti* is recorded from all oceans, predominantly in the tropical zone; epi- and mesopelagic species, most abundant in the upper 200 m (Angel et al., 2008). In the investigated area, *C. giesbrechti* was found almost at all stations (Fig. 16), in 82% of tows. Maximum abundances were recorded at depths 100–200 m (Fig. 17).

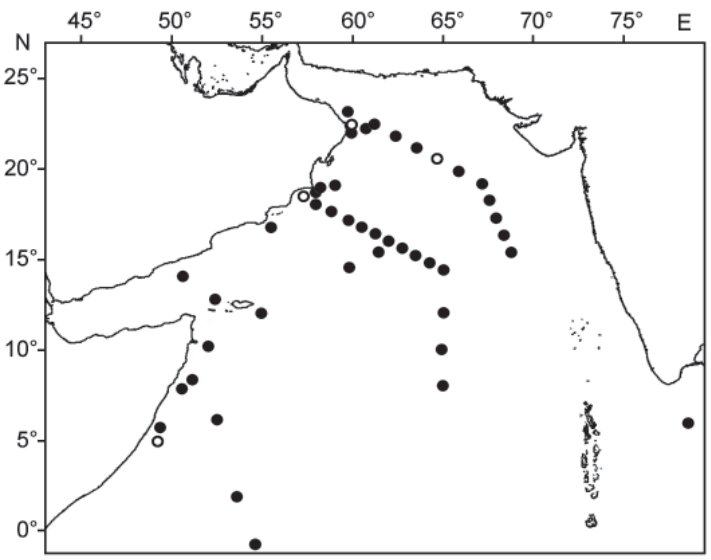


Fig. 16. Occurrence of ***Conchoecetta giesbrechti*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

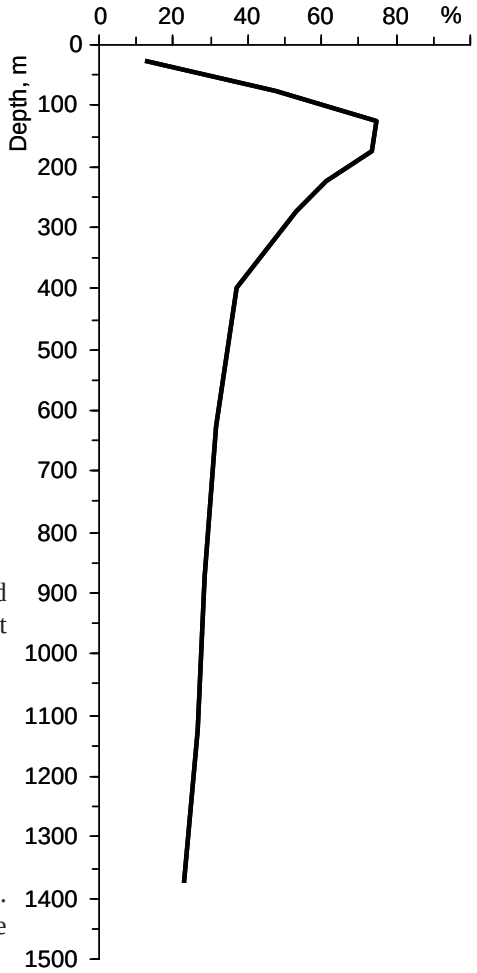


Fig. 17. Occurrence of ***Conchoecetta giesbrechti*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

Genus ***Conchoecia*** Dana, 1849

Carapace characterized by being rather short (H about half L); laterally shaped as rectangle with broadly rounded corners, only PDCs less rounded, especially in males. RAG place at the PVC, LAG near the PDC or a little in front of it. Capitulum of FO in females turned downwards. (Poulsen, 1969; 1973).

Three species of the genus *Conchoecia* have been found in the analyzed material: *C. lophura* Muller, 1906; *C. macrocheira* Muller, 1906; *C. magna* Claus, 1874 (Table 3, Appendix 2). All these species are described below (excluding the female of *C. macrocheira*).

Key to the species of ***Conchoecia*** (adult females and males):

1 Left carapace valve with a series of closely placed, long, narrow gland cells along posterior ventral margin; small LGGs present (Pls 6A, 15A–C, 16A–C) …….. ***C. lophura***

1a Carapace has no accessory glands ……..…..……..… 2

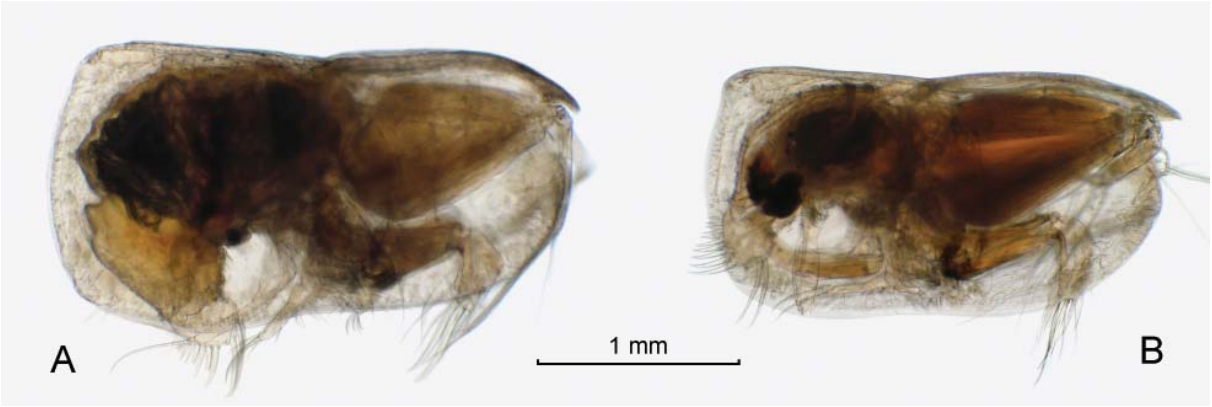
2 L > 3 mm;
in males An1 e-seta has comb with ~ 33 pairs of slender spines;
Md Enp1 with 2 ventral setae
(Pls 6A, 17E, K) .....…… ***C. macrocheira***

2a L < 2 mm;
in males An1 e-seta with 14–15 distal paired spines and ~ 16 proximal alternated;
in both sexes Md Enp1 with 3 ventral setae
(Pls 6A, 18H, 19F, L) ……...….....……...…..…….…. ***C. magna***

Conchoecia lophura Müller, 1906

(Pict. 6; Pls 15, 16; Figs 18, 19)

Conchoecia lophura Müller, 1906a, p. 99, pl. XX figs 1–10.
Conchoecia lophura: Skogsberg, 1920, p. 689, fig. CXXXI; Deevey, 1968a, p. 89, fig. 44; Poulsen, 1969a, p. 171; 1973, p. 125, fig. 61; Angel, 1999, pp. 819, 832, fig. 9.34; Deevey & Brooks, 1980, p. 107, fig. 33 (male).



Pict. 6. ***Conchoecia lophura***. **A** – female; **B** – male.

Females. L = 2.55–2.72 mm (2.62 ± 0.05 mm; N = 14); H/L = 53.3 ± 2.6% (N = 9).

Plate 15**A**–**O**. Carapace (**A**–**C**): H_{post} slightly higher than H_{ant}; all corners rounded; ventral margin somewhat concave; left valve has a series of closely placed, long, narrow glands (about 25 cells); LAG slightly moved anteriorly; posterior margins with small LGGs near PDCs and PVCs; anterior margin with 2 long gland cells below rostrum; surface of carapace has more or less distinct concentric striation. FO (**E**, **D**): capitulum turned downward, pointed, covered with spines of varying size. An1 (**D**): 2nd segment has long dorsal seta; 1st and 2nd segments with numerous surface spines; 4th segment bears a group of hairs on dorsal surface; e-seta has spines down sensory setae on posterior and anterior surfaces. An2 (**F**, **G**): Prp with medial bulge covered with hairs; a-seta on Enp1 bears tiny spines; b-seta with rather strong spines; h-, i- and j- setae with a few tiny spines near its shafts. Lb (**H**): in dorsal projection elongated, tapered anteriorly. Md (**I**, **J**): Bsp has epipodial appendage with short seta; Enp1 has non-plumose dorsal seta and 4 ventral setae. Mx (**K**): Bsp with long single seta extending over distal edge of Enp1 and having strong marginal spines; Enp1 has 5 strong long spines near distal edge. P5 (**L**): Cxp1–2 covered with long hairs; Cxp3 has 6 setae in ventral group; Bsp with 6 setae in proximal ventral group and 3 in distal. P6 (**M**): Cxp covered with hairs and bears 2 plumose setae; dorsal seta on Bsp reaches half Enp1. P7 (**N**): terminal segment with tiny spines on ventral surface. CF (**O**): with unpaired dorsal seta.

Males. L = 2.08–2.45 mm (2.34 ± 0.10 mm; N = 11); H/L = 50.4 ± 2.2% (N = 10).

Plate 16**A**–**O**. Carapace (**A**–**C**): ventral margin less concave than in female; left valve with a series of ~ 20 long glands; LAG slightly moved anteriorly; posterior margins with small LGGs near PVCs; MGGs present. FO (**D**): capitulum with spines on 2/3 of ventral surface and on dorsal posteriorly; its tip rounded. An1 (**D**, **E**): 1st and 2nd segments bare; 4th segment with a group of spines on dorsal surface; in profile armature of e-seta has ~ 70 short teeth directed proximally; b-seta with 4–6 pairs of short hairs opposite distal part of e-comb; d-seta furnished with numerous tiny spines distally. An2 (**F**–**I**): inner surface of Prp bare; b-seta on Enp1 furnished wirh short spines and ~ 20 long hairs near its base; e-seta present; h-, i- and j- setae without spines; right hook appendage thin and long (its tip not swollen), forms 2 right angles; left one forms one right angle, its distal part straight; each of appendages terminate in

small papilla. Lb (**J**): dorsal projection more elongated than in female. Md (**K**, **L**): Bsp more elongated than in female; dorsal seta on Enp1 plumose. Mx, P5, CF: similar to those in female. P6 (**M**): Cxp2 with 2 plumose setae; all setae on Bsp and Enp1–2 present but rudimentary; ventral terminal seta on Enp3 shorter and thinner than two others, and without long hairs (cut off in the drawing). P7 (**N**): longer terminal seta with a double row of spines proximally. CA (**O**): elongated, tapered to end that is rounded; has 5 muscle bands.

Remarks. Arabian Sea specimens of *C. lophura* differ from *C. lophura lissoides* described by Martens (1979: p. 323, figs 10a–d, 11) from samples collected off the Chilean coast by smaller sizes, carapace with rather distinct concentric striation and right hook appendage having tip not swollen (Pl. 16I). The females of *C. lophura lissoides* have L 2.82–3.08 mm, males 2.63–2.84 mm.

Distribution. *Conchoecia lophura* is reported from all oceans; geographical range is from 60°N to 46°S; mesopelagic species, the bathymetric range of adults is usually 400–1000 m, juveniles occur at 400–600 m (Angel et al., 2008). In the Arabian Sea Region, *C. lophura* was found mainly in the southern part of the investigated area (Fig. 18), in 19% of tows. Maximum abundances were recorded at depths 200–500 m (Fig. 19).

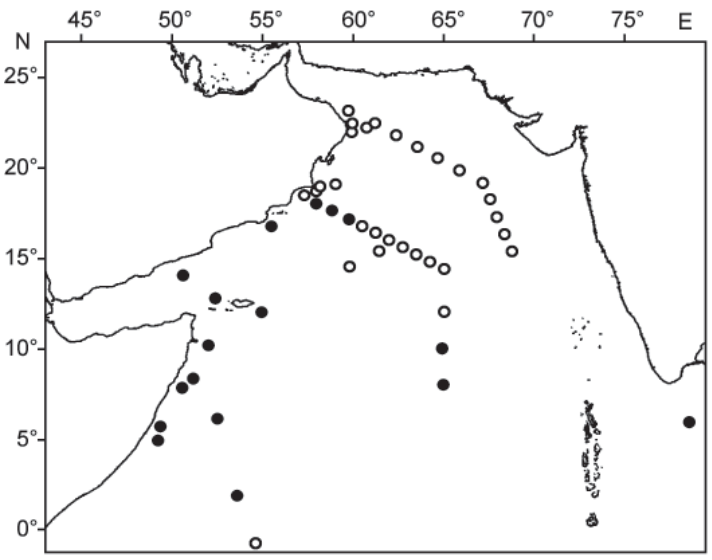


Fig. 18. Occurrence of ***Conchoecia lophura*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

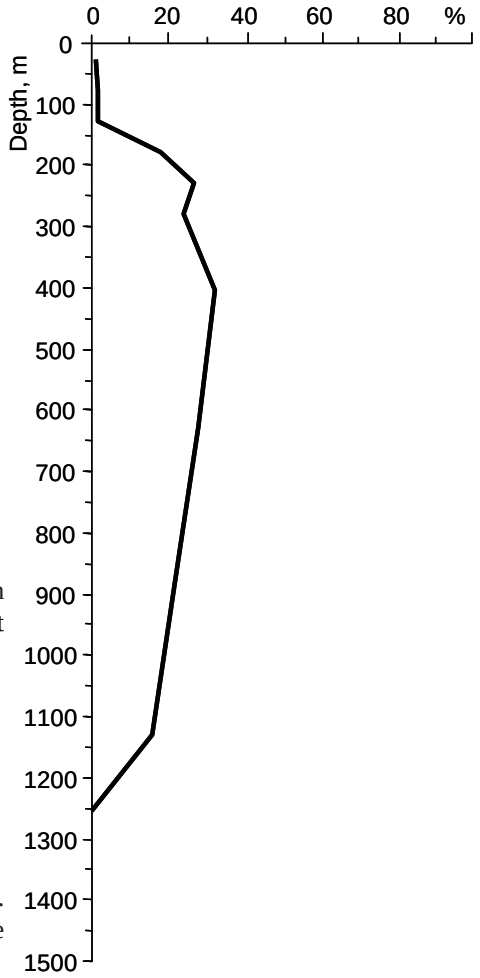


Fig. 19. Occurrence of ***Conchoecia lophura*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

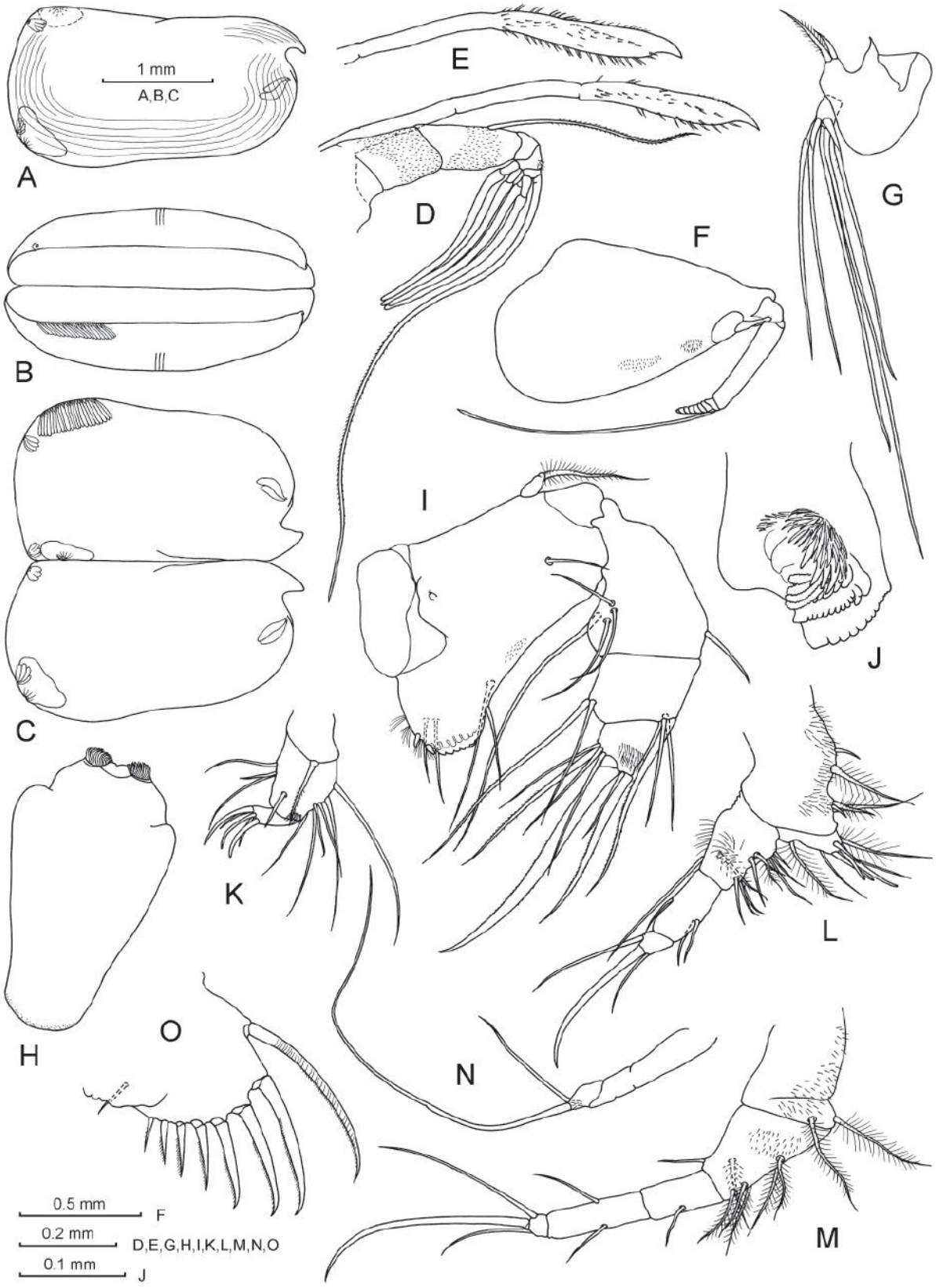


Plate 15. ***Conchoecia lophura***, female. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside. **D** – FO and An1. **E** – other specimen: capitulum of FO. An2: **F** – Prp and Exp; **G** – Enp. **H** – Lb. Md: **I** – Bsp, Enp and Exp; **J** – coxal endite. **K** – Mx. **L** – P5. **M** – P6. **N** – P7. **O** – CF.

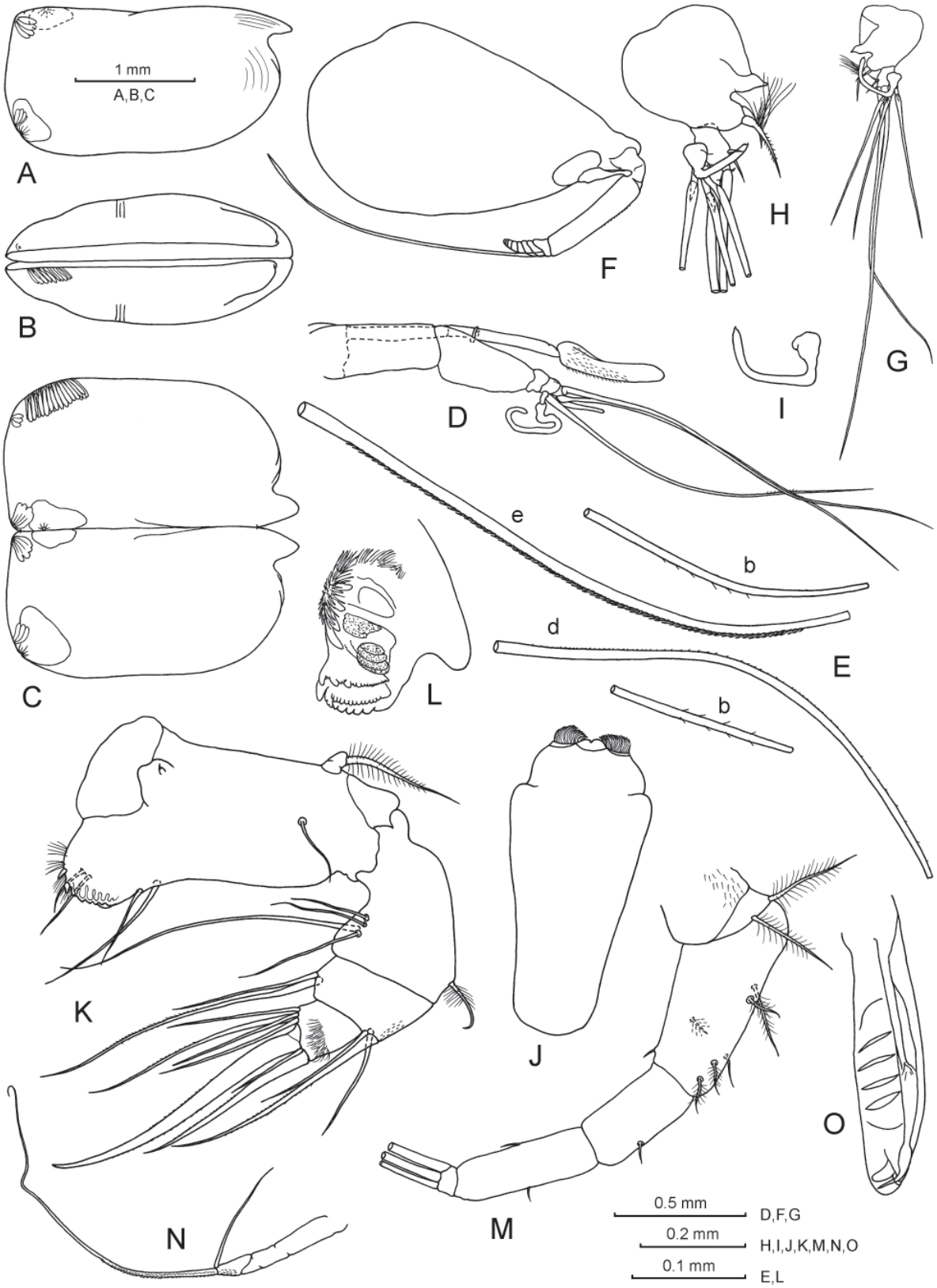


Plate 16. ***Conchoecia lophura***, male. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside. **D** – FO and An1. **E** – An1: armature of b-, d- and e- setae. An2: **F** – Prp and Exp; **G** – right Enp; **H** – left Enp; **I** – right hook appendage. **J** – Lb. Md: **K** – Bsp, Enp and Exp; **L** – coxal endite. **M** – P6. **N** – P7. **O** – CA.

Conchoecia macrocheira Müller, 1906

(Pict. 7; Pl. 17; Figs 20, 21)

Conchoecia macrocheira Müller, 1906a, p. 101, pl. XXI figs 1–9.
Conchoecia macrocheira: Deevey, 1968a, p. 90, fig. 45 (larva); Poulsen, 1969a, p. 171; 1973, p. 128, figs 63, 64; Angel, 1999, pp. 819, 836, fig. 9.35.

Pict. 7. ***Conchoecia macrocheira***. Juvenile female (1.77 mm).

Male. L = 3.10 mm; H/L = 56.3%.

Plate 17**A**, **C**–**S**. Carapace (**A**): $H_{ant} > H_{post}$; anterior margin beneath the rostral incisure swollen; shoulder vaults well developed; LAG slightly moved anteriorly, RAG in usual place on PVC; MGGs present; LGGs absent. FO (**C**): capitulum with spines on proximal 2/3 of ventral surface and a few spines proximally on dorsal surface; its tip rounded. An1 (**D**, **E**): armature of e-seta has comb with 33 pairs of slender spines directed proximally; b- and d- setae have tiny spinules opposite distal part of comb and rarer spinules distally. An2 (**F**–**I**): inner surface of Prp bare; a-seta on Enp1 with no spines, b-seta has a few long hairs; Enp2 with extremely short e-seta; h-, i- and j- setae have about equal lengths; right hook appendage almost squared, long and thin; left one forms one right angle, its distal part straight; both hook appendages terminate into tiny papilla. Md (**J**, **K**): epipodial seta on Bsp missing; Enp1 with 2 ventral setae and non-plumose dorsal seta. Mx (**L**): all setae on Bsp and Enp1–2 with distinct spination; Bsp with long single seta extending over distal edge of Enp1; Enp1 has 8 strong spines near distal edge. P5 (**M**, **N**): surface of Cxp1–2 and Enp1 with long hairs; Cxp3 has 6 setae in ventral group; Bsp with 6 setae in proximal ventral group (4 of them plumose) and 3 in distal (2 of them plumose); epipodite with 4, 5 and 4 long plumose setae in each of three groups; the distal group of setae includes also short seta and a few hairs near its base. P6 (**O**, **P**): Cxp2 with 2 relatively long plumose setae; setae on Bsp and Enp1–2 reduced; ventral terminal seta on Enp3 shorter and thinner than two other, all three setae with long hairs; epipodite has 5, 5 and 6 long plumose setae in each of three groups; as in P5, the distal group of setae includes also short seta and a few hairs near its base. P7 (**Q**): longer terminal seta with double row of tiny hairs proximally. CA (**R**): elongated, tapered to end that is rounded; has 7 muscle bands. CF (**S**): with unpaired dorsal seta.

Juveniles. The juvenile instars of *C. macrocheira* can be easily identified due to their carapaces having characteristic shape with strongly swollen anterior part (Pict. 7; Pl. 17**B**).

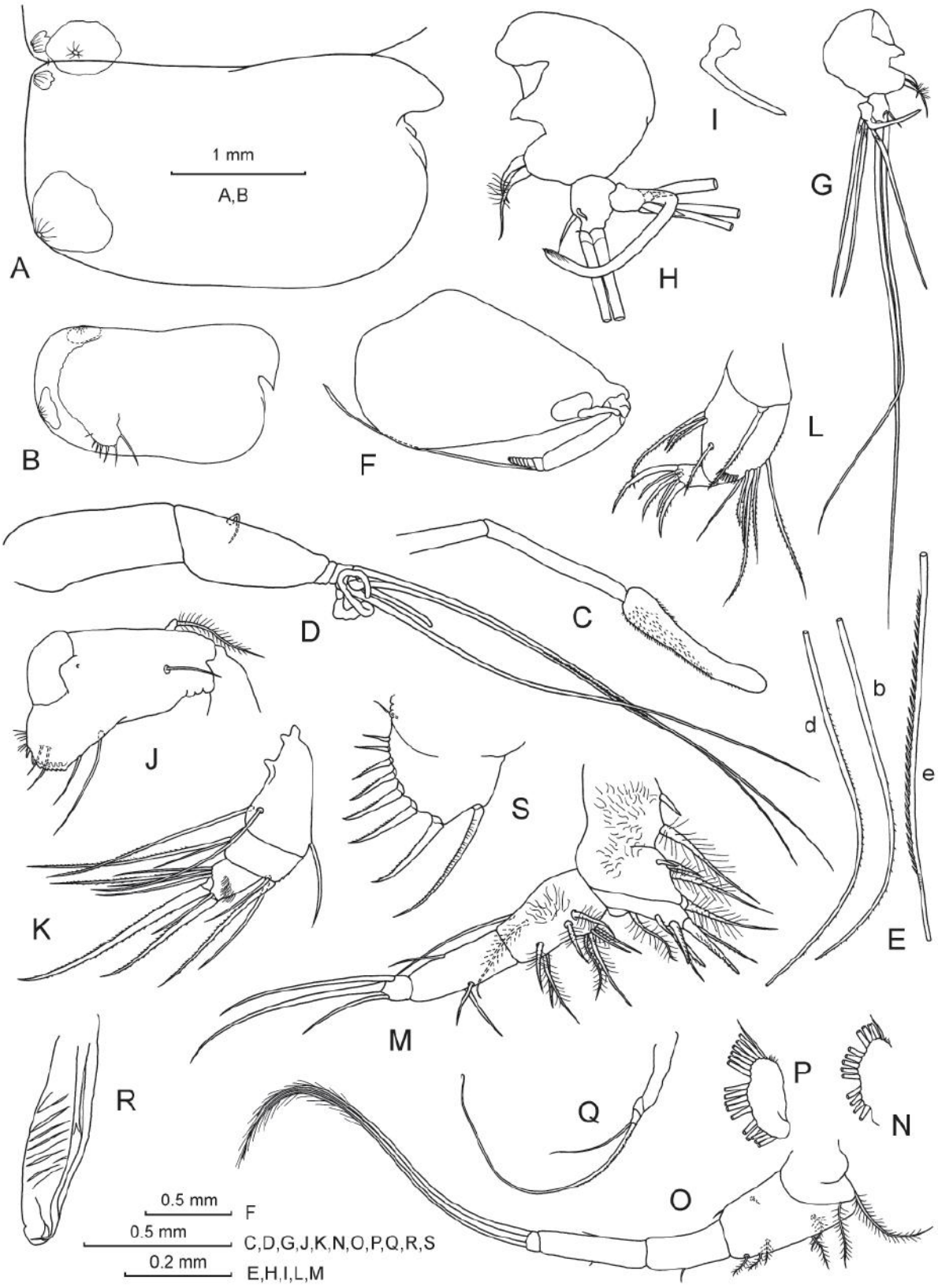


Plate 17. ***Conchoecia macrocheira***, adult male (excluding **B** – lateral view of juvenile female). Carapace: **A** – both valves outside. **C** – FO. **D** – An1. **E** – An1: armature of b-, d- and e- setae. An2: **F** – Prp and Exp; **G**, **H** – left and right Enps; **I** – left hook appendage. Md: **J** – Bsp and Exp; **K** – Enp. **L** – Mx. **M** – P5. **N** – P5: epipodite. **O** – P6. **P** – P6: epipodite. **Q** – P7. **R** – CA. **S** – CF.

Distribution. *Conchoecia macrocheira* is recorded from all oceans; geographical range is from 50°N to 38°S excluding two records from 60°N in the North Atlantic; meso- and bathypelagic species (Angel et al., 2008). In the Arabian Sea Region, *C. macrocheira* was found in the southwest part of the investigated area (Fig. 20), in 4% of tows. Single specimens of this species were recorded at depths 150–1250 m (Fig. 21).

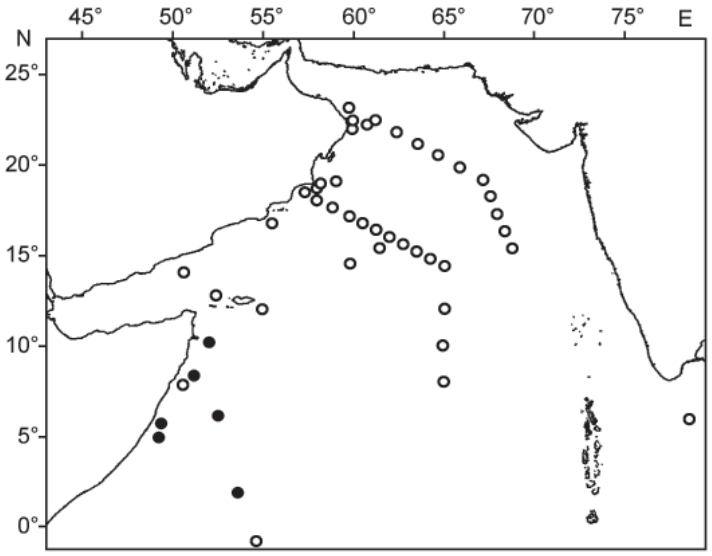


Fig. 20. Occurrence of ***Conchoecia macrocheira*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adult male and juveniles of the species were found.

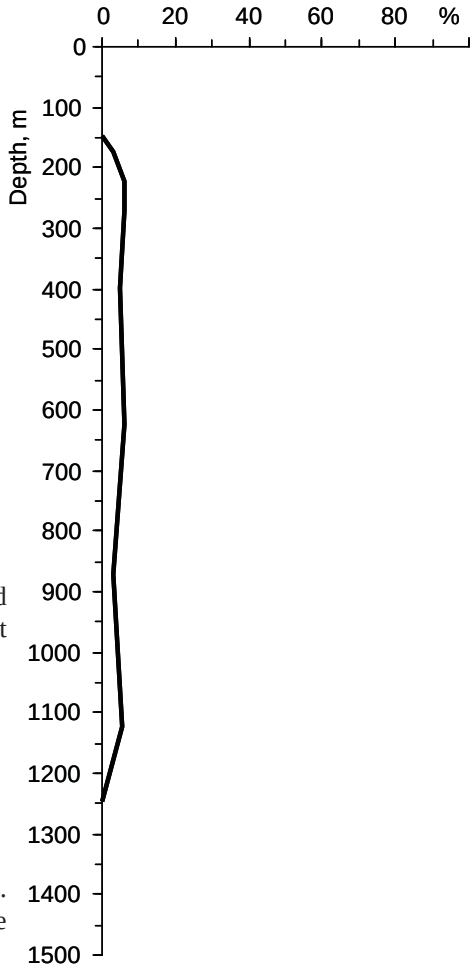


Fig. 21. Occurrence of ***Conchoecia macrocheira*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

Conchoecia magna Claus, 1874

(Pict. 8; Pls 18, 19; Figs 22, 23)

For synonymy before 1906, see Müller, 1906a.
Conchoecia magna var. *typica*: Müller, 1906a, p. 103, pl. XXI figs 17, 18, 20, 26.
Conchoecia magna: Deevey, 1968a, p. 77, figs 36, 37; Angel, 1969b, p. 51, figs 4–6; 1999, pp. 819, 836, fig. 9.36; Poulsen, 1973, p. 135, fig. 66.
Conchoecia aff. *magna*: Martens, 1979, p. 318, figs 7, 8.

Pict. 8. ***Conchoecia magna***. **A** – female; **B** – male.

Females. L = 1.56–1.87 mm (1.71 ± 0.06 mm; N = 179); H/L = 53.0 ± 1.8% (N = 71).

Plate 18**A**–**N**. Carapace (**A**, **B**): shape agrees with genus description; rostrum curved downward. FO (**C**, **D**): capitulum straight, turned downward, with strong spines on almost whole surface, its tip pointed. An1 (**C**): 2nd segment with long, spinous dorsal seta; surfaces of 1st and 2nd segments without spines; 4th segment has a group of short hairs on dorsal surface; e-seta bears tiny spines distally on posterior surface. An2 (**E**–**F**): Prp with medial bulge covered with hairs; a- and b- setae with tiny spines; c-, d-, e- setae missing. Lb (**G**): dorsal projection elongated, tapered anteriorly, with arched anterior edge. Md (**H**, **I**): epipodial appendage with short seta; Enp1 has non-plumose dorsal seta and 3 ventral setae. Mx (**J**): Bsp with long single seta extending over distal edge of Enp1; Enp1 has 4 strong spines near distal edge. P5 (**K**): Cxp3 with 6 setae in ventral group; Bsp with 6 setae in proximal ventral group (one of them plumose) and 3 in distal. P6 (**L**): all setae typical for Conchoeciini present; dorsal seta on Bsp reaches half Enp1. P7 (**M**): longer terminal seta with double row of tiny hairs proximally; terminal segment with very short spines on ventral surface. CF (**N**): with unpaired dorsal seta.

Males. L = 1.46–1.65 mm (1.55 ± 0.04 mm; N = 148); H/L = 53.1 ± 1.9% (N = 61).

Plate 19**A**–**O**. Carapace (**A**–**C**): shoulder vaults well developed; LAG slightly moved anteriorly; MGGs present. FO (**D**, **E**): capitulum with strong spines proximally and tiny spines distally; tip rounded. An1 (**D**, **F**): 4th segment without hairs on dorsal surface; armature of e-seta has comb with 14–15 distal paired spines and ~ 16 proximal alternated ones, all spines directed proximally; b- and d- setae have tiny spines opposite distal part of comb, and d-seta has also rarer spines distally. An2 (**G**–**J**): inner surface of Prp bare; a- and b- setae on Enp1 have tiny spines, and in addition b-seta has a few long hairs; Enp2 with extremely short e-seta; h-, i- and j- setae without spines; right hook appendage almost squared; both hook appendages with pointed tips. Lb (**K**): dorsal projection more elongated than in female. Md (**L**): Bsp more elongated than in female; dorsal seta on Enp1 non-plumose. Mx, P5, P7 (**N**), CF: similar to those in female. P6 (**M**): Cxp2 with 1 plumose seta and 1 thin non-plumose; setae on Bsp and Enp1–2 rudimentary; one of ventral setae on Bsp longer than remaining setae and plumose, dorso-lateral seta missing; all terminal setae on Enp3 about equal and with long hairs. CA (**O**): elongated, tapered to end that is rounded; has 6 muscle bands.

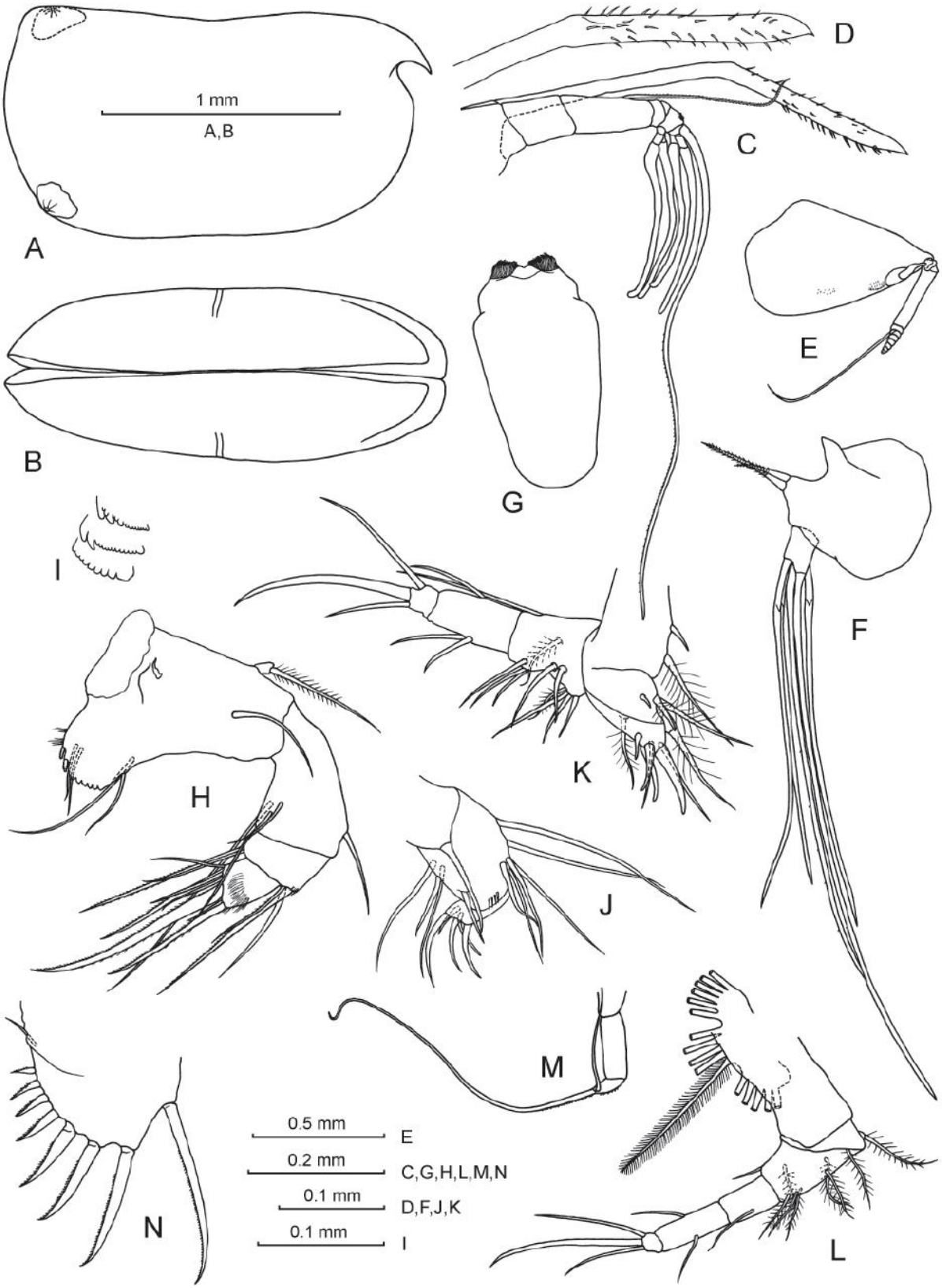


Plate 18. ***Conchoecia magna***, female. Carapace: **A** – lateral; **B** – ventral. **C** – FO and An1. **D** – other specimen: capitulum of FO. An2: **E** – Prp and Exp; **F** – Enp. **G** – Lb. Md: **H** – Bsp, Enp and Exp; **I** –coxal endite: toothed edge, distal and proximal tooth-lists. **J** – Mx. **K** – P5. **L** – P6. **M** – P7. **N** – CF.

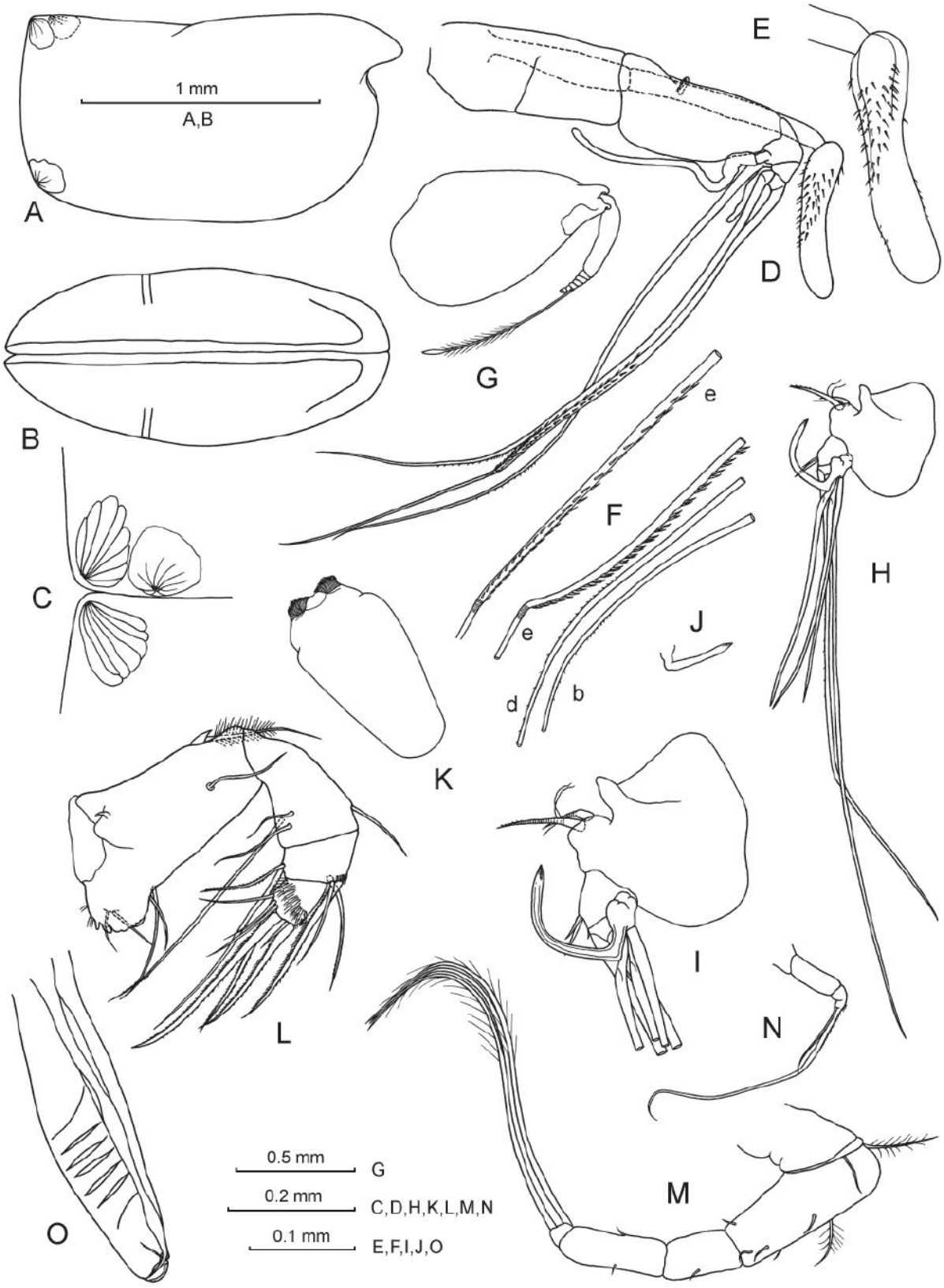


Plate 19. ***Conchoecia magna***, male. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: PDCs. **D** – FO and An1. **E** – capitulum of FO. **F** – An1: armature of b-, d- and e- setae. An2: **G** – Prp and Exp; **H**, **I** – right Enp; **J** – left hook appendage. **K** – Lb. **L** – Md without Cxp. **M** – P6. **N** – P7. **O** – CA.

Distribution. *Conchoecia magna* is recorded from all oceans; geographical range is from 54°N to 54°S, predominantly shallow mesopelagic species, most abundant at depths 100–500 m (Angel et al., 2008). In the Arabian Sea Region, *C. magna* was found mainly in the southern and central parts of the investigated area (Fig. 22), in 35% of tows. Maximum abundances were recorded at depths 50–200 m (Fig. 23).

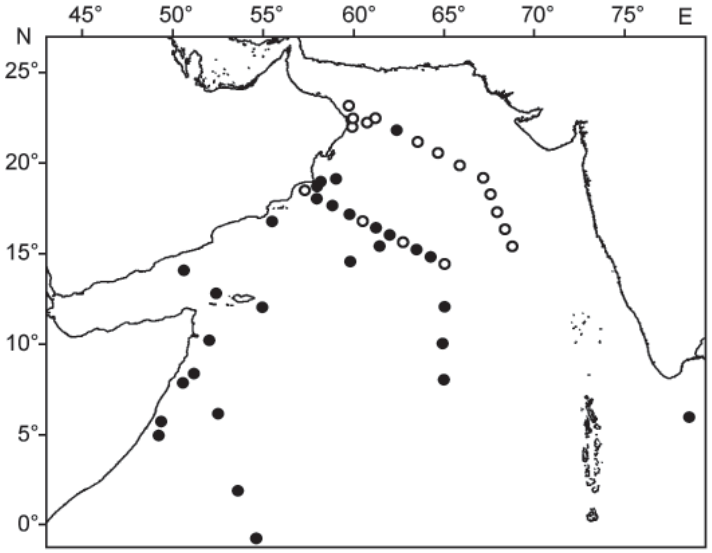


Fig. 22. Occurrence of ***Conchoecia magna*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

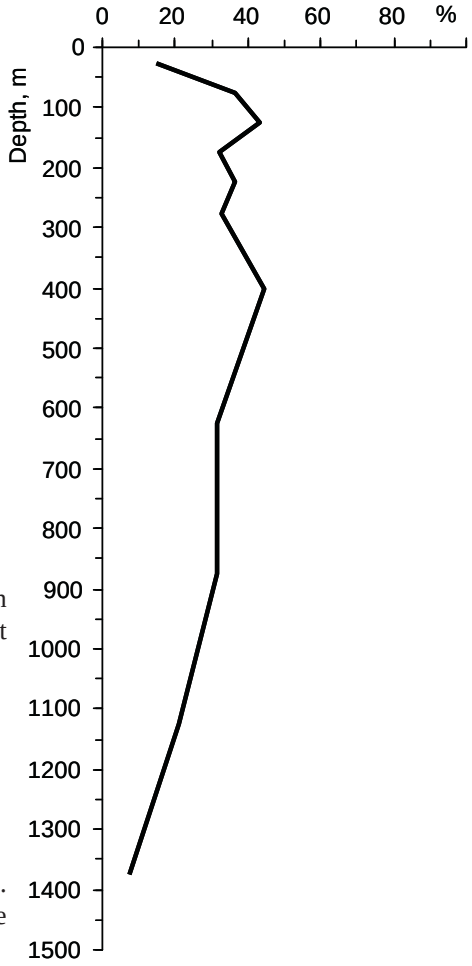


Fig. 23. Occurrence of ***Conchoecia magna*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

Genus ***Conchoecilla*** Claus, 1890

The genus is characterized by the position of the RAG, which is at the anterior end of the carapace margin beneath the rostral incisure. PDCs of carapace acutely angled and developed into a long wedge (Angel, 1999).

A single species, *C. daphnoides* Claus, 1890, has been found in the analyzed material (Table 3, Appendix 2). Male of *C. daphnoides* is described below.

Conchoecilla daphnoides Claus, 1890

(Pict. 9; Pl. 20; Figs 24–26)

For synonymy before 1906, see Müller, 1906a.
Conchoecia daphnoides var. *typica*, *C. daphnoides* var. *minor*: Müller, 1906a, p. 126, pl. XXXI figs 1–15; Deevey, 1968a, p. 111, fig. 60 (female); 1970, p. 819, fig. 9 (male).
Conchoecilla daphnoides: Poulsen, 1973, p. 110, fig. 211; Angel, 1999, pp. 819, 830, fig. 9.40.

Pict. 9. ***Conchoecilla daphnoides***. **A** – male; **B** – pre-adult female.

Females. L = 3.30–3.77 mm (3.60 ± 0.19 mm; N = 5); H/L = 20.4 ± 1.3% (N = 5).

Carapace: L ~ 5 times more than H (far more elongated than in male, see Pl. 3A), with long and pointed rostrum, which is longer on the left valve (Fig. 24A).

Males. L = 2.22–2.36 mm (2.28 ± 0.05 mm; N = 10); H/L = 28.1 ± 1.7% (N = 10).

Plate 20**A**–**S**. Carapace (**A**–**C**): elongated, with serrate posterior margins on both valves; PDCs strongly extended (right longer than left) and pointed; PVCs strongly rounded; in ventral view rostrum broad and obtuse in contrast to females and juveniles having pointed rostrums; RAG opens near anterior ventral corner of carapace beneath the rostrum; LAG opens on posterior margin below PDC, between MGG and left LGG1 (**C**); LGGs1 represent groups of long gland cells that are easily visible in a ventral view: right group places opposite LAG, left one anteriorly of LAG (**B**); one more paired group of glands, LGG2, is located below LGG1; third group, LGG3, and a series of closely placed, narrow gland cells open near PVCs; carapace surface diagonally striated. FO (**D**): capitulum bends up, with rounded, slightly truncated tip, has short spines on proximal 2/3 of ventral surface. An1 (**D**, **E**): in lateral view e-seta bears ~ 100 thin teeth directed proximally; b- and d- setae with a few short spines on level with distal part of e-seta comb. An2 (**F–I**): inner side of Prp bare; Enp1 with strong and large a- and b- setae; their distal halves

covered with hairs, which are longer in mid-parts of setae; e-seta missing; j-, i- and h- setae bare; right hook appendage has 2 processes on inner surface of basal part; both hook appendages end in small papilla. Lb (**J**): in dorsal projection tapered anteriorly, with short hairs laterally; anterior edge rounded and covered with tiny spines. Md (**K**–**M**): Bsp with epipodial appendage having small seta; Enp1 bears plumose dorsal seta and 4 non-plumose ventral setae. Mx (**N**): Bsp with single plumose seta not reaching distal edge of Enp1; Enp1 has 6 setae on anterior side (only most proximal seta non-plumose), 4 plumose setae on posterior side (in one case 5 posterior setae on right Mx; in other species of subfamily Conchoeciinae – 3 posterior setae), 1 non-plumose lateral seta, and 6–9 short spines near distal edge of segment. P5 (**O**): short proximal seta on anterior side of Cxp1 with long hair; Cxp3 with 6 setae in ventral group; Bsp with 6 setae in proximal ventral group (4 of them plumose) and 4 setae in distal (3 of them plumose); dorsal seta on Bsp (vestige of Exp) with rather long hairs proximally. P6 (**P**): Cxp1–2 covered with short hairs distally; Cxp2 bears 2 plumose setae; dorsal and dorso-lateral setae on Bsp extremely short; all 5 ventral setae present and plumose; 3 terminal setae on Enp3 almost equal length, and have long hairs. P7 (**Q**): longer terminal seta with a double row of tiny hairs proximally. CA (**R**): with round end and 5 muscle bands. CF (**S**): unpaired dorsal seta absent.

Juveniles. All instars with pointed rostrum. Pre-adult female and pre-adult male specimens are similar in shape of carapaces (Fig. 24B–E). Male specimens are slightly smaller in length due to the shorter posterior part of carapace, with more developed shoulder vaults (Fig. 24E), have underdeveloped CA (Fig. 24D).

Pre-adult females. L = 2.48–2.64 mm (2.56 ± 0.12 mm); H/L = 22.1 ± 1.0%; N = 2.
Pre-adult males. L = 2.24–2.33 mm (2.27 ± 0.04 mm); H/L = 24.0 ± 0.6%; N = 4.

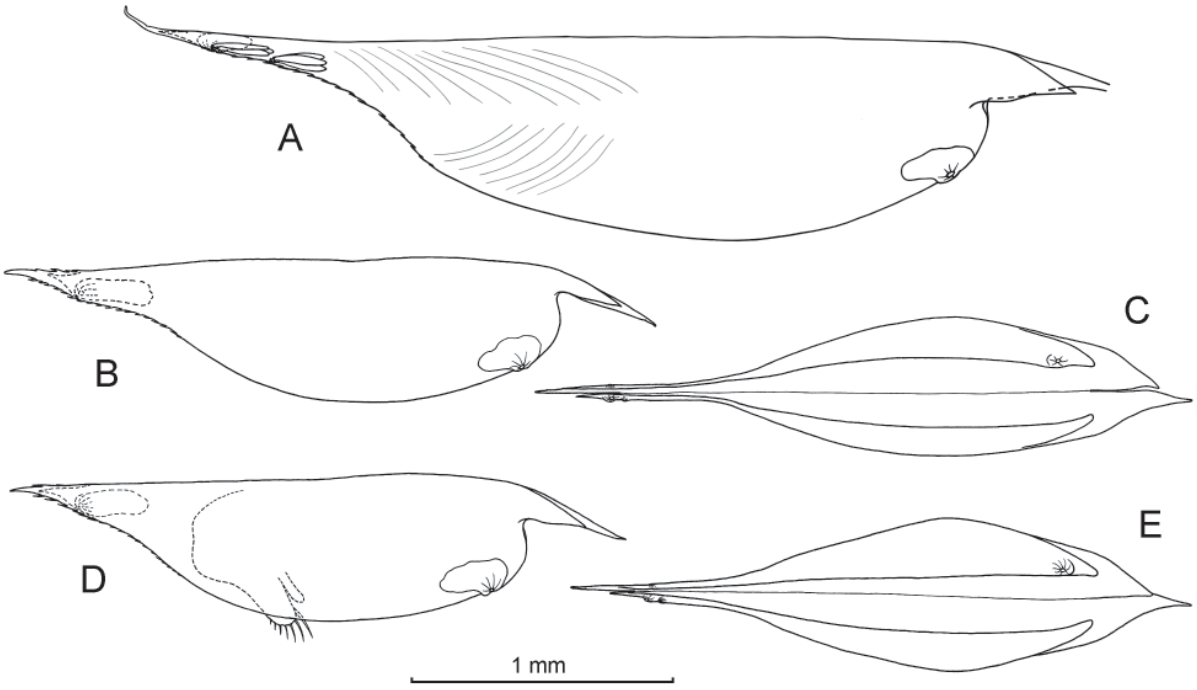


Fig. 24. ***Conchoecilla daphnoides***, adult female (**A**), pre-adult female (**B, C**) and pre-adult male (**D, E**).
A – lateral (tip of left rostrum broken); B, D – lateral (LGGs are not shown); C, E – ventral.

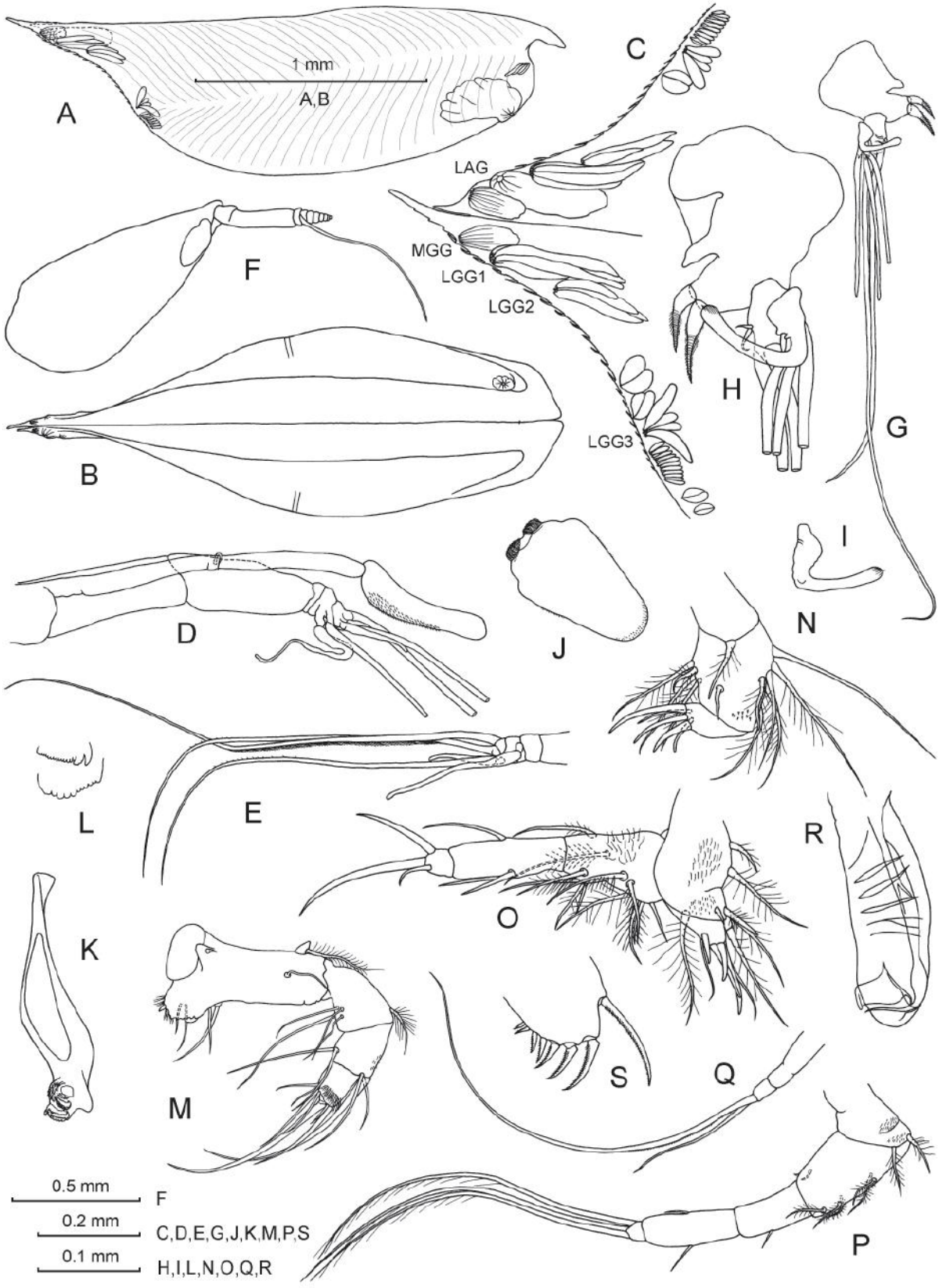


Plate 20. ***Conchoecilla daphnoides***, male. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: PDCs. **D**, **E** – FO and An1. An2: **F** – Prp and Exp; **G**, **H** – left and right Enps; **I** – left hook appendage. **J** – Lb. Md: **K** – Cxp; **L** – coxal endite: toothed edge and distal tooth-list; **M** – Bsp, Exp and Enp. **N** – Mx. **O** – P5. **P** – P6. **Q** – P7. **R** – CA. **S** – CF.

Remarks. *Conchoecilla daphnoides* varies greatly in the length of adult specimens. Müller (1906a) established two varieties differing in size: "*typica*" (females 5.2–5.9 mm, males 3.0–3.25 mm) and "*minor*" (females 4.2–4.9 mm, males 2.25–2.45 mm). The later studies (Poulsen, 1973) found adult individuals of intermediate size and also smaller specimens than Müller's *C. daphnoides minor*. Individuals from our materials belong to the smallest size group of *C. daphnoides*. Perhaps *C. daphnoides* is a species complex as in the case of *D.* aff. *elegans* (see below, p. 83).

Distribution. *Conchoecilla daphnoides* is recorded in all oceans, from 62°N in the Atlantic Ocean to 47°S in Pacific (Poulsen, 1973); a deep to shallow mesopelagic species (Angel et al., 2008). In the Arabian Sea Region, *C. daphnoides* was found in the southern part of the investigated area (Fig. 25), in 7% of tows. Single specimens of *C. daphnoides* were recorded up to 1000 m (Fig. 26), most often at depths 100–500 m.

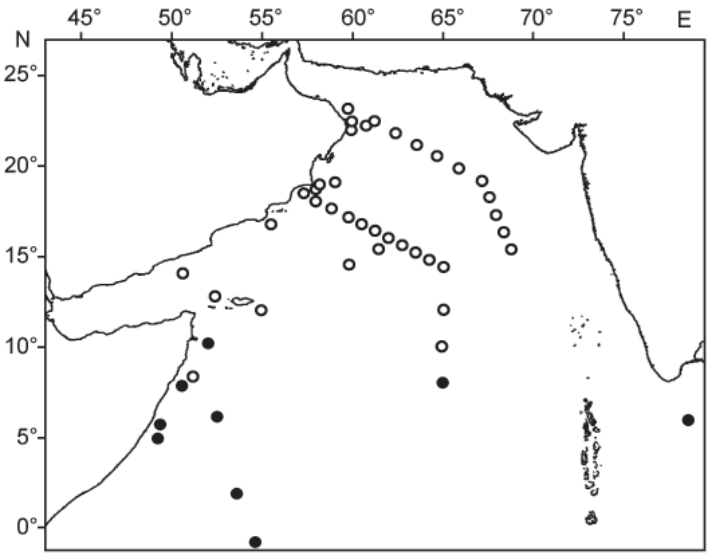


Fig. 25. Occurrence of ***Conchoecilla daphnoides*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

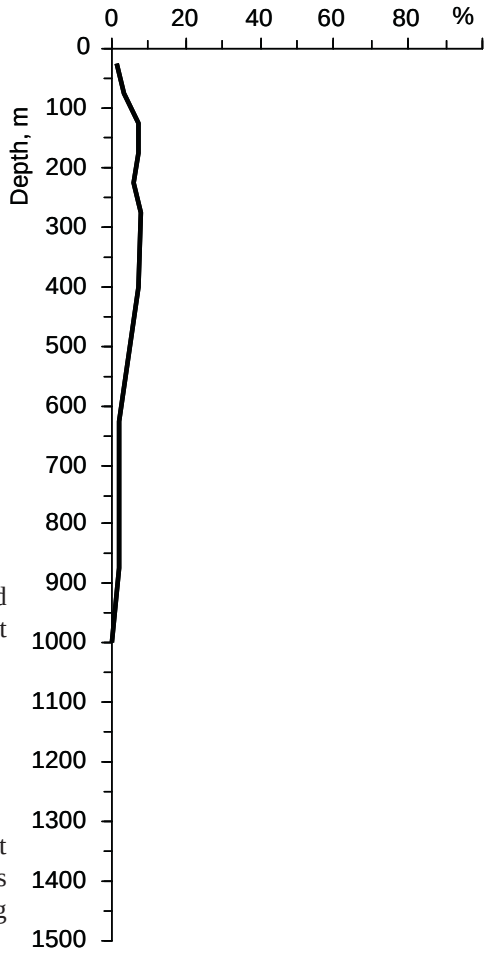


Fig. 26. Occurrence of ***Conchoecilla daphnoides*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

Genus ***Conchoecissa*** Claus, 1890

Carapace highest posteriorly, surface strongly reticulate; rostrum pointed, long, bent downward; PDCs of both valves with distinct, but unequal spines; the PVCs of both valves developed into tubercles which in some species are developed into quite long processes. (Angel et al., 2008).

Three species of the genus *Conchoecissa* have been found in the analyzed material: *C. imbricata* (Brady, 1880); *C. plinthina* (Müller, 1906) and *C. symmetrica* (Müller, 1906) (Table 3, Appendices 1, 2).

Key to the species of ***Conchoecissa*** (adult females and males):

1 Rostrum long;
PVCs developed into long processes
(Pls 3B, 21A, B, 22A, B) ……..……...……...……..….. ***C. imbricata***

1a Rostrum shorter;
processes on PVCs less developed or almost missing ..…....……. 2

2 L < 4 mm;
processes on PVCs short and conical
(see Kock, 1992, fig. 16b, c; Angel et al., 2008) ……***C. symmetrica***

2a L > 4.5 mm;
processes on PVCs slightly developed, almost missing
(Pls 3B, 23A, C) .……..…… ***C. plinthina***

Two of these species, *C. imbricata* and *C. plinthina* (only male), are described here.

Conchoecissa imbricata (Brady, 1880)

(Pict. 10; Pls 21, 22; Figs 27, 28)

For synonymy before 1906, see Müller, 1906a.
Conchoecia imbricata: Müller, 1906a, p. 118, pl. XXVIII figs 1–6; Deevey, 1968a, p. 108, figs 57, 58.
Conchoecissa imbricata: Poulsen, 1973, p. 182, fig. 94; Angel, 1999, pp. 819, 830, fig. 9.42.

Pict. 10. ***Conchoecissa imbricata***. **A** – female; **B** – male.

Females. L = 2.78–3.02 mm; H/L = 42.9 ± 4.1%; N = 2.

Plate 21**A**–**N**. Carapace (**A**, **B**): with PDCs produced into sharp points (left considerably longer than right) and posterior ventral conical processes with serrate margins on both valves; rostrum long, almost symmetric, curved; LAG in usual place, RAG opens on tip of right posterior ventral process, left process bears openings of lateral corner glands; surface of carapace strongly reticulate. FO (**C**): capitulum elongated, with larger spines on ventral surface and proximally on dorsal, and smaller spines more distally on dorsal surface. An1 (**C**): with dorsal seta; e-seta has a row of short spines on its middle third. An2 (**D**–**F**): Prp has medial bulge without spines; Enp2+3 with very short c- or d-seta; h-, i- and j- setae have short spines proximally. Lb (**G**): in dorsal projection oval, laterally with short hairs; hyaline membrane with almost straight edge. Md (**H**–**J**): Bsp has short lateral seta and epipodial seta with stout marginal spines; inner surface of basal endite with a few small spines; Enp1 bears non-plumose dorsal seta and 4 ventral setae, one of ventral setae plumose. Mx (**K**): Bsp with single seta which reaches distal edge of Enp1; Enp1 elongated and has 3–4 strong spines near its distal edge. P5 (**L**): Cxp3 with 6 setae in ventral group; Bsp with 6 setae in proximal ventral group (2 of them plumose) and 3 setae in distal ventral group (one of them plumose). P6 (**M**): Cxp1–2 partly covered with hairs; dorsal seta on Bsp rather long; ventral terminal seta on Enp3 short, about half of longest medial seta. P7 (**N**): longer terminal seta with a double row of tiny spines proximally, shorter seta about half length of longer. CF (as in male in Pl. 22P): unpaired dorsal seta present.

Males. L = 2.55–2.64 mm (2.59 ± 0.05 mm; N = 3); L/H = 39.6 ± 1.0% (N = 2).

Plate 22**A**–**P**. Carapace (**A**, **B**): as in female but less tapered, with more developed shoulder vaults and with MGGs. FO (**C**): elongated, with larger spines proximally, smaller distally. An1 (**C**, **D**): e-seta comb consists of 9–10 paired, stout, large teeth, and unpaired tooth on proximal end of comb; b-seta has a few tiny spines, and d-seta ~ 12 pairs of small spines on level with e-comb; distal parts of both b- and d- setae slightly flattened, with tiny marginal spinules. An2 (**E**–**I**): Enp2 with extremely short e-seta; hook appendages elongated and slender (right larger than left); both have processes on inner surface of basal part; their tips pointed, with small papilla. Lb (**J**): dorsal projection more elongated than in female. Md (**K**): dorsal seta on Enp1 plumose. Mx (**L**), P5, P7 (**N**), CF (**P**): similar to those in female. P6 (**M**): all setae on Bsp and Enp1–2 present but shorter than in female; ventral terminal seta on Enp3 shorter and thinner than two others, and without long hairs (cut off in the drawing). CA (**O**): with round end and 4–5 muscle bands.

Distribution. *Conchoecissa imbricata* is one of the most widely reported species; occurs in all oceans; geographical range is from 60°N to 50°S; predominantly shallow mesopelagic species (Angel et al., 2008). In the Arabian Sea Region, *C. imbricata* was found mainly in the south-west of the investigated area (Fig. 27), in 9% of tows, at depths up to 500 m (Fig. 28).

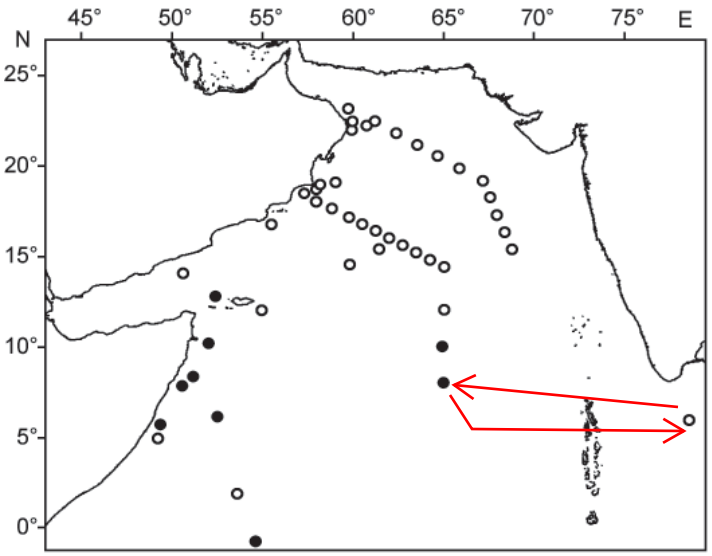


Fig. 27. Occurrence of ***Conchoecissa imbricata*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

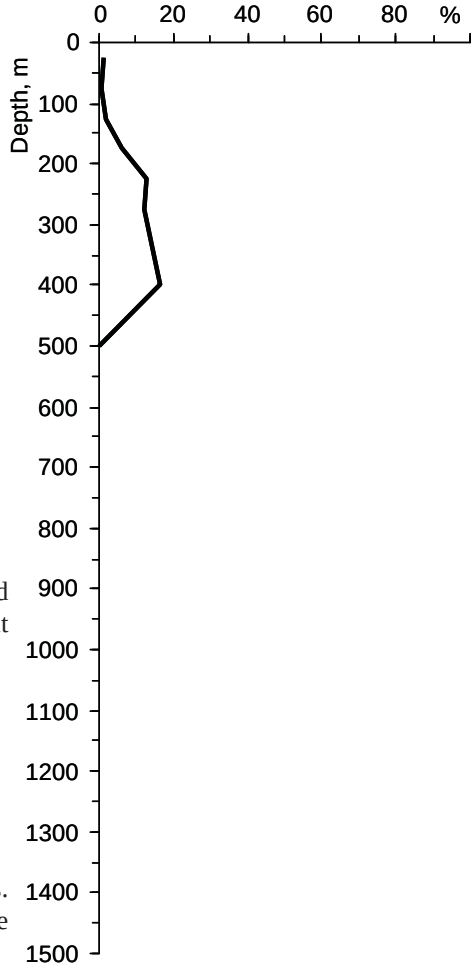


Fig. 28. Occurrence of ***Conchoecissa imbricata*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

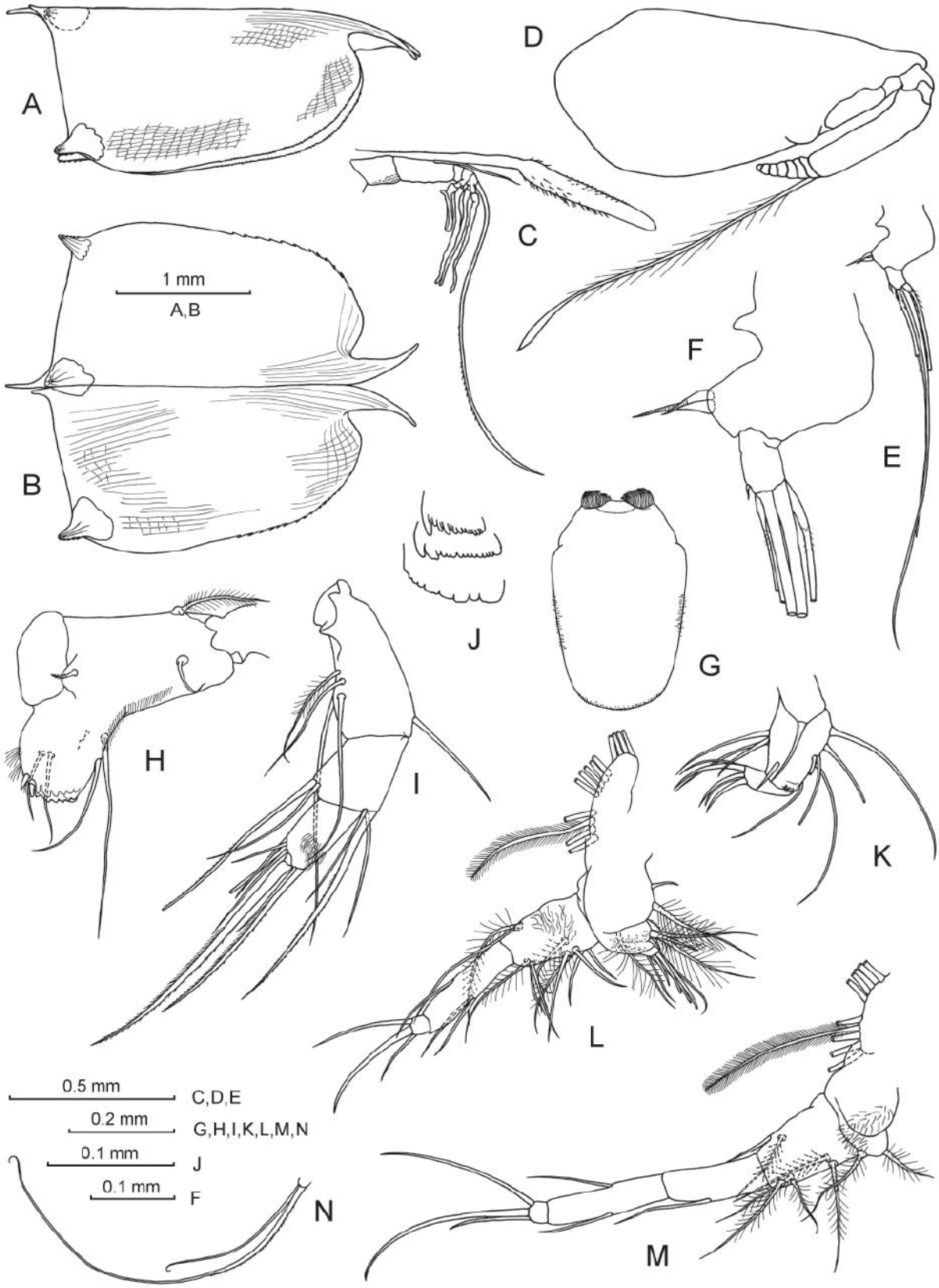


Plate 21. ***Conchoecissa imbricata***, female. Carapace: **A** – lateral; **B** – both valves outside. **C** – FO and An1. An2: **D** – Prp and Exp; **E**, **F** – Enp. **G** – Lb. Md: **H** – Bsp and Exp; **I** – Enp; **J** – coxal endite: toothed edge, distal and proximal tooth-lists. **K** – Mx. **L** – P5. **M** – P6. **N** – P7.

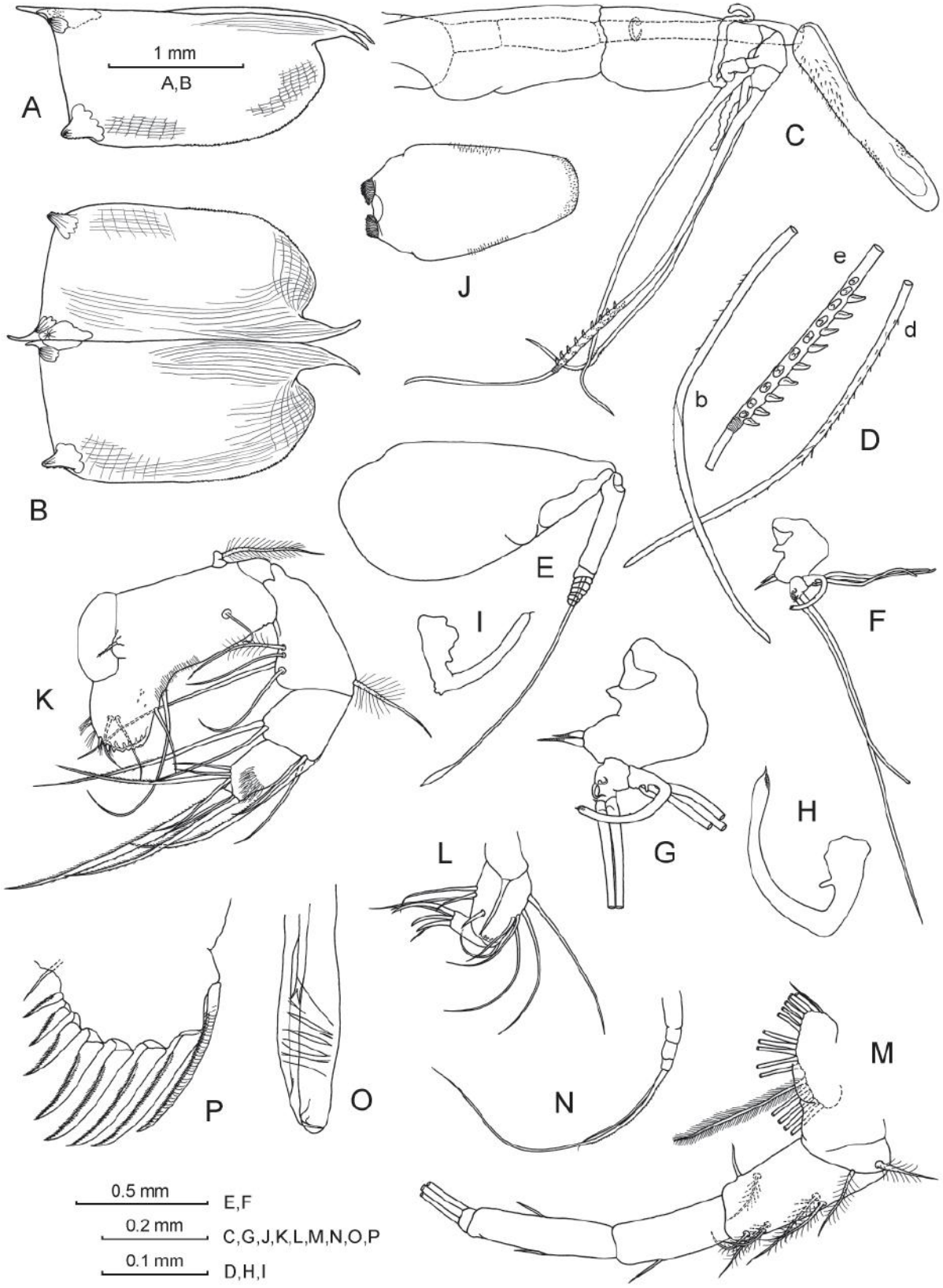


Plate 22. ***Conchoecissa imbricata***, male. Carapace: **A** – lateral; **B** – both valves outside. **C** – FO and An1. **D** – An1: armature of b-, d- and e- setae. An2: **E** – Prp and Exp; **F**, **G** – right Enp; **H**, **I** – right and left hook appendages. **J** – Lb. **K** – Md without Cxp. **L** – Mx. **M** – P6. **N** – P7. **O** – CA. **P** – CF.

Conchoecissa plinthina (Müller, 1906)

(Pict. 11; Pl. 23; Figs 29, 30)

Conchoecia plinthina Müller, 1906a, p.116, pl. XXVII figs 1–6, 9, 10, 20.
Conchoecissa plinthina: Poulsen, 1973, p. 188, fig. 98; Angel, 1999, pp. 819, 830, fig. 9.43.

Pict. 11. ***Conchoecissa plinthina***. Male.

Female. L = 5.28 mm; H/L = 46.4%.

Males. L = 4.53–4.83 mm; H/L = 46.2 ± 0.3%; N = 2.

Plate 23**A**–**V**. Carapace (**A**–**C**): tapered anteriorly; rostrum pointed, symmetric; PDCs with spines (left longer than right); tubercles on PVCs slightly developed; LGGs present and open on posterior margin just above RAG and opposite on left valve; MGGs present; surface of carapace strongly reticulate. FO (**D**, **E**): capitulum elongated; its distal part slightly bent, tip rounded; proximal 2/3 of ventral surface with spines, and a few tiny spines on dorsal surface distally. An1 (**D**, **F**): e-seta has a comb with ~ 40 pairs of stout large teeth densely placed almost at right angles to seta, and a pair of shorter, flattened processes just distally of comb; b-seta has a few spinules on level with e-comb; d-seta with double row of spinules, more numerous and densely arranged than in *C. imbricata* (see Pl 22D); its distal part slightly flattened, with tiny marginal spinules. An2 (**G**–**J**): inner surface of Prp bare; b-seta on Enp2 of left An2 with a few long hairs; on b-seta of right Enp2 long hairs absent; e-seta present; right hook appendage elongated, strongly curved, and has a process on inner surface of basal part; left one far shorter; both appendages with rounded tips ending into small papillae. Lb (**K**): in dorsal projection with rounded anterior edge covered with tiny spinules; with hairs laterally; hyaline membrane with almost straight edge. Md (**L**–**N**): Bsp with short lateral seta; seta on epipodial appendage only a little shorter than lateral one; Enp1 bears plumose dorsal seta and 4 ventral setae (3 shorter of them are plumose). Mx (**O**): Bsp with single seta not reaching distal edge of Enp1; Enp1 elongated and has 6 strong short spines near its distal edge. P5 (**P**, **Q**): Cxp3 with 7 setae in ventral group (one of them plumose); Bsp with 6 setae in proximal ventral group (2 of them plumose) and 3 setae in distal ventral group (one of them plumose); ventral terminal seta on Enp2 about 2 times shorter than central one; epipodite with 4, 5 and 4 long plumose setae in each of three groups. P6 (**R**): Cxp2 with 2 plumose setae; all setae on Bsp and Enp1–2 present; ventral terminal seta on Enp3 slightly shorter than two others and without long hairs; epipodite with 5, 5 and 6 long plumose setae in each of three groups. P7 (**S**): longer terminal seta with a double row of tiny hairs proximally, shorter seta about half of longer one. CA (**T**): with rounded end and 6 muscle bands. CF (**U**, **V**): first 5 claws have double rows of strong triangular teeth; 6^{th} to 8^{th} claws far shorter and slender, with double rows of thin spines; unpaired dorsal seta present.

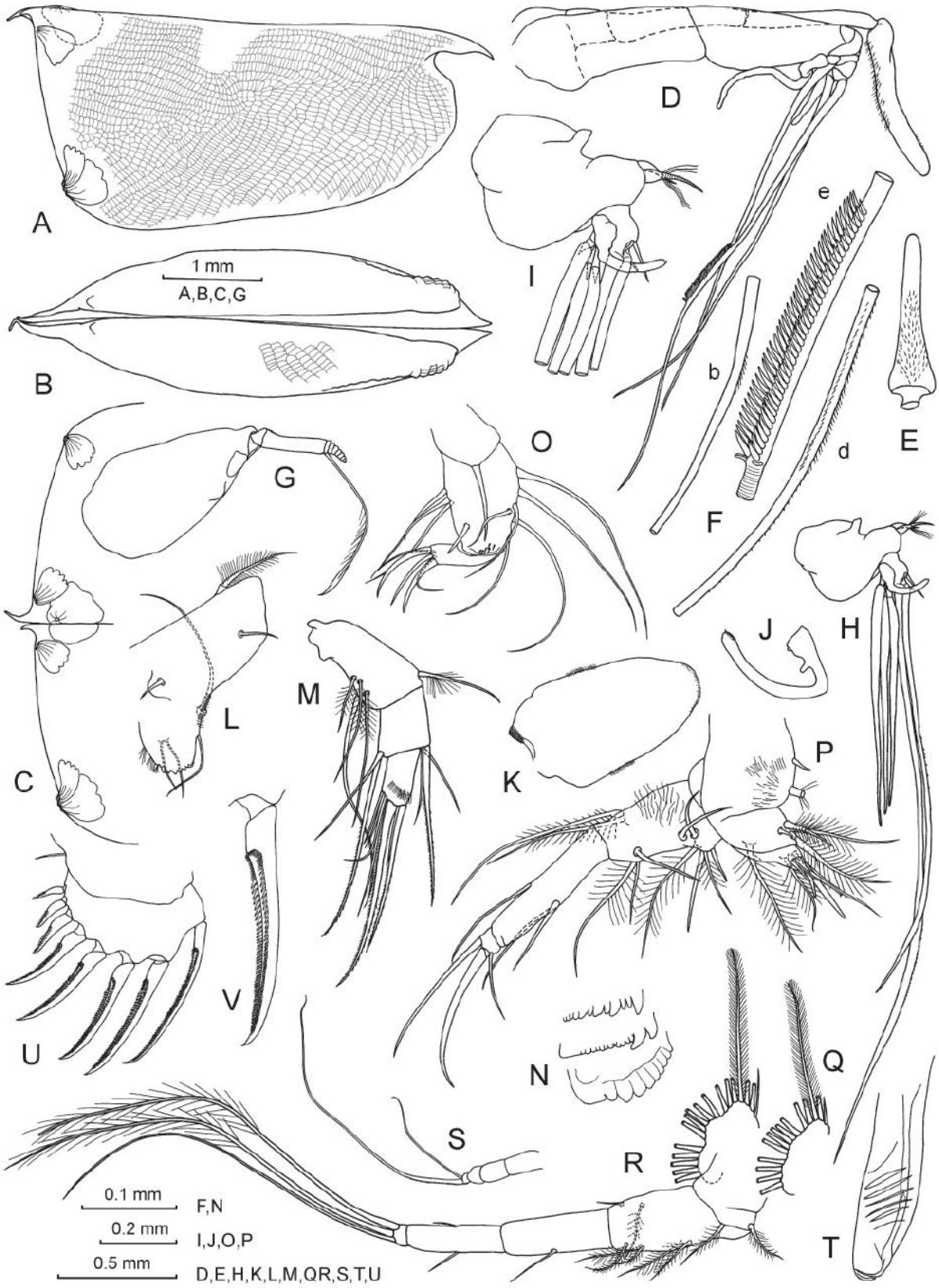


Plate 23. ***Conchoecissa plinthina***, male. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: posterior margins. **D** – FO and An1. **E** – capitulum of FO ventrally. **F** – An1: armature of b-, d- and e- setae. An2: **G** – Prp and Exp; **H**, **I** – left Enp; **J** – right hook appendage. **K** – Lb. Md: **L** – Bsp and Exp; **M** – Enp; **N** – coxal endite: toothed edge, distal and proximal tooth-lists. **O** – Mx. **P** – P5. **Q** – P5: epipodite. **R** – P6. **S** – P7. **T** – CA. **U** – CF. **V** – CF: 3rd claw (higher magnification).

Distribution. *Conchoecissa plinthina* occurs in all oceans (from 45°S–50°N), appears to be rare in the North Pacific; bathypelagic species, mainly caught at depths of 1000–2000 m (Angel et al., 2008). In the investigated area, *C. plinthina* was found only at four stations (Fig. 29), deeper than 1000 m (Fig. 30).

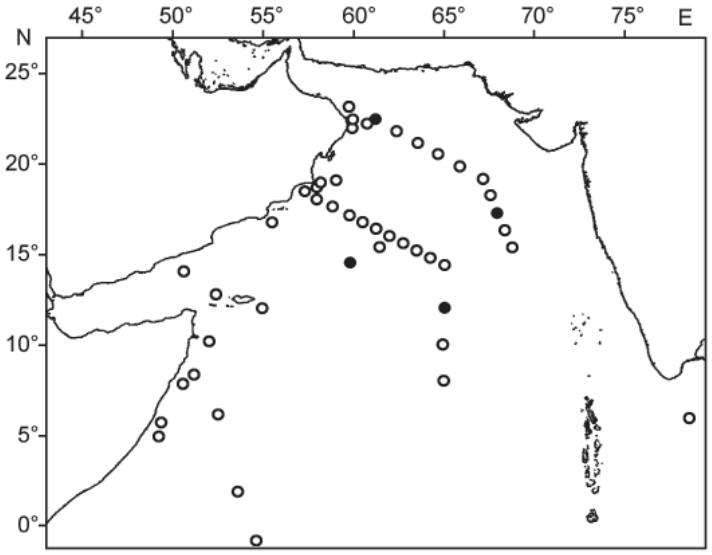


Fig. 29. Occurrence of ***Conchoecissa plinthina*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

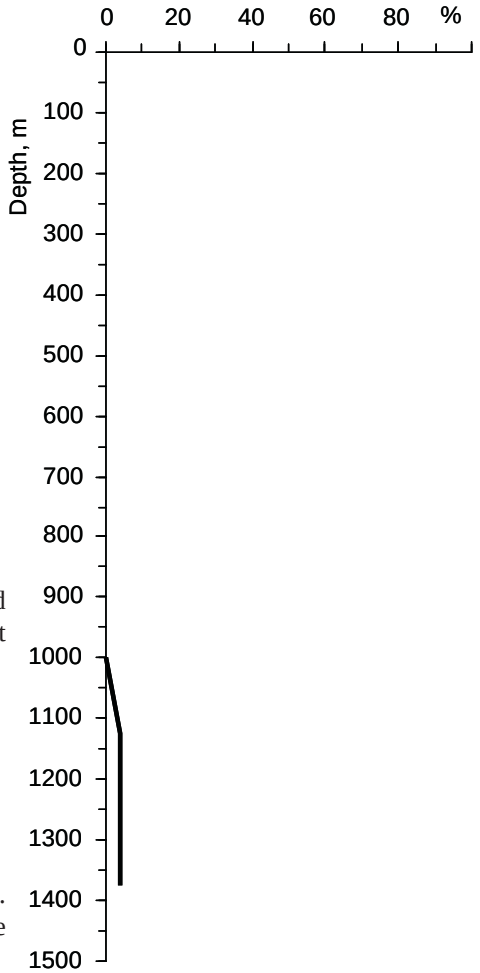


Fig. 30. Occurrence of ***Conchoecissa plinthina*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

Genus ***Discoconchoecia*** Martens, 1979

Carapace elongated, delicate, tapered anteriorly; right PDC with 1–3 spines or without, left one always without spines; LAG and RAG about at usual places near PDC and PVC; e-seta of male An1 without comb of spines; instead of comb, e-seta has, at about two-thirds of its length, a characteristic oval plate like a suctorial organ, seemingly formed of long fragile spines cemented together. (Scogsberg, 1920; Deevey, 1968a).

Three species of the genus *Discoconchoecia* was found in the analyzed material: *D. discophora* (Müller, 1906); *D.* aff. *elegans* (Sars, 1865) and *D. tamensis* (Poulsen, 1973) (Table 3, Appendix 2). All these species are described below.

Key to the species of ***Discoconchoecia***:

Adult females:

1 Mean H/L < 40%; posterior margin of carapace almost straight; right PDC with 1–3 spines; An1 with dorsal seta, sensorly setae extend over half e-seta; Md Enp1 has 3 ventral setae (Pls 7B, 24A, C, D, H) ..... ***D. discophora***

1a Mean H/L > 40%; posterior margin of carapace more or less convex; right PDC with spines or without; An1 without dorsal seta, sensorly setae ~ half e-seta; Md Enp1 has 2 ventral setae (Pls 7B, 26A, D, I, 28A, D, J) 2

2 Right PDC with 1–3 spines; LAG slightly displaced along dorsal margin from posterior hinge toward rostrum; a-seta on An2 Enp1 with a few long hairs near its base (Pls 7B, 26C, G) ..... ***D.*** aff. ***elegans***

2a Right PDC without spines; LAG just near posterior hinge; a-seta on An2 Enp1 without long hairs (Pls 7B, 28C, H) ..... ***D. tamensis***

Adult males:

1 Mean H/L < 40%; An1 a-seta without swelling, c-seta longer than 2nd segment, d-seta markedly shorter and thinner than b- and e- setae; width of An2 Enp1 about equal its length; A2 Enp2 with f- and g- setae having swollen bases, f-seta somewhat shorter than g-seta; one of terminal claws on Md Enp3 curved (Pls 7B, 25A, D, H, J, L) ..... ***D. discophora***

1a Mean H/L > 40%; An1 a-seta has swelling on level with hooked dorsal seta, c-seta much shorter than 2nd segment; d-seta only somewhat shorter than b- and e- setae; width of An2 Enp1 about twice its length; f- and g- setae on An2 Enp2 with bases not swollen, f-seta more than two times longer than g-seta; all terminal claws on Md Enp3 straight (Pls 7B, 27A, D, H, I, M, 29A, D, I, J, M) 2

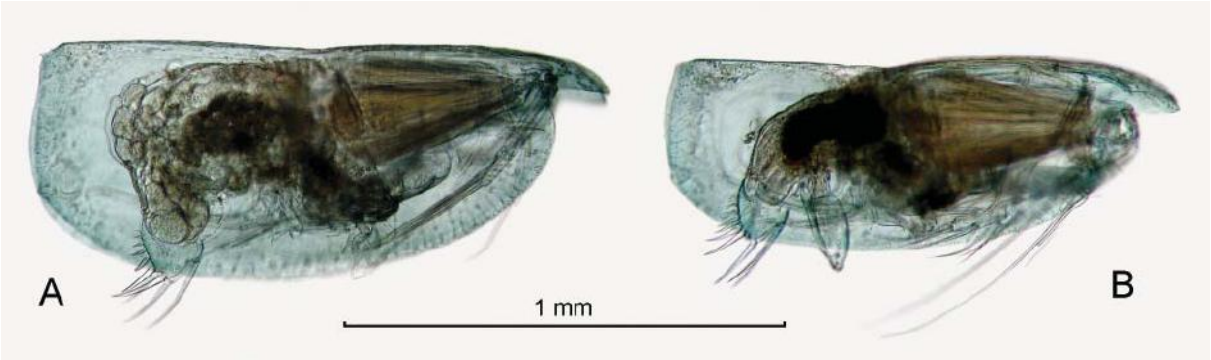
2 Right PDC with very small 1–3 spines (or without spines but with angled corner); LAG slightly displaced toward rostrum; a- and b- setae on An2 Enp1 with thickened bases, a-seta strongly curved (Pls 7B,27C, I) ..... ***D.*** aff. ***elegans***

2a Both PDCs rounded; LAG just near posterior hinge; a- and b- setae on An2 Enp1 markedly more delicate (Pls 7B, 29C, J) ..... ***D. tamensis***

Discoconchoecia discophora (Müller, 1906)

(Pict. 12; Pls 24, 25; Figs 31, 32)

Conchoecia discophora Müller, 1906a, p. 67, pl. XIII figs 1–9, 12–18.
Discoconchoecia discophora discophora: Martens, 1979, p. 341.



Pict. 12. ***Discoconchoecia discophora***. **A** – female; **B** – male.

Females. L = 1.23–1.42 mm (1.31 ± 0.04 mm; N = 154); H/L = 38.1 ± 1.8% (N = 20).

Plate 24**A**–**M**. Carapace (**A**–**C**): well elongated, tapered anteriorly; dorsal margin almost straight, ventral arched; right PDC with distinct spine and 1–2 small additional spines, left one angled but not pointed; LAG just near posterior hinge of carapace, RAG about in usual place. FO (**D**): straight; no clear division into stem and capitulum which is bare and has rounded tip. An1 (**D**): 2nd segment with short dorsal seta; e-seta with tiny spines distally on posterior surface; sensory setae extend over half e-seta. An2 (**E**, **F**): Prp with feebly marked medial bulge covered with tiny spines; a- and b- setae on Enp1 have fine spines, b-seta longer than Enp2+3; c- and d-setae present; g-seta distally slightly widened and only a little longer than f-, h-, i- and j- setae. Lb (**G**): in dorsal projection tapered, anterior edge slightly rounded. Md (**H**): Enp1 has non-plumose dorsal seta and 3 ventral setae. Mx (**I**): Bsp with single seta not reaching distal edge of Enp1; Enp1 with 6 setae on anterior side, 3 on posterior (one of them plumose), 1 laterally and a few small spines near insertion of Enp2. P5 (**J**): Cxp3 with 6 setae in ventral group; Bsp bears 6 setae in proximal ventral group (one of them plumose) and 2 setae in distal ventral group. P6 (**K**): surfaces of Cxp1–2 with hairs distally; all setae typical for Conchoeciini present; dorsal seta on Bsp long, almost reaching distal edge of Enp1, most distal ventral seta extending over distal edge of Enp1. P7 (**L**): longer of 2 terminal setae proximally with a double series of tiny short spines. CF (**M**): unpaired dorsal seta missing.

Males. L = 1.08–1.23 mm (1.14 ± 0.02 mm; N = 105); H/L = 36.9 ± 2.0% (N = 12).

Plate 25**A**–**R**. Carapace (**A**–**C**): more elongated, with much smaller spines on right PDC than in female; MGGs present. FO (**D**): capitulum short and bare; its tip rounded. An1 (**D**, **E**): a-seta thick and long (about as long as b- and e- setae); b-seta thickened proximally and has double row of short spines on its distal half; c-seta long, slightly longer than 2nd segment; e-seta proximally thickened, with oval plate; it has small but easily visible swelling just distally of plate; d-seta slender and shorted, extends somewhat over oval plate, has a few fine spines opposite this plate. An2 (**F**–**J**): inner surface of Prp bare; width of Enp1 about equal its length; a- and b- setae have tiny spines; e-seta missing; f- and g- setae have swollen bases (**J**) and about equal lengths (f-seta somewhat shorter than g-seta), slightly widened distally; right hook appendage large and strongly curved, slightly tapered toward end, which is rounded; left one thin and weak. Lb (**K**): dorsal projection more elongated than in female. Md (**L**): dorsal seta on Enp1 plumose; Enp2 with a few long hairs on anterior surface; one of 3 longest terminal claws on Enp3 curved. Mx (**M**), P5 (**N**), P7 (**P**), CF (**R**): similar to those in female. P6 (**O**): all

setae present but much shorter than in female; dorsal seta on Bsp reaches half Enp1; all terminal setae on Enp3 about equal and with long hairs. CA (**Q**): rather widened, strongly narrowed to end; tip rounded.

Remarks. Specimens of *D. discophora* from our materials are in the best agreement with specimens described by Müller (1906a), excluding the lack of c- and d- setae on female An2 Enp2+3 in the latter.

Arabian Sea male specimens differ from male of *D. discophora capitelonga* described by Martens (1979: p. 341, fig. 20c, f) from samples collected off the Chilean coast by the shorter capitulum of FO and the lack of long hairs on its ventral surface and on anterior surface of Md Enp2 (Pl. 25D, L).

A single female described by Poulsen (1973: p. 48, fig. 20) as *D. discophora* and having left PDC evenly rounded, right one without additional spines, long anterior hairs on e-seta of An1, and dorsal seta on CF, most probably, is not "*discophora*". The male specimen (Angel, 1999: fig. 9.46C, D, H) with short c-, long d- setae on An1, and relatively not large right hook appendage; and also the female specimen (Chavtur & Stovbun, 2004: fig. 3) having carapace with cellular sculpture and L = 1.75 mm, most probably, are not "*discophora*", too. A single female found by Deevey (1968a: p. 42, fig. 15) from Sargasso Sea off Bermuda was only 1.15 mm long, smaller than females from our materials (1.23–1.42 mm) and those described by Müller (1906a: 1.25–1.5 mm).

Distribution. *Discoconchoecia discophora* is recorded from all oceans but records are rather rare; mesopelagic species, most abundant at depths 700–1200 m (Angel et al., 2008). In the investigated area (Fig. 31), *D. discophora* was found in 36% of tows. Maximum abundances were recorded at depths 200–500 m (Fig. 32).

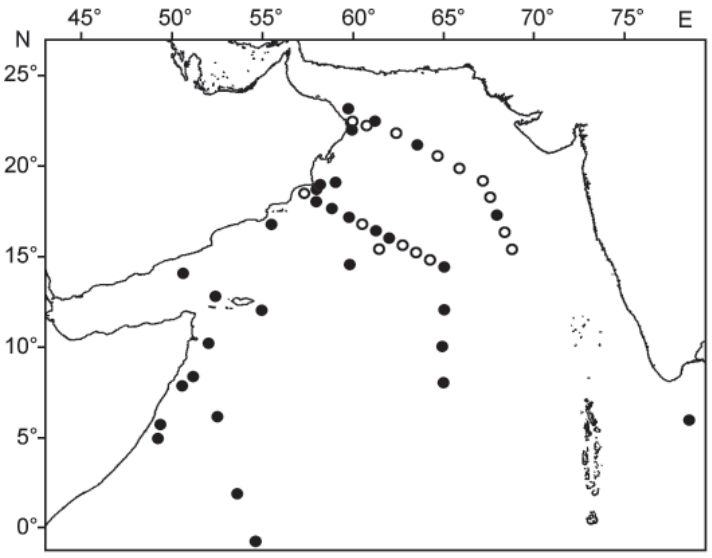


Fig. 31. Occurrence of ***Discoconchoecia discophora*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

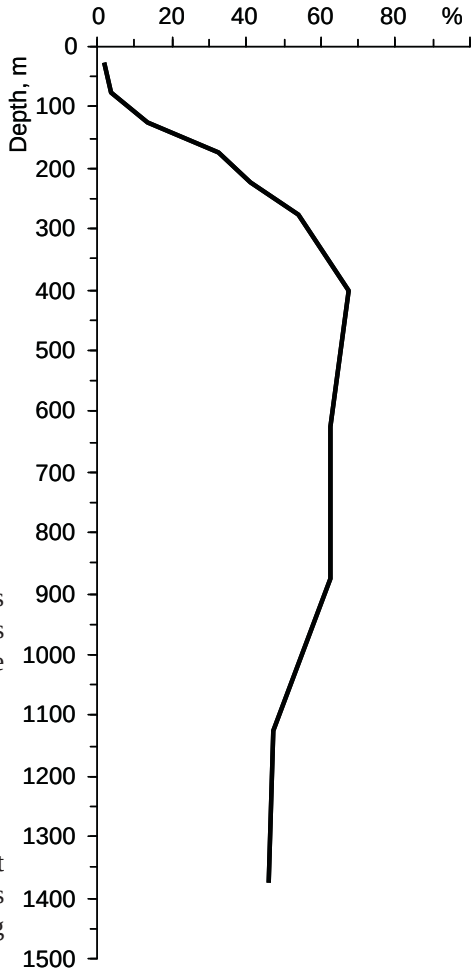


Fig. 32. Occurrence of ***Discoconchoecia discophora*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

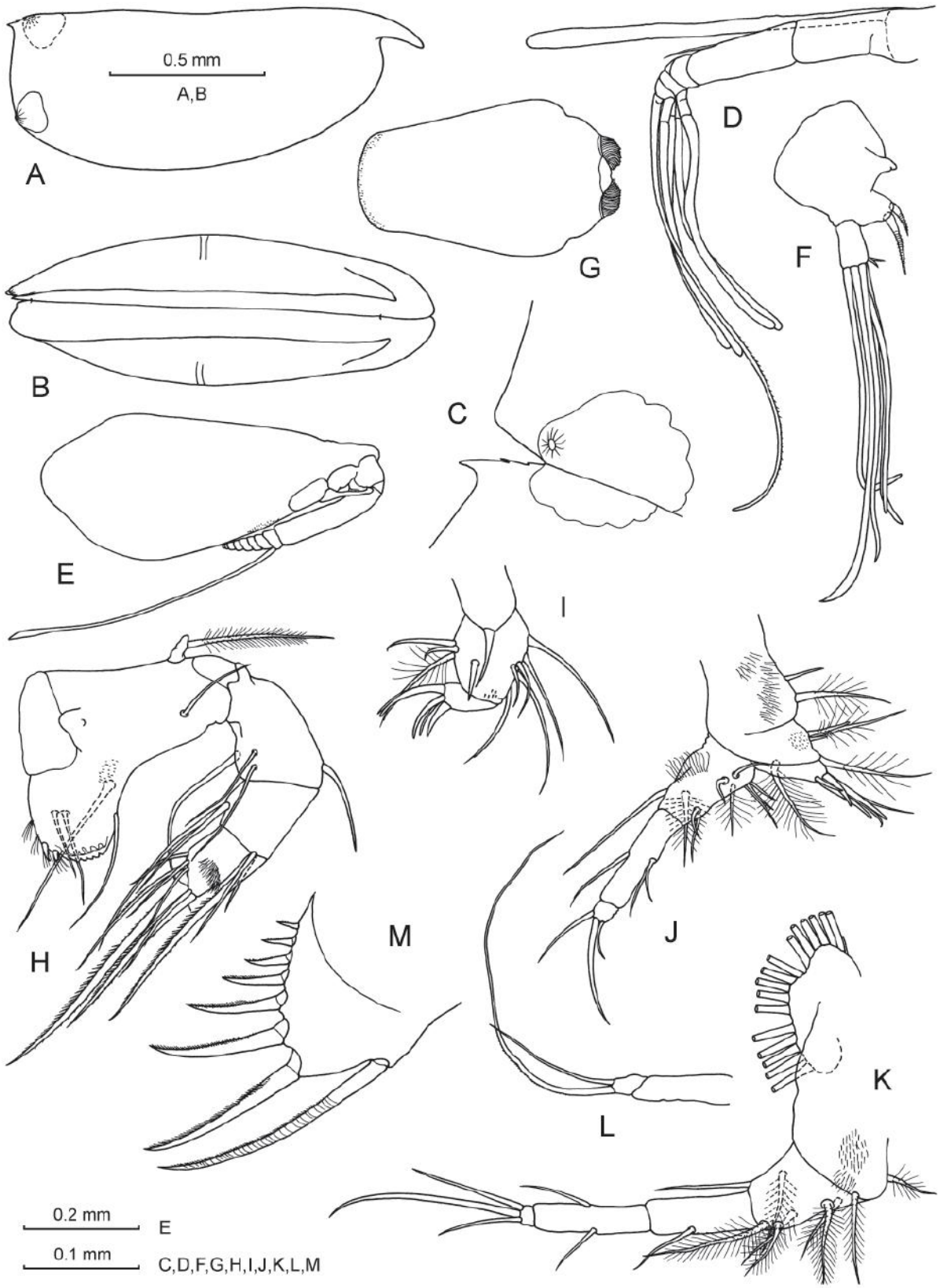


Plate 24. ***Discoconchoecia discophora***, female. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: PDCs. **D** – FO and An1. An2: **E** – Prp and Exp; **F** – Enp. **G** – Lb. **H** – Md without Cxp. **I** – Mx. **J** – P5. **K** – P6. **L** – P7. **M** – CF.

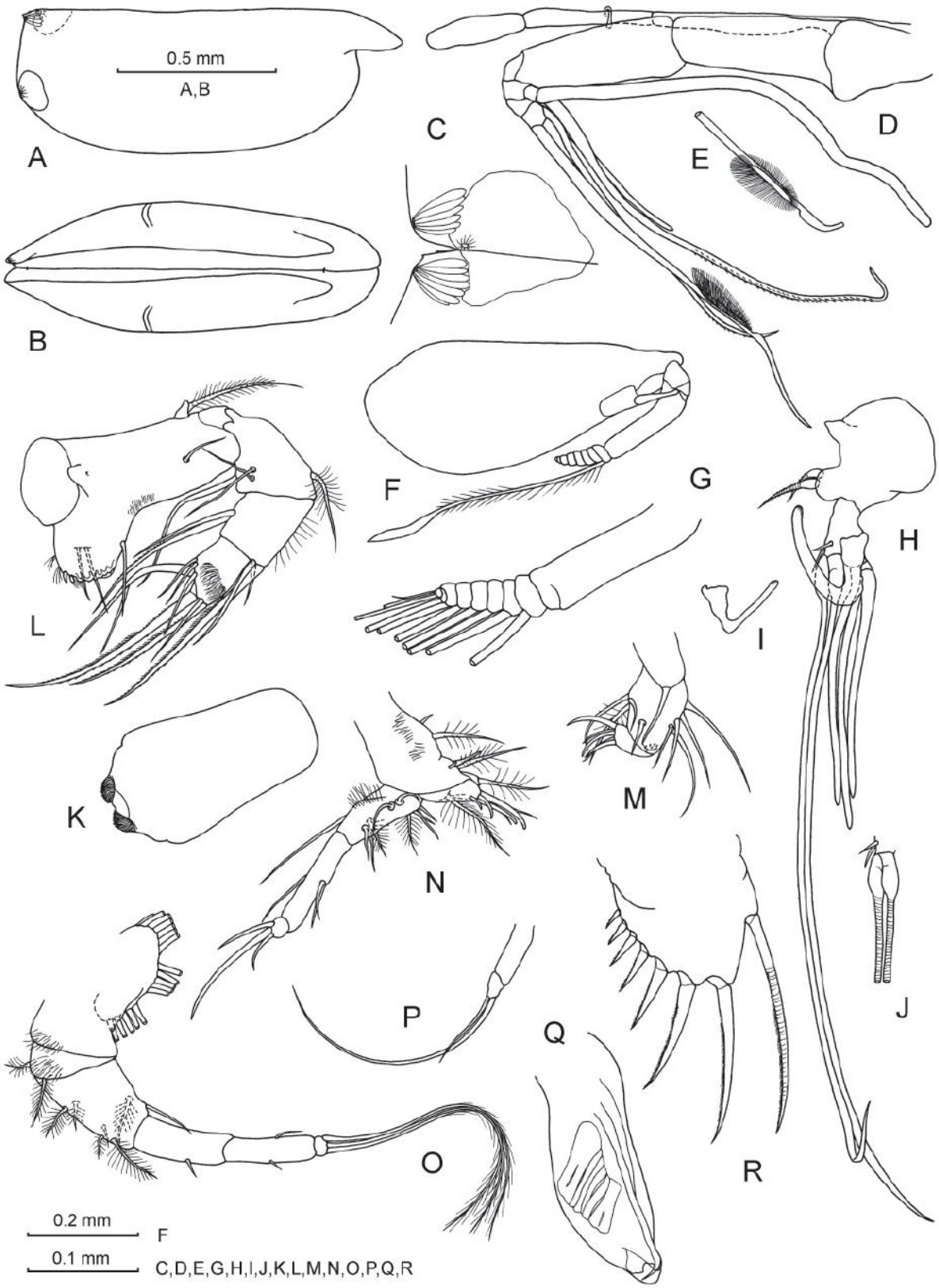


Plate 25. ***Discoconchoecia discophora***, male. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: PDCs. **D** – FO and An1. **E** – An1: armature of e-seta. An2: **F** – Prp and Exp; **G** – Exp (higher magnification); **H** – right Enp; **I** – left hook appendage; **J** – setae of Enp2. **K** – Lb. **L** – Md without Cxp. **M** – Mx. **N** – P5. **O** – P6. **P** – P7. **Q** – CA. **R** – CF.

Discoconchoecia aff. ***elegans*** (Sars, 1865)

(Pict. 13; Pls 26, 27; Figs 33, 34)

For synonymy before 1906, see Müller, 1906a.
Conchoecia elegans: Müller, 1906a, p. 69, pl. XIII figs 10, 11, 19–26; Skogsberg, 1920, p. 624, figs CXVII, CXVIII; Deevey, 1968a, p. 40, fig. 14.
Paraconchoecia elegans: Poulsen, 1973, p. 45, fig. 18.
Discoconchoecia aff. *elegans*: Martens, 1979, p. 344; Kock, 1992, p. 64, fig. 17; McKenzie et al., 1997, p. 165, figs 6.2.1, 6.2.2.
Discoconchoecia elegans: Angel, 1999, pp. 819, 834, fig. 9.47.
Discoconchoecia elegans elegans: Chavtur & Stovbun, 2004, p. 221, figs 2, 3F, H.

Pict. 13. ***Discoconchoecia*** aff. ***elegans***. **A** – female; **B** – male.

Females. L = 1.18–1.37 (1.27 ± 0.04 mm; N = 22); H/L = 40.3 ± 1.5% (N = 14).

Plate 26**A**–**N**. Carapace (**A**–**C**): well elongated, tapered anteriorly; posterior margin convex; right PDC with distinct spine and 1–2 small additional spines, left one with distinct bulge; LAG slightly displaced along dorsal margin from posterior hinge toward rostrum; RAG about in usual place. FO (**D**, **E**): straight; no clear division into stem and capitulum; the latter bare, with rounded tip. An1 (**D**): 2nd segment without dorsal seta; e-seta below sensory setae with short spines; lengths of sensory setae about half e-seta. An2 (**F**, **G**): inner surface of Prp bare, without medial bulge; a-seta on Enp1 has a few long hairs near its base, b-seta as long as Enp2+3; c- and d- setae missing. Lb (**H**): dorsal projection with rounded anterior edge. Md (**I**): Bsp has epipodial appendage with tiny seta; Enp1 bears non-plumose dorsal seta and 2 ventral setae; Enp2 with long hairs on anterior surface. Mx (**J**): one of 3 setae on posterior side of Enp1 plumose; Enp2 with long hairs on anterior surface. P5 (**K**): Cxp3 with 6 setae in ventral group; Bsp has 6 setae in proximal ventral group and 2 setae in distal ventral group. P6 (**L**): surface of Cxp1–2 with hairs; Bsp with dorsal seta reaching about half Enp1, and with most distal ventral seta not reaching distal edge of Enp1; central terminal claw on Enp3 longer than total length of Enp1–3. P7 (**M**): longer of 2 terminal setae proximally with a double series of tiny spines. CF (**N**): unpaired dorsal seta absent.

Males. L = 1.22–1.28 mm (1.25 ± 0.03 mm; N = 14); H/L = 41.2 ± 2.1% (N = 12).

Plate 27**A**–**S**. Carapace (**A**–**C**): length in average about as in female, posterior edge less convex; right PDC with very small spine and 1–2 additional spines (or without spine but with pointed corner); MGGs present. FO (**D**, **E**): short, only a little longer than shaft of An1; capitulum short and usually bare, sometimes with short hairs on ventral surface, its tip rounded. An1 (**D**, **F**): a-seta thick and long (about equal to b-, d- and e- setae), slightly narrows toward end, has a swelling about on level with hooked dorsal seta on 2nd segment; b- and e- setae thickened proximally; b-seta has a few short spines opposite oval plate on e-seta; e-seta with 4–5 pairs of short spines just distally of oval plate; c-seta about half length of 2nd segment; d-seta slender and bare. An2 (**G**–**K**): inner surface of Prp bare; width of Enp1 about twice its length; a- and b- setae

on Enp1 with thick bases, a-seta strongly curved, both setae have tiny spines; e-seta extremely small; f-seta somewhat longer than half of g-seta (in contrast to other members of subfamily Conchoeciinae which have g-seta longer than f-seta); hook appendages with rounded tips. Lb (**L**): dorsal projection more elongated than in female. Md (**M**): dorsal seta on Enp1 plumose; Enp2 with a few long hairs on anterior surface; all terminal claws on Enp3 straight. Mx (**N**), P5 (**O**), P7 (**Q**), CF (**S**): similar to those in female. P6 (**P**): both setae on Cxp2 shortened, one of them plumose, other one thin and weak; all setae on Bsp and Enp1–2, except dorso-lateral one on Bsp, strongly reduced; all terminal setae on Enp3 about equal and with long hairs (cut off in the drawing). CA (**R**): characteristically curved; end rounded distally.

Remarks. *Discoconchoecia* aff. *elegans* is widely spread over all oceans from high to low latitudes and varies considerably in size in different localities from 0.88 to 2.36 mm (Angel et al., 2008). There is an opinion that it is a species complex (Angel, 1999). The main differences between Arabian Sea specimens and those from other regions (Müller, 1906a; Skogsberg, 1920; Deevey, 1968a; Poulsen, 1973; Angel, 1999) are the presence of a few long hairs on a-seta of female An2 and the swelling on a-seta of male An1.

Distribution. In the Arabian Sea Region, *Discoconchoecia* aff. *elegans* was found mainly in the south-west of the investigated area (Fig. 33), in 8% of tows. Maximum abundances were recorded at depths 200–500 m (Fig. 34).

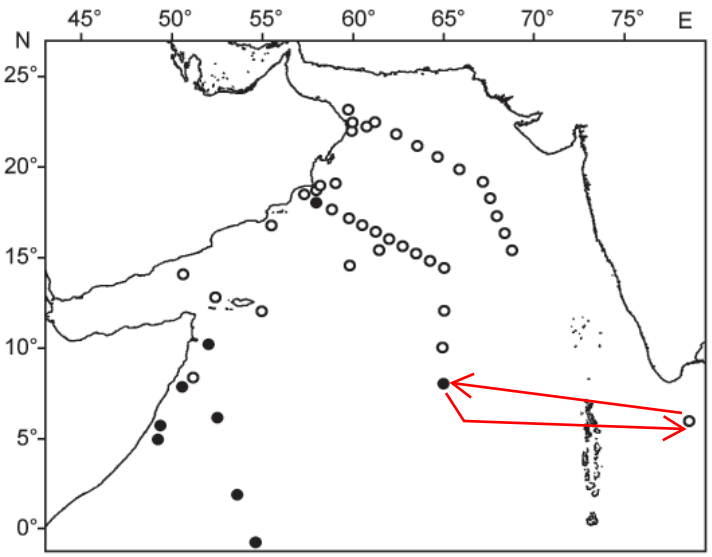


Fig. 33. Occurrence of ***Discoconchoecia*** aff. ***elegans*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

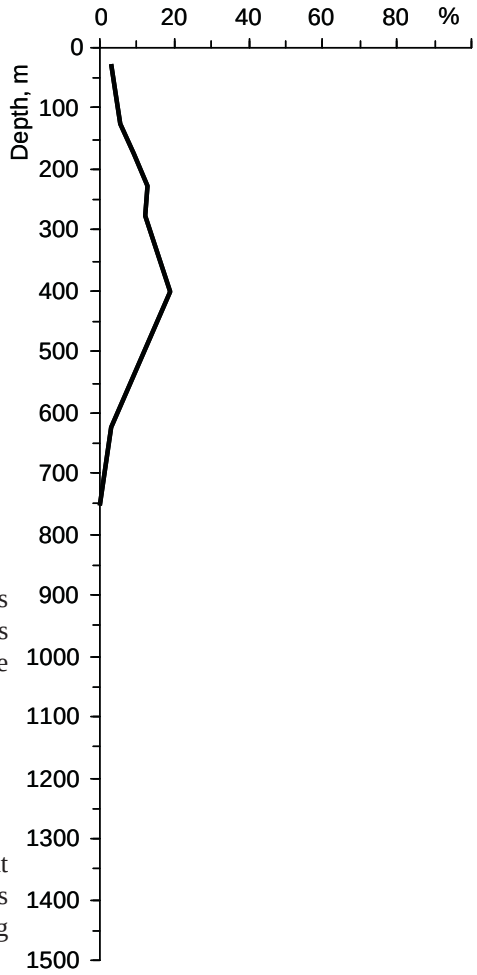


Fig. 34. Occurrence of ***Discoconchoecia*** aff. ***elegans*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

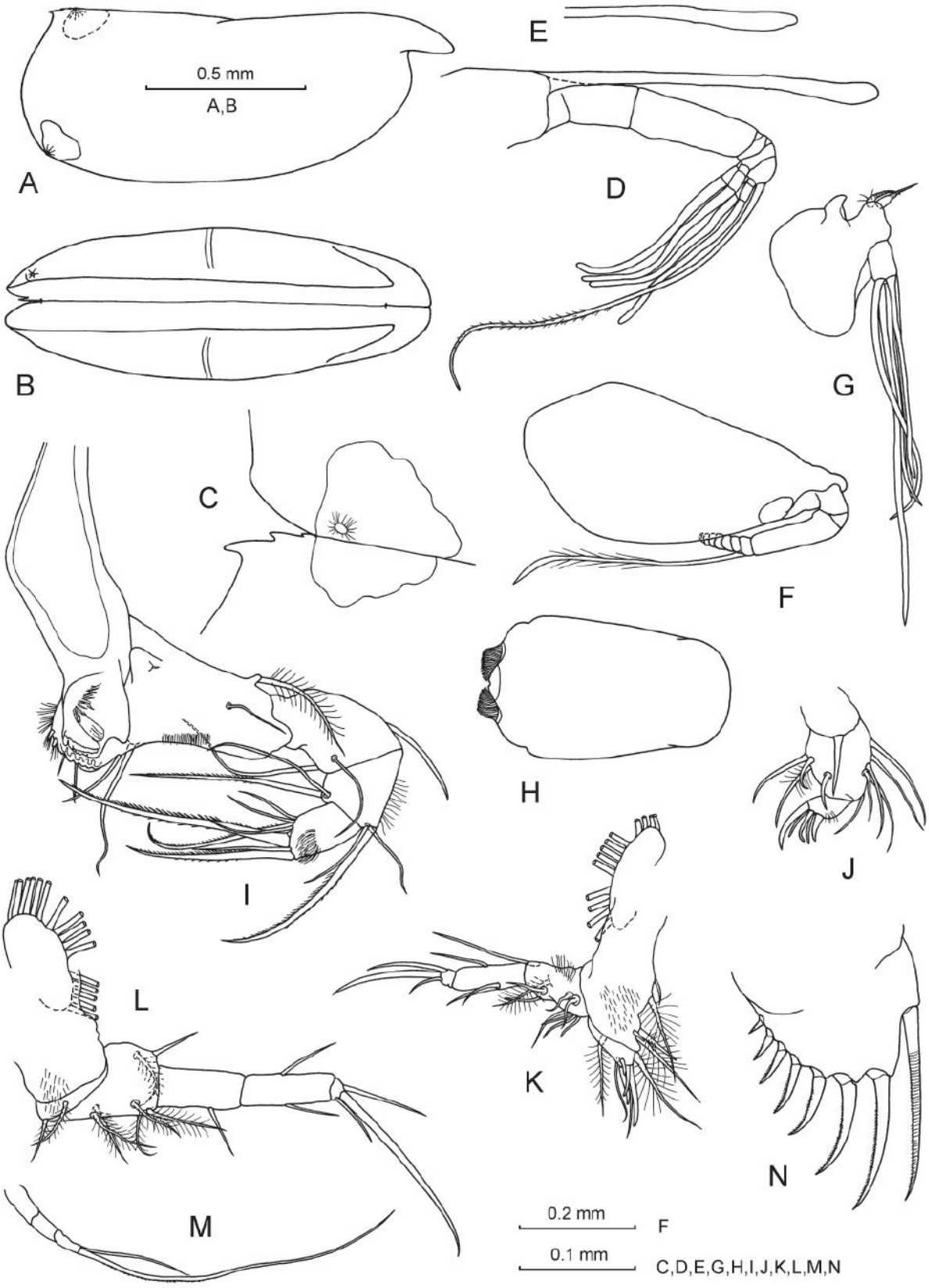


Plate 26. ***Discoconchoecia*** aff. ***elegans***, female. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: PDCs. **D** – FO and An1. **E** – other specimen: capitulum of FO. An2: **F** – Prp and Exp; **G** – Enp. **H** – Lb. **I** – Md. **J** – Mx. **K** – P5. **L** – P6. **M** – P7. **N** – CF.

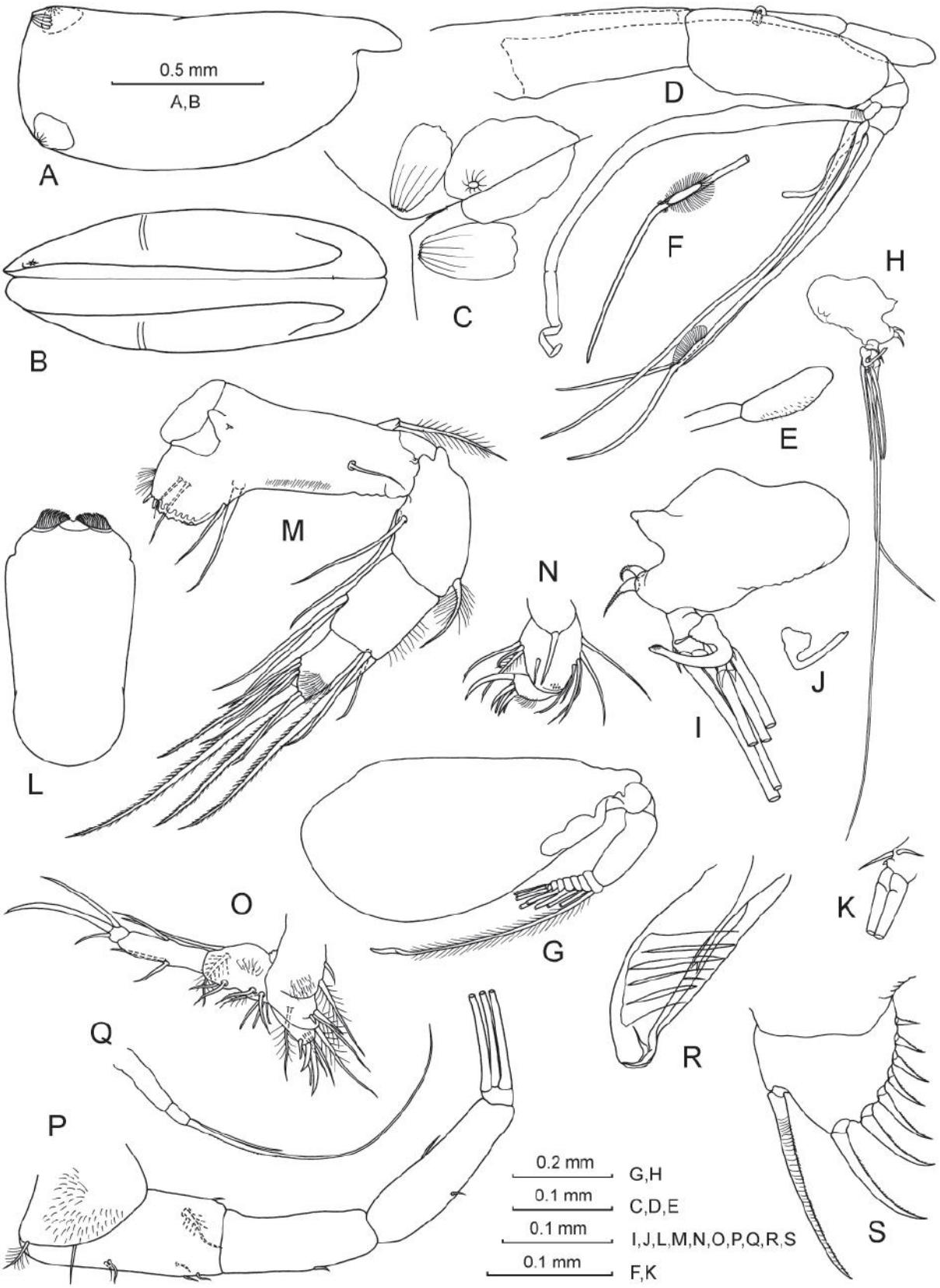
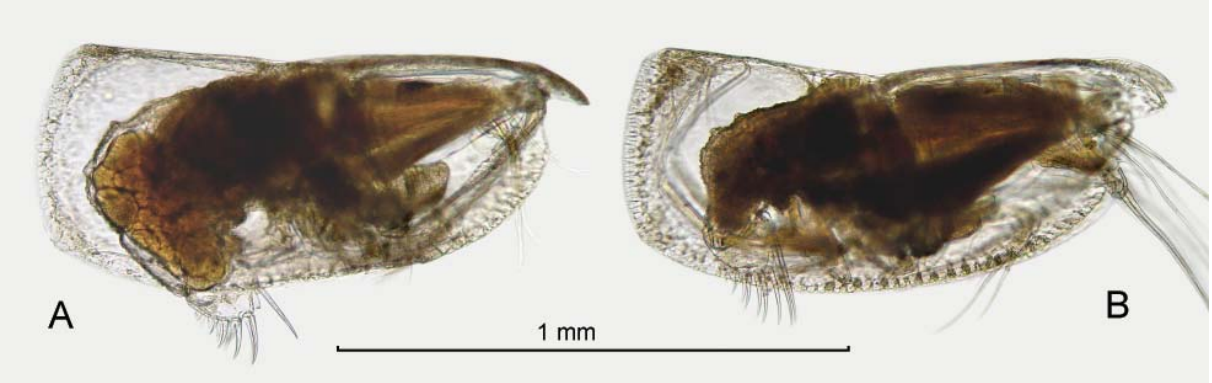


Plate 27. ***Discoconchoecia*** aff. ***elegans***, male. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: PDCs. **D** – FO and An1. **E** – other specimen: capitulum of FO. **F** – An1: armature of e-seta. An2: **G** – Prp and Exp; **H**, **I** – left and right Enps; **J** – left hook appendage; **K** – setae of Enp2. **L** – Lb. **M** – Md without Cxp. **N** – Mx. **O** – P5. **P** – P6. **Q** – P7. **R** – CA. **S** – CF.

Discoconchoecia tamensis (Poulsen, 1973)

(Pict. 14; Pls 28, 29; Figs 35, 36)

Paraconchoecia tamensis Poulsen, 1973, p. 47, fig. 19 (male).
Discoconchoecia tamensis: Martens, 1979, p. 341.



Pict. 14. ***Discoconchoecia tamensis***. **A** – female; **B** – male.

Females. L = 0.97–1.18 (1.10 ± 0.04 mm; N = 381); H/L = 43.2 ± 1.7% (N = 36).

Plate 28**A**–**O**. Carapace (**A**–**C**): less elongated and with less convex posterior margin than in *D.* aff. *elegans* (see Pls 7B, 26A); right PDC without spines and sharply rounded, left one rounded; LAG just near posterior hinge; RAG in usual place. FO (**D**, **E**): similar to that of *D.* aff. *elegans* (Pl. 26D, I). An1 (**D**, **F**): without dorsal seta; e-seta with double row of short spines on proximal half of its posterior surface; sensory setae as long as about half e-seta. An2 (**G**, **H**): Prp without medial bulge but with rather long hairs on its place and more posteriorly; a-seta without long hairs. Lb (**I**): in dorsal projection less elongated than in *D.* aff. *elegans* (Pl. 26H). Md (**J**), Mx (**K**) and P5 (**L**): similar to those of *D.* aff. *elegans* (Pl. 26I–K). P6 (**M**): surface of Cxp without hairs; Bsp has very short dorsal seta and most distal ventral seta extending over distal edge of Enp1; central terminal claw shorter than total length of Enp1–3. P7 (**N**) and CF (**O**): similar to those of *D.* aff. *elegans* (Pl. 26M, N).

Males. L = 1.04–1.18 mm (1.10 ± 0.03 mm; N = 241); H/L = 42.7 ± 1.4% (N = 24).

Plate 29**A**–**S**. Carapace (**A**–**C**): mean length as in female, posterior edge almost straight; both PDCs rounded; MGGs present. FO (**D**, **E**): similar to that of *D.* aff. *elegans* (see Pl. 27D, E). An1 (**D**, **F**, **G**): a-seta with swelling about on level with hooked dorsal seta on 2nd segment and usually one of a-setae (on left or on right An1) has swelling with a constriction between it and the distal part of seta; e-seta just distal of oval plate with 2 pairs of short spines. An2 (**H**–**K**): a- and b- setae slenderer and a-seta less curved than in *D.* aff. *elegans* (Pl. 27I); hook appendages with pointed tips. Lb (**L**): dorsal projection more elongated than in female. Md (**M**): with plumose dorsal seta on Enp1. Mx (**N**), P5 (**O**), P7 (**Q**), CF (**S**): similar to those in female. P6 (**P**): both setae on Cxp2 short and non-plumose; all terminal setae on Enp3 about equal and with long hairs (cut off in the drawing). CA (**R**): similar to that of *D.* aff. *elegans* (Pl. 27R).

Remarks. Species was described by Poulsen (1973) on the basis of a single male specimen (1.1 mm). Males of *D. tamensis* from our materials have some features that distinguish them from the type specimen. These are the following: **a**) both valves of carapace with rounded PDCs (Pl. 29C); **b**) usually only one of a-setae (on right or on left An1) has about a third of its length from the basis a distinct swelling with a constriction between it and the distal part (Pl. 29F). In male specimen described by Poulsen (1973: p. 47, fig. 19a–c), right PDC forms a sharp angle without spine and most possibly both a-setae have swelling with the constriction between it and the distal part.

Distribution. Single record of *Discoconchoecia tamensis* was from the central Pacific Ocean (07º46'S, 131º 22'W) "with 300 m wire" (Poulsen, 1973). In the investigated area, *D. tamensis* was found at almost all stations (Fig. 35), in 74% of tows. Maximum abundances were recorded at depths 50–150 m (Fig. 36).

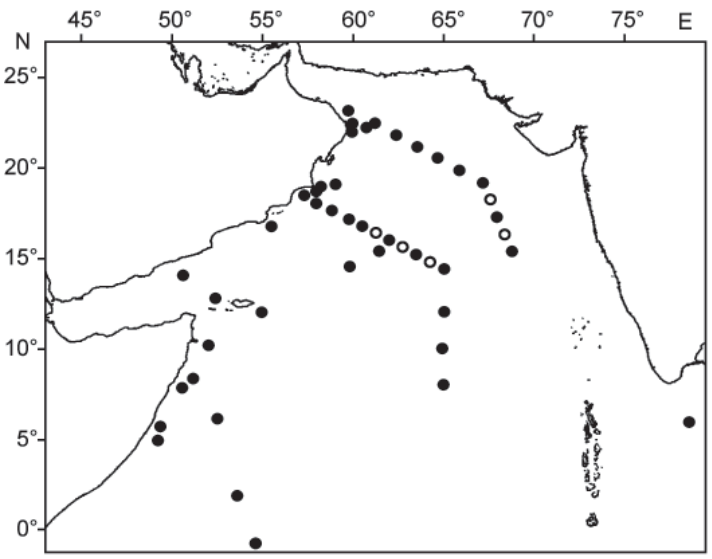


Fig. 35. Occurrence of ***Discoconchoecia tamensis*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

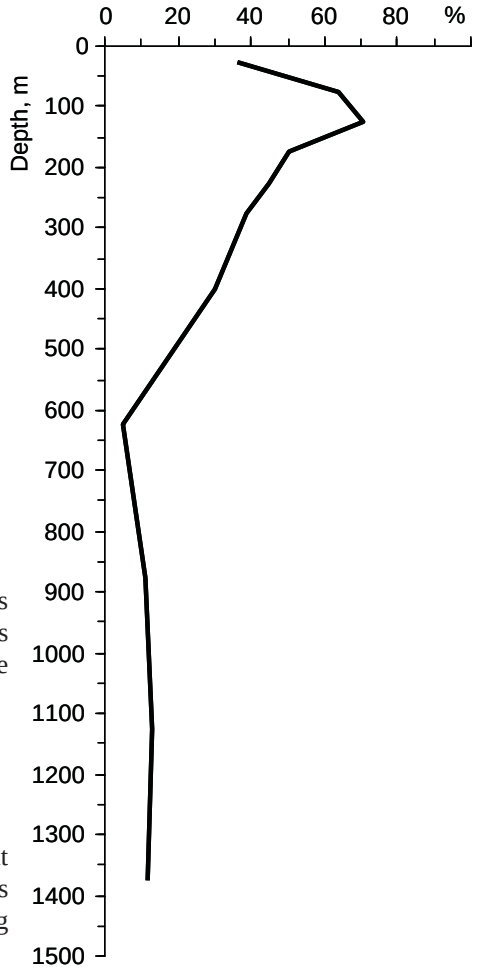


Fig. 36. Occurrence of ***Discoconchoecia tamensis*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

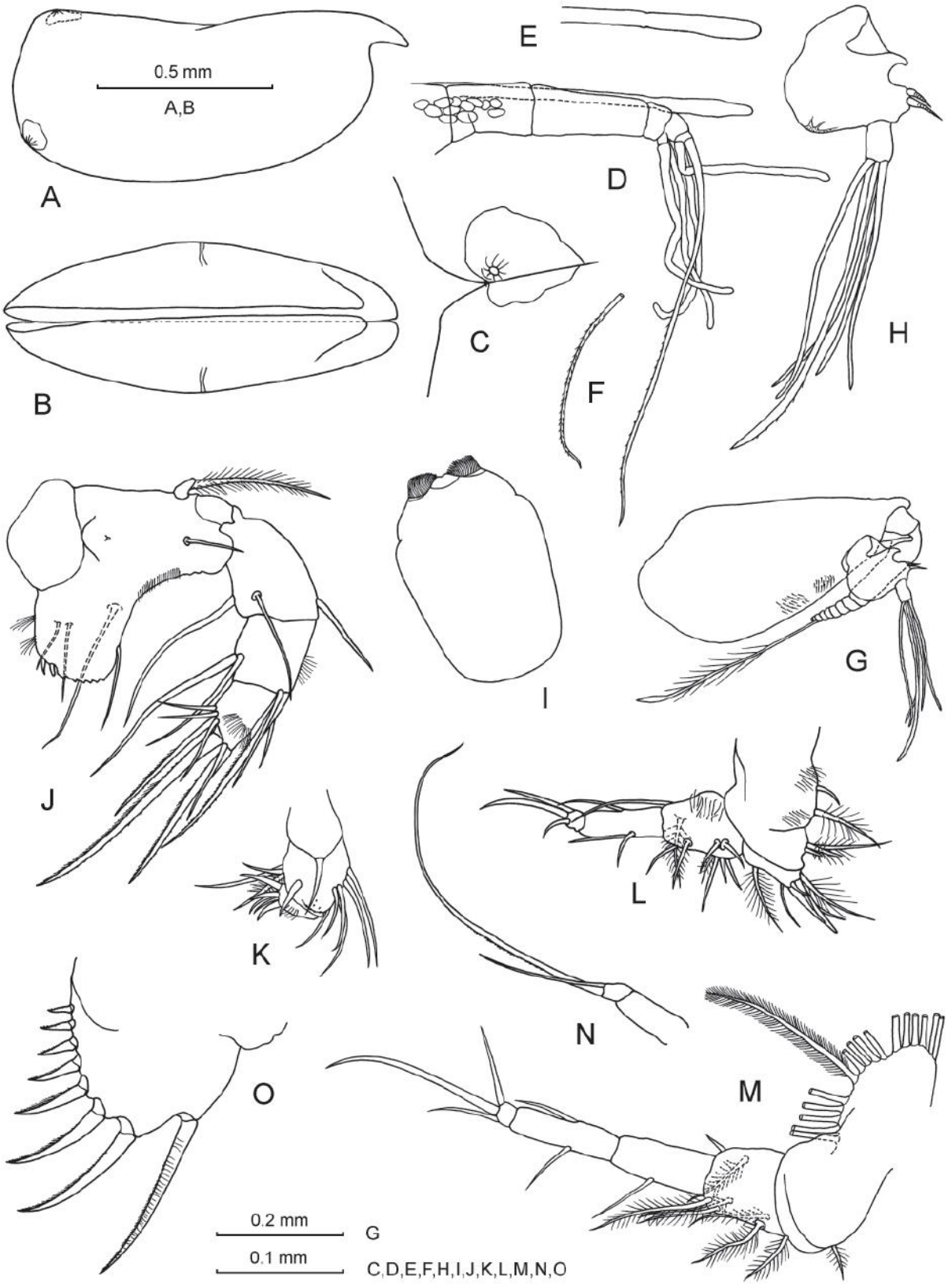


Plate 28. ***Discoconchoecia tamensis***, female. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: PDCs. **D** – FO and An1. **E** – other specimen: capitulum of FO. **F** – An1: e-seta. An2: **G** – Prp and Exp; **H** – Enp. **I** – Lb. **J** – Md without Cxp. **K** – Mx. **L** – P5. **M** – P6. **N** – P7. **O** – CF.

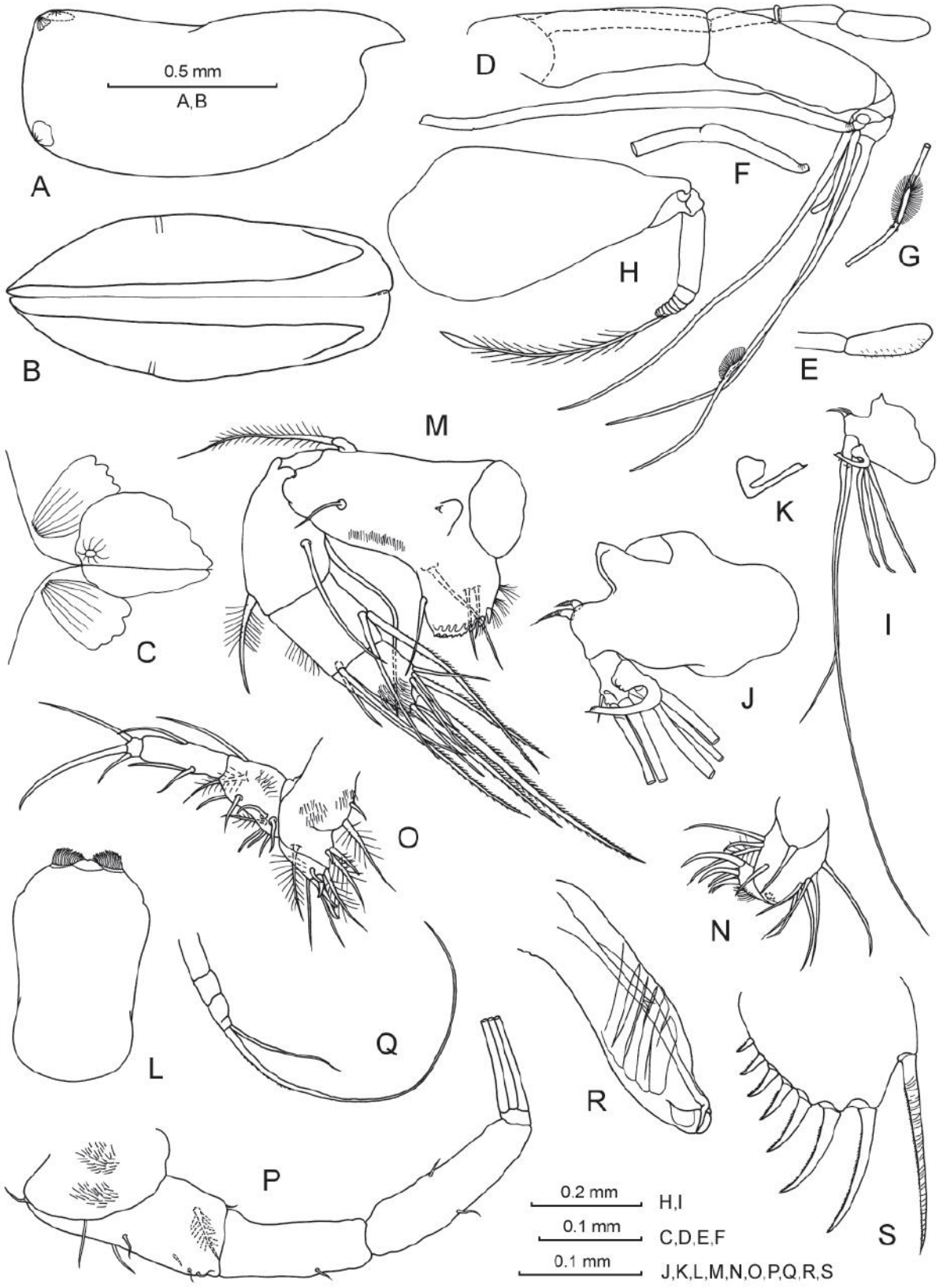


Plate 29. ***Discoconchoecia tamensis***, male. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: PDCs. **D** – FO and right An1. **E** – other specimen: capitulum of FO. An1: **F** – fragment of left a-seta; **G** – armature of e-seta. An2: **H** – Prp and Exp; **I**, **J** – right Enp; **K** – left hook appendage. **L** – Lb. **M** – Md without Cxp. **N** – Mx. **O** – P5. **P** – P6. **Q** – P7. **R** – CA. **S** – CF.

Genus ***Loricoecia*** Poulsen, 1973

Carapace characterized by the presence of LGG on the PVC of each valve, right LGG opens just over RAG. RAG and LAG is in the usual places. Posterior and dorsal margins of carapace form approximately right angle with no spines, PDCs and PVCs are rounded (less in the males than in females). (Deevey, 1968a; Poulsen, 1973).

A single species has been found in the analyzed material (Table 3, Appendix 2).

Loricoecia loricata (Claus, 1894)

(Pict. 15; Pls 30, 31; Figs 37, 38)

For synonymy before 1906, see Müller, 1906a.
Conchoecia loricata var. *typica* and var. *minor*: Müller, 1906a, p. 95, 96, Pl. XXII figs 1–15.
Conchoecia loricata loricata: Deevey, 1968a, p. 92, figs 46–47.
Loricoecia loricata: Poulsen, 1973, p.145, fig. 72; McKenzie et al., 1997, p. 171, figs 6.3.1–2; Angel, 1999, pp. 820, 835, fig. 9.54.

Pict. 15. ***Loricoecia loricata***. **A** – female; **B** – male.

Females. L = 1.60–1.84 mm (1.70 ± 0.06 mm; N = 13); H/L = 52.5 ± 1.7% (N = 9).

Plate 30**A**–**N**. Carapace (**A**–**C**): tapered anteriorly; PDCs rounded; LAG and RAG in usual places; PVC of each valve with LGG; right LGG opens on posterior margin just over RAG. FO (**D**): stem length almost twice total length of 1st and 2nd segments of An1; capitulum with rather strong spines on almost whole ventral surface and on dorsal posteriorly, its tip rounded. An1 (**D**): with very long dorsal seta, which is longer than total length of 1st and 2nd segments; e-seta bears tiny spines on posterior surface below sensory setae. An2 (**E**, **F**): Prp with medial bulge covered with hairs; a- and b- setae with tiny spines; c-, d-, e- setae missing; h-, i- and j- setae with proximal spines. Lb (**G**): dorsal projection almost rectangular, laterally with short spines, its anterior edge almost straight; hyaline membrane slightly concave. Md (**H**, **I**): Bsp with epipodial appendage having rather long seta, and with short lateral seta; Enp1 has non-plumose dorsal seta and 4 ventral setae (3 of them noticeably shorter and slenderer). Mx (**J**): Bsp with long single seta extending over distal edge of Enp1; Enp1 elongated, has 5 well visible spines near distal edge. P5 (**K**): Cxp3 with 6 setae in ventral group; Bsp with 7 setae in proximal ventral group (one of them plumose) and 3 in distal ventral group. P6 (**L**): all setae typical for Conchoeciini present; dorsal seta on Bsp short. P7 (**M**): both terminal setae with double rows of tiny hairs proximally. CF (**N**): unpaired dorsal seta present.

Males. L = 1.46–1.60 mm (1.53 ± 0.05 mm; N = 11); H/L = 49.4 ± 2.0% (N = 9).

Plate 31**A**–**Q**. Carapace (**A**–**C**): similar to that in female; MGG present. FO (**D**): mid-part of capitulum narrowed, with spines on ventral surface proximally, tip rounded. An1 (**D**–**F**)**:** armature of e-seta represented as a comb with ~ 26 spines (in lateral view 18–20

spines seen) directed proximally and a few fine short spines directed contrary: distally spines paired, proximally they are alternately spaced; b- and d- setae have a few tiny spines opposite distal part of e-comb. An2 (**G**–**J**): Prp with medial bulge without hairs; a- and b- setae on Enp1 with tiny spines; Enp2 with extremely short e-seta; right hook appendage acute-angled, larger than left; both appendages with slightly widened round tips. Lb (**K**): in dorsal projection more elongated than in female. Md (**L**): Bsp longer than in female; dorsal seta on Enp1 plumose. Mx (**M**), P5, P7 (**O**), CF (**Q**): similar to those in female. P6 (**N**): Cxp2 with 2 rather long plumose setae; setae on Bsp and Enp1–2 rudimentary; all terminal setae on Enp3 about equal and with long hairs. CA (**P**): with 6 muscle bands; end rounded.

Remarks. Specimens of *L. loricata* described formerly differ from those in our materials: **a**) by the arrangement (all spines paired) and number of spines on An1 e-seta (Müller, 1906a: 22 pairs of spines in *L. loricata typica*, 11 pairs in *L. loricata minor;* Deevey, 1968a: 20–23 pairs; Poulsen, 1973: 18–22 pairs); **b**) by the presence of long hairs on b-seta of male An2 Enp1 (Müller, 1906a: only in *L. l. typica*, pl. XXII fig. 6; Deevey, 1968a: fig. 47 b); **c**) by sizes (excluding *L. l. minor*).

L. loricata in our materials is similar to Müller's *L. l. minor*, have b-seta on male An2 Enp1 without long hairs (see Pl. 31H, I and Müller, 1906a: pl. XXII fig. 14) and lengths of carapaces coincided with those of *L. l. minor* (Müller, 1906a: p. 96, females 1.6–1.7, male 1.55 mm). However, males from our materials have more spines on An1 e-seta than males of *L. l. minor* (see Pl. 31E, F and Müller, 1906a: pl. XXII fig. 10).

Distribution. *Loricoecia loricata* is recorded from all oceans; in the North Atlantic Ocean it is often subdominant in the halocyprid populations at depths of 300–900 m in temperate latitudes (Angel et al., 2008). In the Arabian Sea Region, *L. loricata* was found mainly in the southern part of the investigated area (Fig. 37), in 6% of tows. Maximum abundances were recorded at depths 300–500 m (Fig. 38).

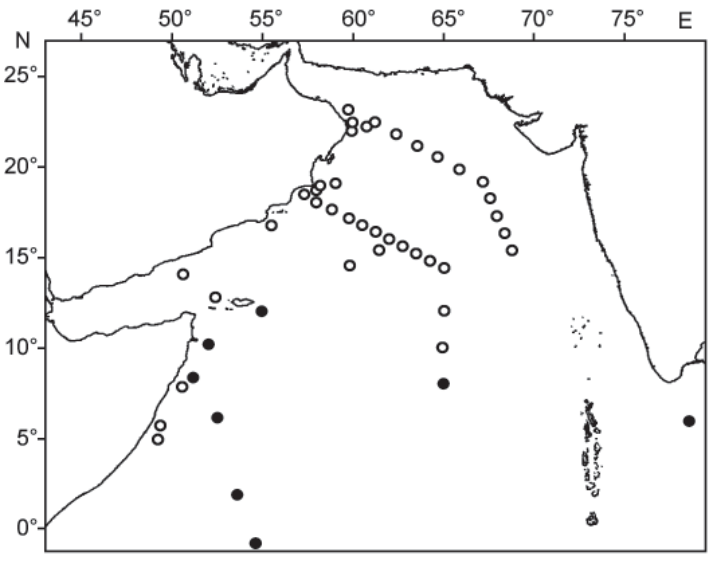


Fig. 37. Occurrence of ***Loricoecia loricata*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

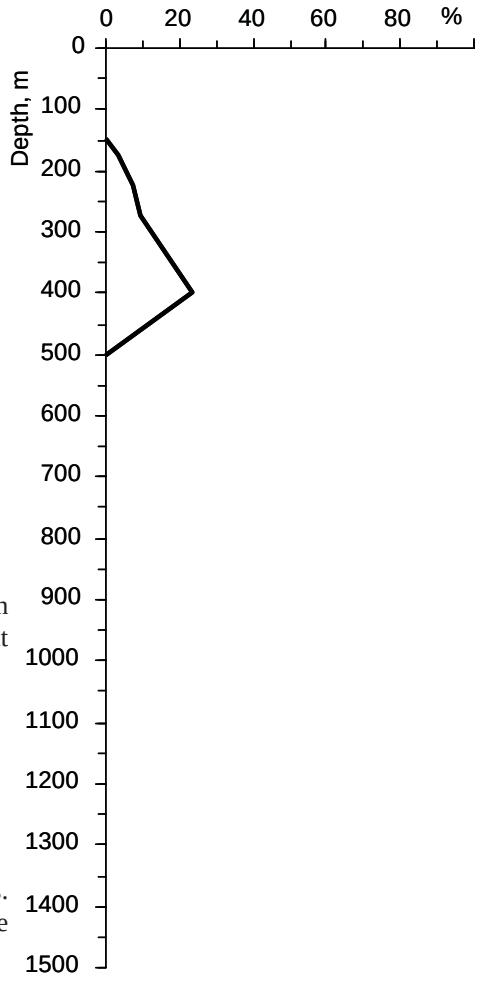


Fig. 38. Occurrence of ***Loricoecia loricata*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

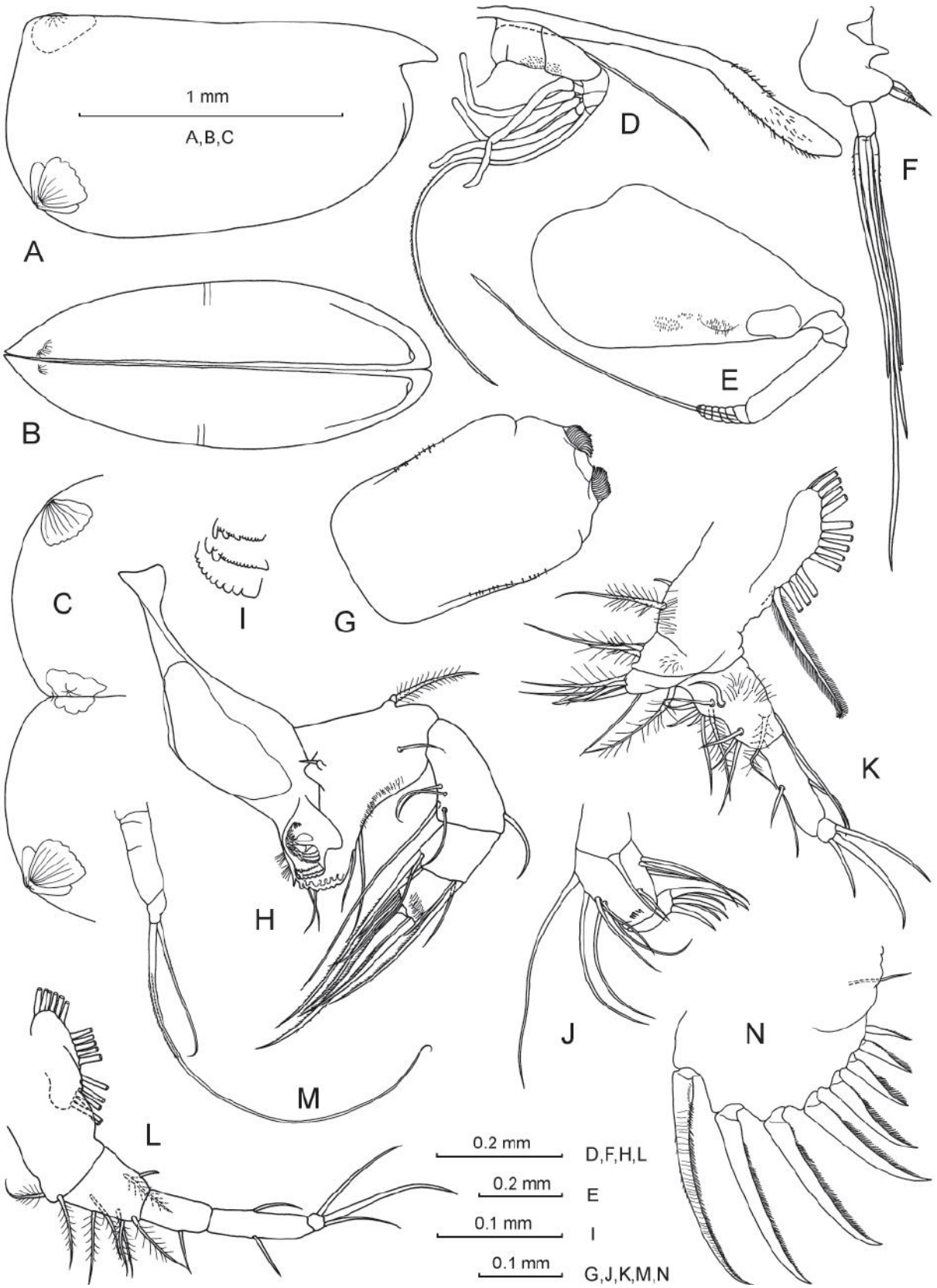


Plate 30. ***Loricoecia loricata***, female. Carapace: **A** – lateral; **B** – ventral; **C** – both valves from outside: posterior margins. **D** – FO and An1. An2: **E** – Prp and Exp; **F** – Enp. **G** – Lb. Md: **H** – Bsp, Enp and Exp; **I** – coxal endite: toothed edge, distal and proximal tooth-lists. **J** – Mx. **K** – P5. **L** – P6. **M** – P7. **N** – CF.

Plate 31. ***Loricoecia loricata***, male. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: posterior margins. **D** – FO and An1. An1: **E** – armature of b-, d- and e- setae; **F** – other specimen (L 1.46 mm): armature of e-seta. A2: **G** – Prp and Exp; **H**, **I** – right and left Enps; **J** – right hook appendage. **K** – Lb. **L** – Md without Cxp. **M** – Mx. **N** – P6. **O** – P7. **P** – CA. **Q** – CF.

Genus ***Mikroconchoecia*** Claus, 1890

Small species always with short and high carapaces, and usually with clear sculpture; ventral margin strongly curved. LAG opens just on PDC, RAG displaced dorsally along posterior margin. In the females 3 or 4 of sensory setae on An1 are bifurcate; in the males a-seta on An1 is bifurcate. Males have a single row of small pegs as armature on the e-seta of An1. (Deevey, 1968a; Poulsen, 1973; Angel, 1999).

Two species of the genus *Mikroconchoecia* have been identified in the analyzed material: *M. curta* s.l. (Lubbock, 1860) and *M. stigmatica* (Müller, 1906) (Table 3, Appendix 2). Both are described below.

Key to the species of ***Mikroconchoecia***:

Adult females

1 L > 0.94 mm;
carapace with no sculpture; rostrum elongated, strongly bent down;
RAG opens about in middle of posterior margin;
all sensory setae on An1 bifurcate;
longest seta on An2 Exp2 more than 1.5 Prp;
Md Bsp with plumose lateral seta; Mx Bsp with single seta
(Pls 5B, 34A, E, F, I, L) ..……...……..……...…….....…. ***M. stigmatica***

1a L < 0.94 mm;
carapace sculptured; rostrum shorter, less bent down;
RAG opens on posterior margin about 2/3 H from dorsal margin;
An1 with 3 bifurcate sensory setae and 1 not forked;
longest seta on An2 Exp2 not much longer than Prp;
Md Bsp non-plumose lateral seta; Mx Bsp without setae
(Pls 5B, 32A, F, G, J, K) ..…...…….…….…..... ***M. curta*** s.l.

Adult males

1 L > 1 mm;
RAG opens about in middle of posterior margin;
An1 has a-seta longer than its 2nd segment, c-seta longer than total length of 3rd to 5th segments, e-seta with a row of 7 small pegs;
longest seta on An2 Exp more than 1.5 Prp,
Md Bsp with plumose lateral seta; Mx Bsp with single seta
(Pls 5B, 35A, D, E, F, K, M) ……..……..……..…..……. ***M. stigmatica***

1a L < 1 mm;
RAG opens on posterior margin about 2/3 H from dorsal margin;
An1 has a-seta not longer than its 2nd segment, c-seta shorter than total length of 3rd to 5th segments, e-seta with a row of more than 10 small pegs;
longest seta on An2 Exp not much longer than Prp;
Md Bsp with non-plumose lateral seta; Mx Bsp without setae
(Pls 5B, 33A, E, F, G, K, L) ..…...……...……..……...….. ***M. curta*** s.l.

Mikroconchoecia curta s.l. (Lubbock, 1860)

(Pict. 16; Pls 32, 33; Figs 39–41)

For synonymy before 1906, see Müller, 1906a.
Conchoecia curta: Müller, 1906a, p. 86; pl. XXX figs 1–9; Skogsberg, 1920, p. 661, fig. CXXV; Deevey, 1968a, p. 60, fig. 26; Deevey & Brooks, 1980, p. 92, fig. 26j–m (male).
Microconchoecia curta: Poulsen, 1973, pp. 67–68, fig. 32.
Mikroconchoecia cf. *curta*: Martens, 1979, p. 350, fig. 24.
Mikroconchoecia curta: Angel, 1999, pp. 820, 831, fig. 9.78.

Pict. 16. ***Mikroconchoecia curta*** s.l. **A** – female; **B** – male.

Females. L = 0.75–0.94 mm (0.79 ± 0.03 mm; N = 59); H/L = 66.9 ± 2.5% (N = 28).

Plate 32**A**–**O**. Carapace (**A**–**E**): globose; all surfaces with concentric striation (not shown in drawings); shoulder vault more or less developed; rostrum bent down; RAG opens on posterior margin about 2/3 way from dorsal margin; LAG opens just on PDC. FO (**F**): capitulum of FO short, bare, widened distally, with rounded tip. An1 (**F**): 2 sensory setae on 4th segment of An1 deeply forked; one of sensory setae on 5th segment has 1 short and 1 long branches, other seta not bifurcate; e-seta with spinules on posterior side distally. An2 (**G**, **H**): Prp with medial bulge which has no hairs; longest setae on Exp not much longer than Prp; a- and b- setae on Enp1 with tiny spines; h-, i- and j- setae somewhat longer than half g-seta. Lb (**I**): in dorsal projection broad and short; anterior edge almost straight, with small notch in the middle and slightly rounded corners. Md (**J**): Bsp shortened, with epipodial setae and non-plumose lateral seta; Enp1 has non-plumose dorsal seta and 2 ventral setae; Enp2 without long hairs on its anterior side. Mx (**K**): Bsp without any setae; setae on anterior side of Enp1 relatively short, not longer than Enp1. P5 (**L**): Cxp1 covered with rather long hairs; Cxp3 with 6 setae in ventral group; Bsp with 6 setae in proximal ventral group and 3 setae in distal ventral group. P6 (**M**): Cxp2 usually with rudimentary ventral seta, second seta rather long and plumose; dorsal seta on Bsp very short. P7 (**N**): both terminal setae with spines. CF (**O**): broad, with relatively short claws; dorsal seta absent.

Males. L = 0.71–0.92 mm (0.76 ± 0.03 mm; N = 148); H/L = 61.8 ± 2.7% (N = 30).

Plate 33**A**–**P**. Carapace (**A**–**D**): a little more elongated than in female; rostrum comparatively straight; MGGs present. FO (**E**): capitulum of FO without any spines, widened distally. An1 (**E**, **F**): a-seta bifurcated, not reaching proximal edge of 2nd segment; c-seta shorter than total length of 3rd–5th segments; e-seta with a single row of 11–14 small pegs; d-seta bears a few spinules opposite distal pegs on e-seta; b-seta bare. An2 (**G**–**I**): Prp with medial bulge covered with hairs; Enp1 with a- and b- setae having tiny spines; e-seta comparatively long; j-seta has swollen base covered with hairs; h-seta with rarely placed marginal spinules; right hook appendage evenly curved, more or less swollen in the middle and narrowed towards tip in 2 tiny papillae; left appendage far smaller and not swollen. Lb (**J**): in dorsal projection narrowed anteriorly; anterior edge rounded, without clear corners. Md (**K**): Enp1 has non-plumose dorsal

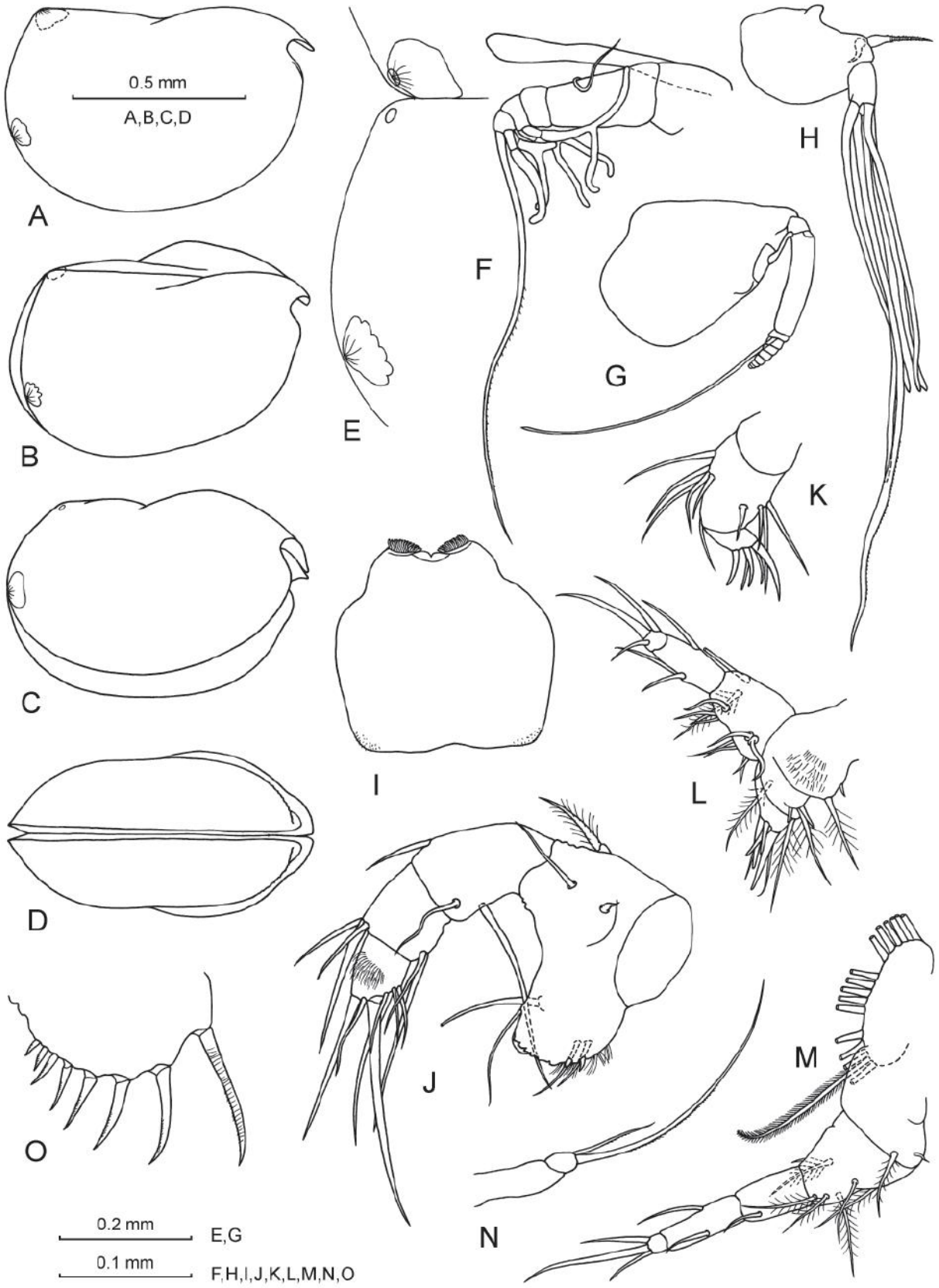


Plate 32. ***Mikroconchoecia curta*** s.l., female. Carapace: **A –** lateral; **B –** dorso-lateral; **C –** ventro-lateral; **D –** ventral; **E –** both valves from outside: posterior margins. **F –** FO and An1. An2: **G –** Prp and Exp; **H –** Enp. **I –** Lb. **J –** Md without Cxp. **K –** Mx. **L –** P5. **M –** P6. **N –** P7. **O –** CF.

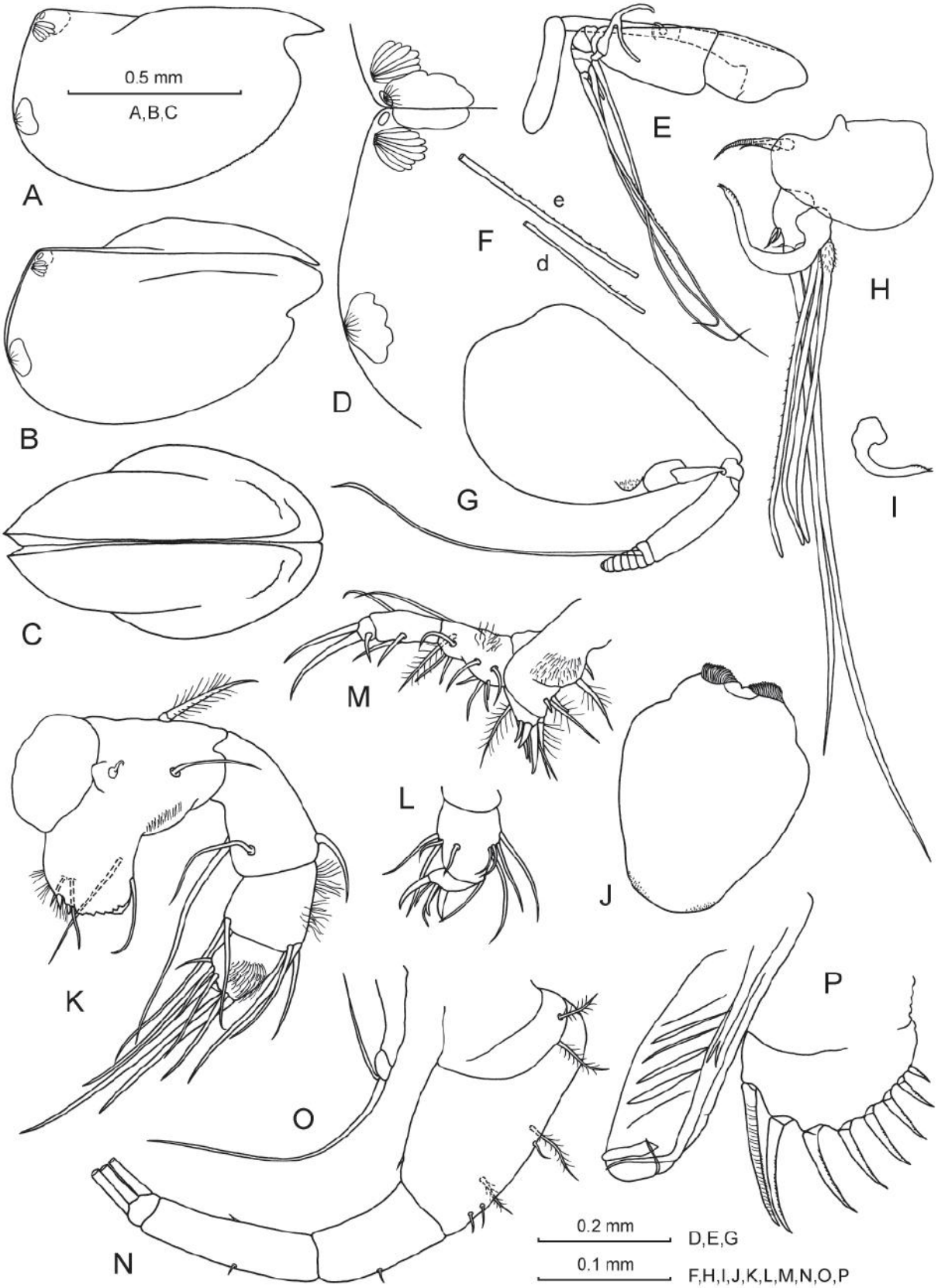


Plate 33. ***Mikroconchoecia curta*** s.l., male. Carapace: **A –** lateral; **B –** dorso-lateral; **C –** ventral; **D –** both valves from outside: posterior margins. **E –** FO and An1. **F** – An1: armature of d- and e- setae. An2: **G –** Prp and Exp; **H** – right Enp; **I –** left hook appendage. **J –** Lb. **K** – Md without Cxp. **L –** Mx. **M –** P5. **N** – P6. **O –** P7. **P –** CA and CF.

seta; Enp2 with long hairs on anterior side. Mx (**L**), P5 (**M**), CF (**P**): similar to those in female. P6 (**N**): Cxp2 with 2 short plumose setae; most of setae on Bsp and Enp1–2 rudimentary; dorso-lateral seta on Bsp absent; Enp3 with 3 long terminal setae having long hairs distally (cut off in the drawing). P7 (**O**): spines on terminal setae invisible. CA (**P**): rather broad, with rounded end; has 5 muscle bands.

Remarks. At least three forms (species) of *Mikroconchoecia curta* s.l. were found in the analyzed materials. Specimens represented here, in the Pls 32 and 33, are closer in their structures to Martens' *Mikroconchoecia* cf. *curta* (Martens, 1979: fig. 24). They are largest and have slightly angled and more developed shoulder vaults (Pls 32B, C, 33B) than in the two other smaller forms (Fig. 39C, D, G).

The morphology of limbs in all three forms is similar but the smallest males have: **a**) right hook appendage on An2 Enp3 with strongly swollen mid-part; **b**) both hook appendages with a few small knobs on their surface (Fig. 39H, I); **c**) relatively larger copulatory appendage (Fig. 39J). The similar hook appendages are represented in Müller's drawings of *M. curta* (Müller, 1906a: pl. XXX figs 4, 5).

In this study (Müller, 1906a: pl. XXX), but in figs 6, 7, the right hook appendages of two other individuals are also shown, and these are similar to those of the two larger forms of *M. curta* s.l. from the Arabian Sea Region. See Pl. 33H, I, P for comparison.

Thus, all three forms of *M. curta* s.l. need detailed study and redescription, most possibly as separate species.

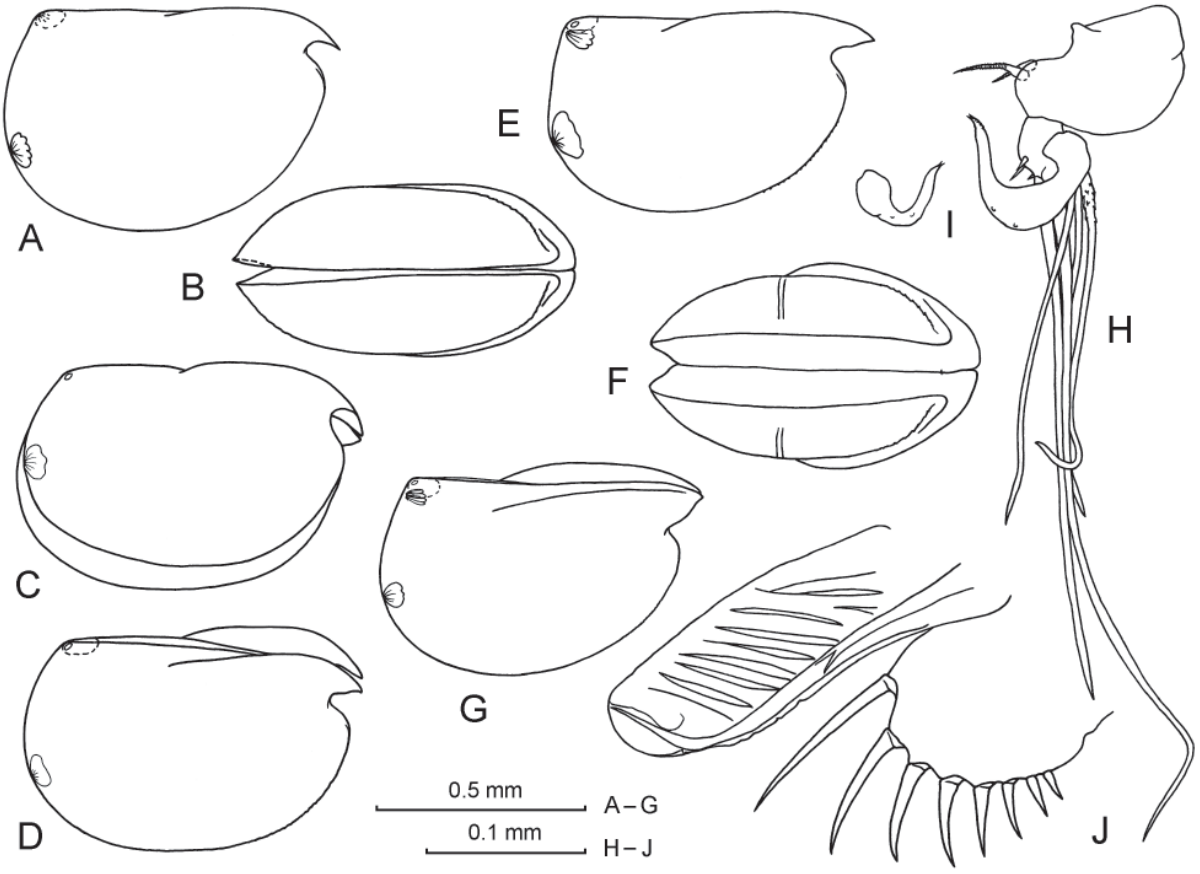


Fig. 39. ***Mikroconchoecia curta*** s.l., other female (**A–D**) and male (**E–J**) specimens.
A, E – lateral; B, F – ventral; C – ventro-lateral; D, G – dorso-lateral. An2: H – right Enp; I – left hook appendage. J – CA and CF.

Distribution. *Mikroconchoecia curta* is recorded from all oceans (except the North Pacific Ocean); geographical range is from 60°N to 57°S; predominantly shallow mesopelagic species, most abundant at depths 50–400 m (Angel et al., 2008). In the Arabian Sea Region, *M. curta* was found mainly in the southern part of the investigated area (Fig. 40), in 27% of tows. Maximum abundances were recorded at depths 50–150 m (Fig. 41). The larger specimens were found at the deeper depths.

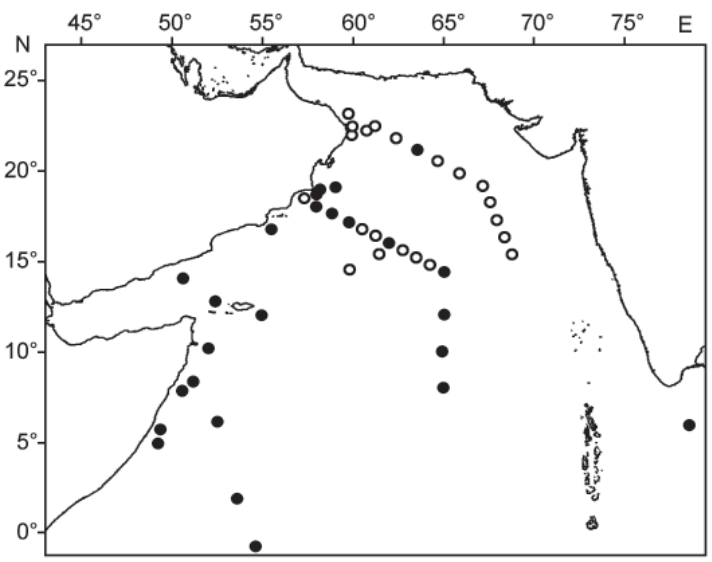


Fig. 40. Occurrence of ***Mikroconchoecia curta*** s.l. at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

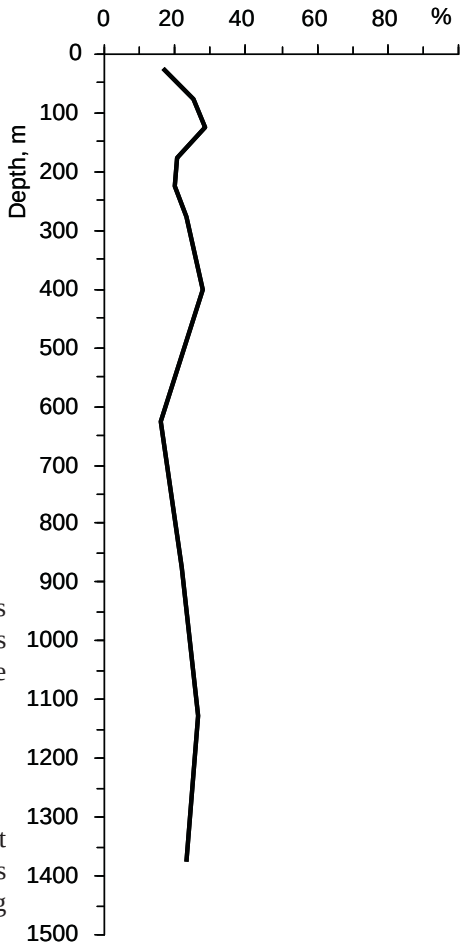


Fig. 41. Occurrence of ***Mikroconchoecia curta*** s.l. at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

Mikroconchoecia stigmatica (Müller, 1906)

(Pict. 17; Pls 34, 35; Figs 42, 43)

Conchoecia stigmatica Müller, 1906a, p. 88, pl. XXX figs 22–28.
Conchoecia stigmatica: Deevey & Brooks, 1980, p. 94, fig. 27.
Microconchoecia stigmatica: Poulsen, 1973, p. 69.
Mikroconchoecia stigmatica: Angel, 1999, pp. 820, 831, fig. 9.80.

Pict. 17. ***Mikroconchoecia stigmatica***. **A** – female; **B** – male.

Females. L = 0.94–1.04 mm (1.00 ± 0.04 mm; N = 7); H/L = 69.0 ± 1.8% (N = 7).

Plate 34**A**–**O**. Carapace (**A**–**D**): globose; surface with no striation; rostrum elongated, strongly bent down; RAG opens about in the middle of posterior margin. FO (**E**): capitulum of FO elongated, bare, distally slightly pointed. An1 (**E**): 3 sensory setae on An1 deeply forked, fourth seta (on 5th segment) has 1 short and 1 long branches; e-seta with spinules on posterior side distally. An2 (**F**, **G**): Prp with medial bulge which has no hairs; longest setae on Exp more than 1.5 Prp; a- and b- setae on Enp1 with tiny spines; h-, i- and j- setae somewhat longer than 2 thirds of g-seta. Lb (**H**): in dorsal projection broad and short; anterior edge almost straight, with small notch in the middle, and with slightly pointed corners, which are covered with tiny hairs. Md (**I**–**K**): Bsp short, with epipodial seta and plumose lateral seta; Enp1 has non-plumose dorsal seta and 2 ventral setae; Enp2 without long hairs on its anterior side. Mx (**L**): Bsp with single seta almost reaching distal edge of Enp1; Enp1 elongated, with relatively longer setae than in *M. curta* s.l. in Pl. 32K. P5 (**M**): Cxp1 covered with rather long hairs; Cxp3 with 6 setae in ventral group; Bsp has 6 setae in proximal ventral group and 3 setae in distal ventral group. P6 (**N**): Cxp2 with 2 plumose setae; dorsal seta on Bsp extremely short and weak, most distal ventral seta extends beyond distal edge of Enp1. P7 (**O**): spines on terminal setae invisible. CF (as in male in Pl. 35R): broad, with relatively short claws; dorsal seta absent.

Males. L = 1.07–1.13 mm (1.11 ± 0.03 mm; N = 7); H/L = 58.3 ± 1.8% (N = 7).

Plate 35**A**–**R**. Carapace (**A**–**C**): more elongated than in female; rostrum comparatively straight; MGGs present. FO (**D**): capitulum without any spines; slightly narrowed towards tip. An1 (**D**, **E**): a-seta bifurcated, extends beyond proximal edge of 2nd segment; c-seta relatively longer than in *M. curta* s.l. (Pl. 33E); e-seta with a single row of 7 small pegs; d-seta bears a few spinules opposite distal pegs on e-seta; b-seta bare. An2 (**F**–**I**): Prp with medial bulge covered with tiny hairs; a- and b- setae on Enp1 have spines; e-seta present; j-seta has base covered with hairs; hook appendages similar to those of *M. curta* s.l. in Pl. 33H, I. Lb (**J**): in dorsal projection narrowed anteriorly; anterior edge straight, with slightly rounded corners. Md (**K**, **L**): Enp1 has non-plumose dorsal seta; Enp2 with long hairs on anterior side. Mx (**M**), P5 (**N**), CF (**R**): similar to those in female. P6 (**O**): Cxp2 with 2 plumose setae; most of setae on Bsp and Enp1–2 shorter than in female; dorsal seta on Bsp extremely

short; all terminal setae on Enp3 about equal and with long hairs (cut off in the drawing). P7 (**P**): longer terminal seta with a double row of spines proximally. CA (**Q**): rather broad, with rounded end; has 6 muscle bands.

Distribution. *Mikroconchoecia stigmatica* is recorded from all oceans but most records are from the Atlantic Ocean; geographical range is from 60°N to 54°S but it is very much less abundant in the tropical latitudes; mesopelagic species; the adults are most abundant at depths of 900–1500 m, the juveniles – between 300–900 m. (Angel et al., 2008). In the Arabian Sea Region, *M. stigmatica* was found mainly in the central part of the investigated area (Fig. 42), in 4% of tows. Specimens of this species were found deeper than 500 m except a single record (one male) in layer 200–250 m (Fig. 43).

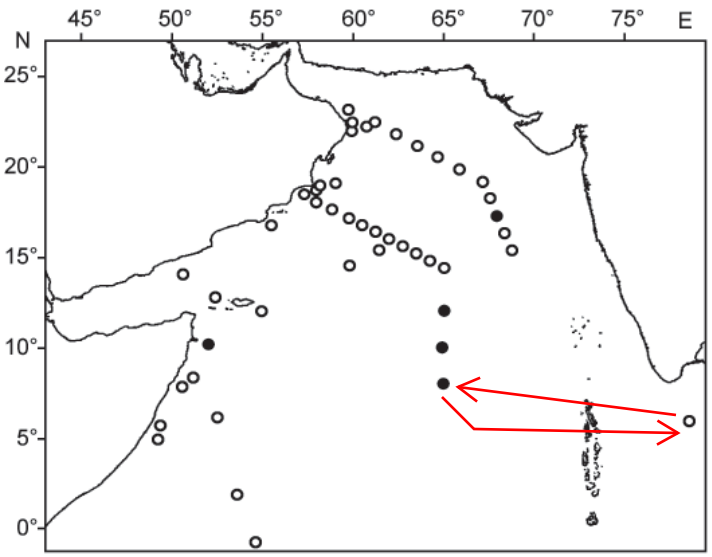


Fig. 42. Occurrence of ***Mikroconchoecia stigmatica*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

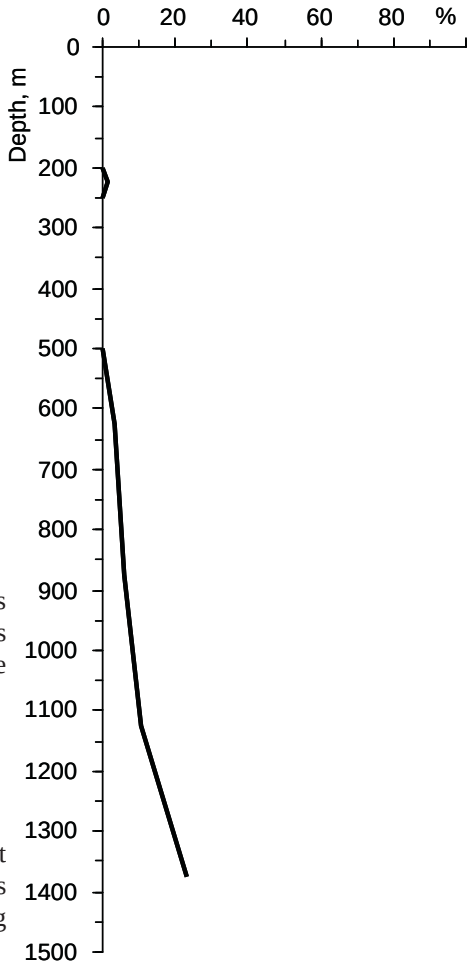


Fig. 43. Occurrence of ***Mikroconchoecia stigmatica*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

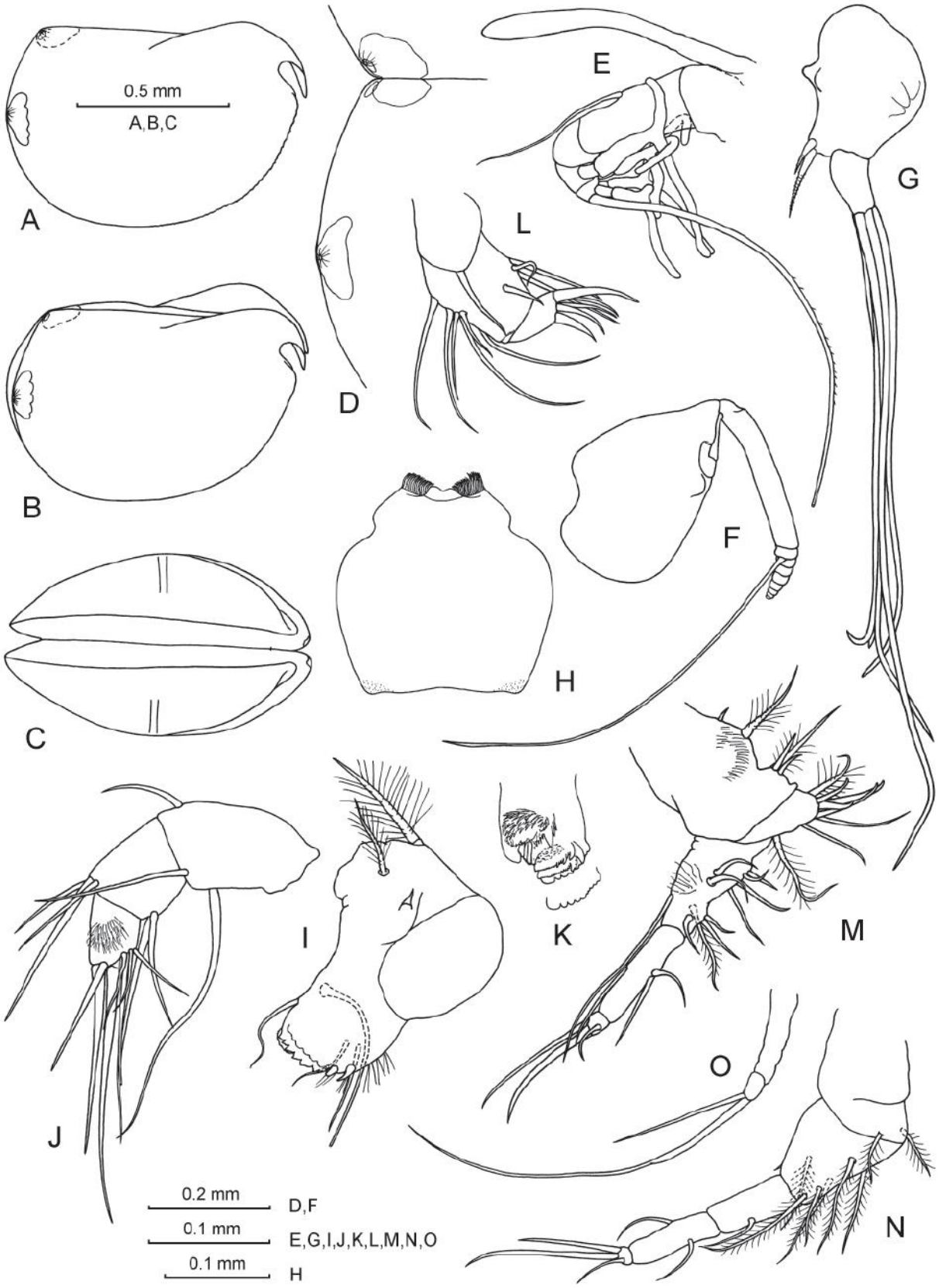


Plate 34. ***Mikroconchoecia stigmatica***, female. Carapace: **A –** lateral; **B –** dorso-lateral; **C –** ventral; **D –** both valves outside: posterior margins. **E –** FO and An1. An2: **F –** Prp and Exp; **G –** Enp. **H –** Lb. Md: **I –** Bsp, Exp; **J –** Enp; **K –** coxal endite and its toothed edge. **L –** Mx. **M –** P5. **N –** P6. **O –** P7.

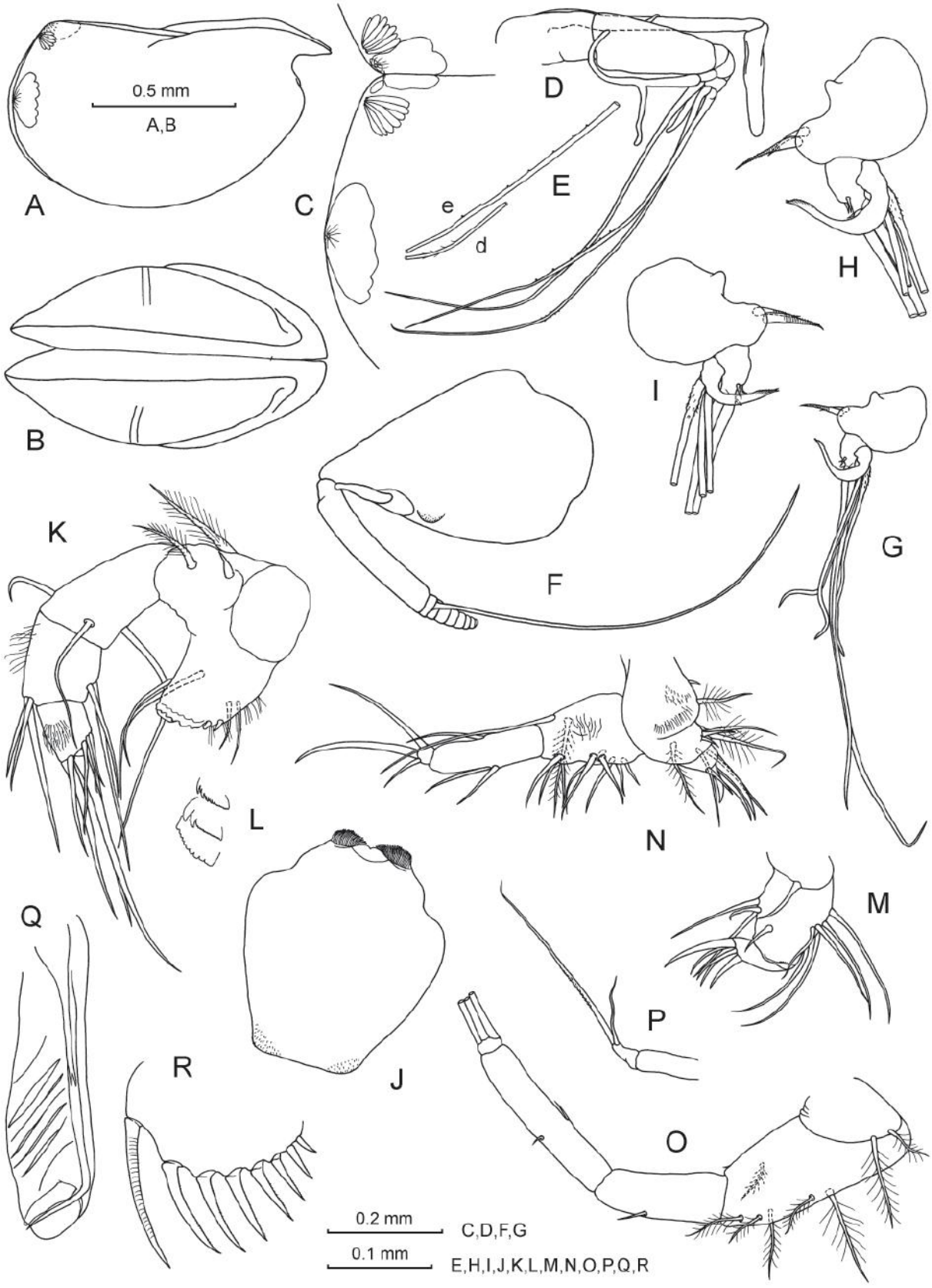


Plate 35. ***Mikroconchoecia stigmatica***, male. Carapace: **A –** lateral; **B –** ventral; **C –** both valves outside: posterior margins. **D –** FO and An1. **E –** An1: armature of d- and e- setae. An2: **F –** Prp and Exp; **G**, **H –** right Enp; **I –** left Enp. **J –** Lb. Md: **K –** Bsp, Exp and Enp; **L –** coxal endite: toothed edge, distal and proximal tooth-lists. **M –** Mx. **N –** P5. **O –** P6. **P –** P7. **Q –** CA. **R –** CF.

Genus ***Orthoconchoecia*** Granata & Caporiacco, 1949

The main characters of this genus are the following: **a**) the presence of a series of larger medial gland cells along the posterior margin of carapace; **b**) one of the two lateral setae (c-seta) on the Enp2 of male An2 is exceptionally long, and in the female in its place is a seta as long as Enp2; **c**) b-seta of male An1 has an elongate pad. (Poulsen, 1973).

The following species of the genus *Orthoconchoecia* have been identified in the analyzed material: *O. atlantica* (Lubbock, 1856); *O. secernenda* (Vavra, 1906); *O. bispinosa* (Claus, 1891) and *O. striola* s.s. (Müller, 1906) (Table 3, Appendices 1, 2).

Key to the species of ***Orthoconchoecia*** (adult females and males):

1 L > 3 mm;
posterior and dorsal margins of carapace form acute angle;
both PDCs without spines;
in males An1 e-seta and An2 g-seta reaching beyond posterior margin of carapace;
CF with dorsal seta
(Pls 5C, 36A, C, 37A, C, D, G, O) ..…..……....…… ***O. atlantica***

1a L < 3 mm;
posterior and dorsal margins of carapace form almost right angle;
both PDCs with spines;
in males An1 e-seta and An2 g-seta far shorter;
CF without dorsal seta ……...…...…... 2

2 Carapace usually with distinct longitudinal striation;
PDCs with strong triangular spines;
in males: capitulum of FO with truncated tip; An1 e-seta has comb with
~ 40 long conical spines placed alternately at almost right angles to seta
(Pls 5C, 38A, C, 39A, C, E, F) …….……...……..... ***O. striola* s.s.**

2a Carapace without longitudinal striation;
PDCs with less developed spines;
in males: capitulum of FO with rounded tip; An1 e-seta comb with
30–50 pairs of short spines directed proximally ……..……...……. 3

3 L usually < 2 mm;
in males An1 e-seta comb with ~ 50 pairs of spines
(Angel, 1970, p. 147, figs 1–3) ……...……..…… ***O. bispinosa***

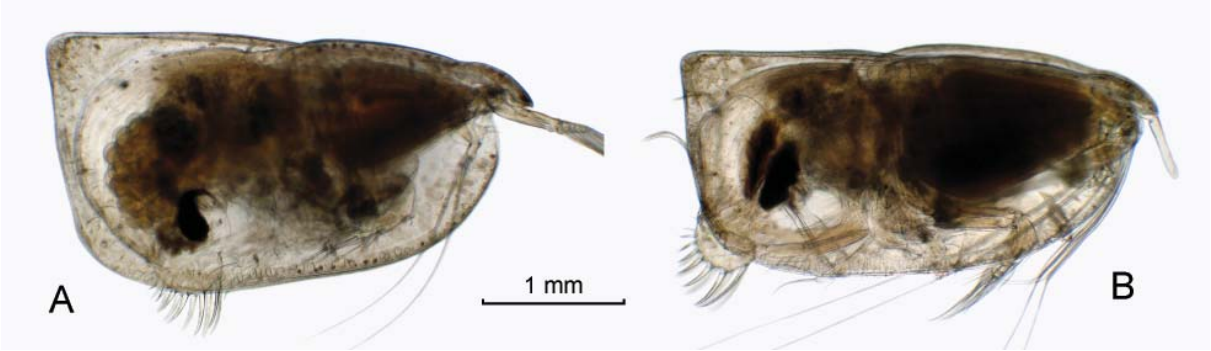
3a L usually > 2 mm;
in males An1 e-seta comb with ~ 30 pairs of spines
(Angel, 1970, p. 158, figs 7–9) ……..……...…… ***O. secernenda***

The two most abundant species, *O. atlantica* and *O. striola* s.s., are described below.

Orthoconchoecia atlantica (Lubbock, 1856)

(Pict. 18; Pls 36, 37; Figs 44, 45)

For synonymy before 1906, see Müller, 1906a.
Conchoecia atlantica: Müller, 1906a, p. 92, pl. V figs 6, 7, pl. XIX figs 17–28; Rudjakov, 1962, p. 189, fig. 9 (male); Deevey, 1968a, p. 69, fig. 32; Poulsen, 1969a, p. 158.
Orthoconchoecia atlantica: Granata & Caporiacco, 1949, p. 23; Poulsen, 1973, p. 94, fig. 47; Angel, 1999, pp. 821, 833, fig. 9.87.



Pict. 18. ***Orthoconchoecia atlantica***. **A** – female; **B** – male.

Females. L = 3.07–3.73 mm (3.43 ± 0.13 mm; N = 95); H/L = 51.0 ± 1.8% (N = 63).

Plate 36**A**–**N**. Carapace (**A**–**C**): thick, with rough surface; higher in posterior part; posterior margin straight and forms acute angle with dorsal margin; PDCs rounded; RAG and LAG in usual places. FO (**D**): capitulum tapered towards the end; has strong spines proximally and small distally; tip rounded. An1 (**D**): 1st and 2nd segments covered with tiny spines; 4th segment has short hairs on dorsal surface; dorsal seta long, with tiny hairs; sensory setae (a–d) about one-third of e-seta; e-seta with short spines mainly on posterior side below sensory setae. An2 (**E**, **G**): Prp with hairs on medial bulge and just posteriorly; a- and b- setae with fine spines; Enp2+3 has long c- (or d-) seta; h-, i- and j- setae thin and comparatively short, covered with rare hairs proximally. Lb (**H**): dorsal projection broad, almost rectangular. Md (**I**, **J**): epipodial appendage has strong seta; Enp1 with non-plumose dorsal seta and 4 ventral setae (2 plumose); anterior side of Enp2 with short spines. Mx (**K**): Enp1 has about 12 short spines near distal edge. P5 (**L**): Cxp3 with 6 setae in ventral group; Bsp with 7 setae in proximal ventral group (one of them plumose) and 4 setae in distal group. P6 (**M**): all setae typical for Conchoeciini present; 3 terminal setae on Enp3 about equal. P7 (**N**): terminal segment with short spines on its ventral surface; longer of 2 terminal setae with a double row of spines proximally. CF (as in male in Pl. 37 O): dorsal seta present.

Males. L = 3.07–3.54 mm (3.30 ± 0.11 mm; N = 88); H/L = 46.0 ± 1.6% (N = 59).

Plate 37**A**–**O**. Carapace (**A**–**C**): H_{post} almost as high as H_{ant}; MGGs present. FO (**D**): capitulum with small spines proximally and bare distal part. An1 (**D**, **E**): 1st and 2nd segments bare; 4th segment with a few hairs on dorsal surface; e-seta extends beyond posterior margin of carapace and has comb of ~ 80 paired spines directed proximally and 2 spines directed distally; also 1 or 2 spines present below the comb; b-seta has long and narrow oval pad opposite e-comb, and a few spines proximally and distally from pad; d-seta bears (on level with distal part of e-comb) a series of spines increasing in size distally. An2 (**F**–**I**): b-seta on Enp1 with long hairs in its middle part; c-seta on Enp2 very long; e-seta extremely short; g-seta very long, about equal to e-seta on An1; h-, i- and j- setae thin, weak and short, j-seta with slightly swollen base; right hook appendage evenly curved, with 2 processes on inner side of its base; left appendage smaller and slender; tips of both appendages with long, bent outwards, papillae. Lb (**J**): dorsal projection more elongated than in female. Md (**K**): dorsal seta on Enp1 has hairs proximally.

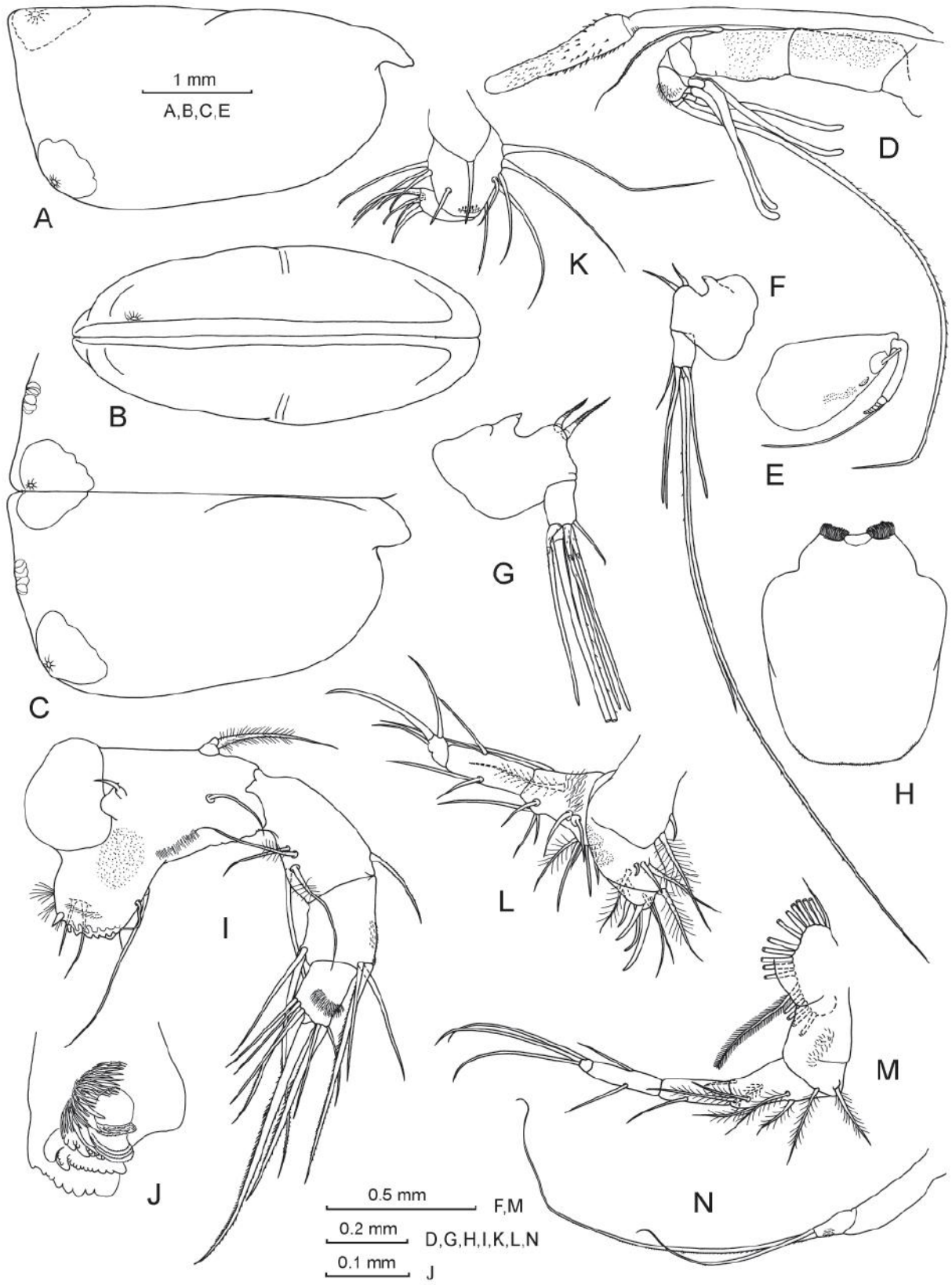


Plate 36. ***Orthoconchoecia atlantica***, female. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside. **D** – FO and An1. An2: **E** – Prp and Exp; **F**, **G** – left and right Enp. **H** – Lb. Md: **I** – Bsp, Exp and Enp; **J** – coxal endite. **K** – Mx. **L** – P5. **M** – P6. **N** – P7.

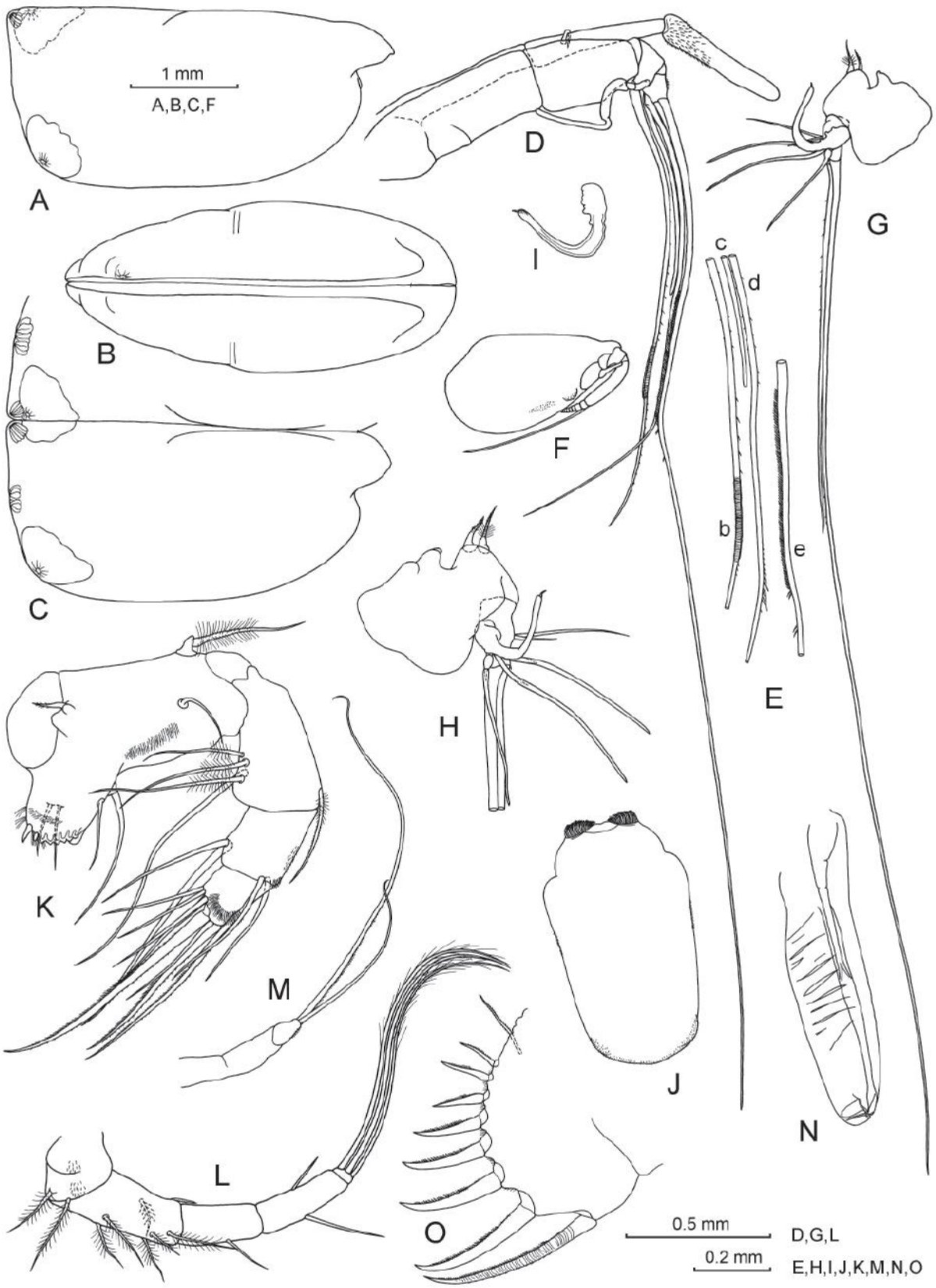


Plate 37. ***Orthoconchoecia atlantica***, male. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside. **D** – FO and An1. **E** – An1: armature of b-, d- and e- setae. An2: **F** – Prp and Exp; **G**, **H** – right and left Enps; **I** – right hook appendage. **J** – Lb. **K** – Md: Bsp, Exp and Enp. **L** – P6. **M** – P7. **N** – CA. **O** – CF.

Mx, P5, P7 (**M**), CF (**O**): similar to those in female. P6 (**L**): armature of Bsp and Enp1–2 as in female but most of setae slightly shorter; 3 terminal setae on Enp3 about equal and with long hairs. CA (**N**): elongated, with about 7 muscles and rounded end.

Distribution. *Orthoconchoecia atlantica* is recorded from all oceans mainly in the tropical and temperate zones; geographical range in the Atlantic Ocean is 35°N–53°S, in the Pacific Ocean 50°N–58°S; shallow mesopelagic species with a range of 100–300 m for juveniles and 400–500 m for adults (Angel et al., 2008). In the investigated area (Fig. 44), *O. atlantica* was found in 44% of tows. Maximum abundances were recorded at depths 50–150 m (Fig. 45).

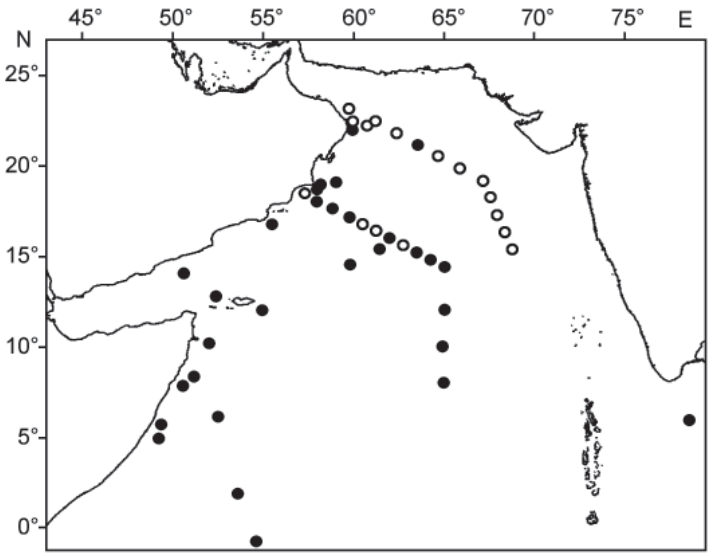


Fig. 44. Occurrence of ***Orthoconchoecia atlantica*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

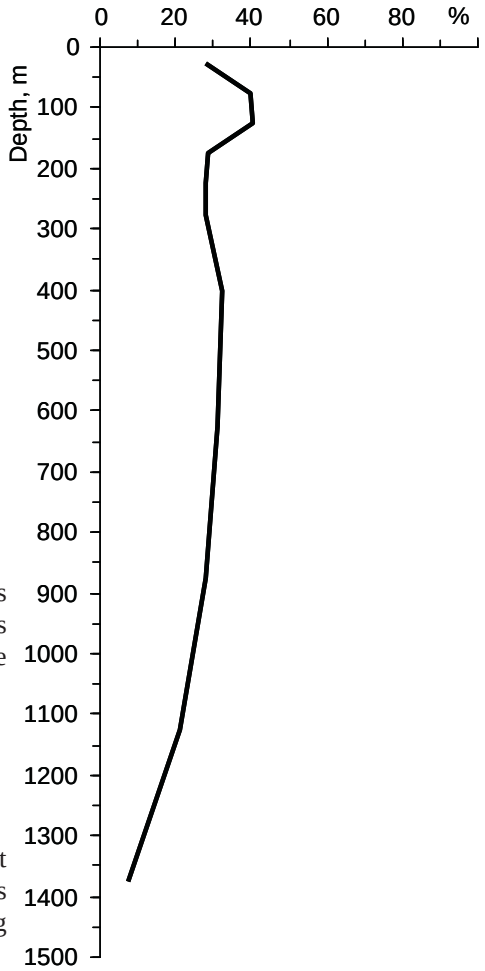


Fig. 45. Occurrence of ***Orthoconchoecia atlantica*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

Orthoconchoecia striola s.s. (Müller, 1906)

(Pict. 19; Pls 38, 39; Figs 46, 47)

Conchoecia striola Müller, 1906a, p. 91, pl. XVIII figs 11, 20–24.
Orthoconchoecia striola: Poulsen, 1969a, p. 157; 1973, p. 85, fig. 42.
Orthoconchoecia striola striola: Martens, 1979, p. 353, figs 25, 26.

Pict. 19. ***Orthoconchoecia striola*** s.s. **A** – female; **B** – male.

Females. L = 2.12–2.48 mm (2.34 ± 0.09 mm; N = 30); H/L = 49.3 ± 1.8% (N = 26).

Plate 38**A**–**O**. Carapace (**A**–**C**): higher in posterior part; with longitudinal striation, which is often almost invisible; PDCs extend into strong triangular spines (right spine longer than left); RAG and LAG about in usual places. FO (**D**): capitulum thickened proximally, narrows towards rounded tip and with short spines on ventral surface and on dorsal posteriorly. An1 (**D**): surface of 1st segment and proximal part of 2nd covered with short spines; dorsal seta long; sensory setae (a–d) about one-third of e-seta; the latter with short spinules on posterior (distally from sensory setae) and anterior sides. An2 (**E**–**G**): Prp with hairs on medial bulge and posteriorly from it; Enp1 with pointed processus mamillaris; a- and b- setae bear fine marginal spines; End2+3 with c- or d-seta, which is longer than this segment and furnished with tiny spines; h-, i- and j- setae with elongated shafts which have slightly swollen bases; all three setae covered with short spines proximally. Lb (**H**): in dorsal projection rather broad, narrows anteriorly, with almost straight anterior edge. Md (**I**, **J**): Bsp with epipodial appendage having seta; Enp1 has non-plumose dorsal seta and 4 ventral setae (2 of them very short); anterior side of Enp2 with short spines. Mx (**K**): Bsp with single seta not reaching distal edge of Enp1; Enp1 with about 10–12 tiny spines near distal edge. P5 (**L**): Cxp3 with 6 setae in ventral group; Bsp has 7 setae in proximal ventral group (one of them plumose) and 3 setae in distal ventral group. P6 (**M**): non-plumose dorsal seta shorter than half Enp1; 3 terminal setae on Enp3 about equal length. P7 (**N**): longer of 2 terminal setae with a double row of spines proximally. CF (**O**): no dorsal seta.

Males. L = 1.98–2.26 mm (2.11 ± 0.07 mm; N = 50); H/L = 43.9 ± 1.8% (N = 29).

Plate 39**A**–**Q**. Carapace (**A**–**C**): more elongated and less tapered anteriorly than in female; posterior margin almost straight and forms almost right angle with dorsal margin; MGGs present. FO (**D**): capitulum broad, with truncated tip, covered with hairs as in female. An1 (**E**, **F**): e-seta has comb with ~ 40 rather long conical spines placed alternately at almost right angles to seta; d-seta with tiny spines opposite distal part of e-comb; b-seta has oval pad and distally from it a double row of spines. An2 (**G**–**I**): medial bulge with no spines; c-seta on Enp2 very long; e-seta present; h-, i- and j- setae with elongated shafts and covered with short spines proximally; only j-seta shaft has slightly swollen base; right hook appendage strongly but smoothly curved, left one smaller and less curved, both appendages ending in tiny papillae. Lb (**J**): in dorsal projection more elongated than in female. Md (**K**): Bsp more elongated than in female. Mx (**K**), P5 (**M**), P7 (**O**), CF (**Q**):

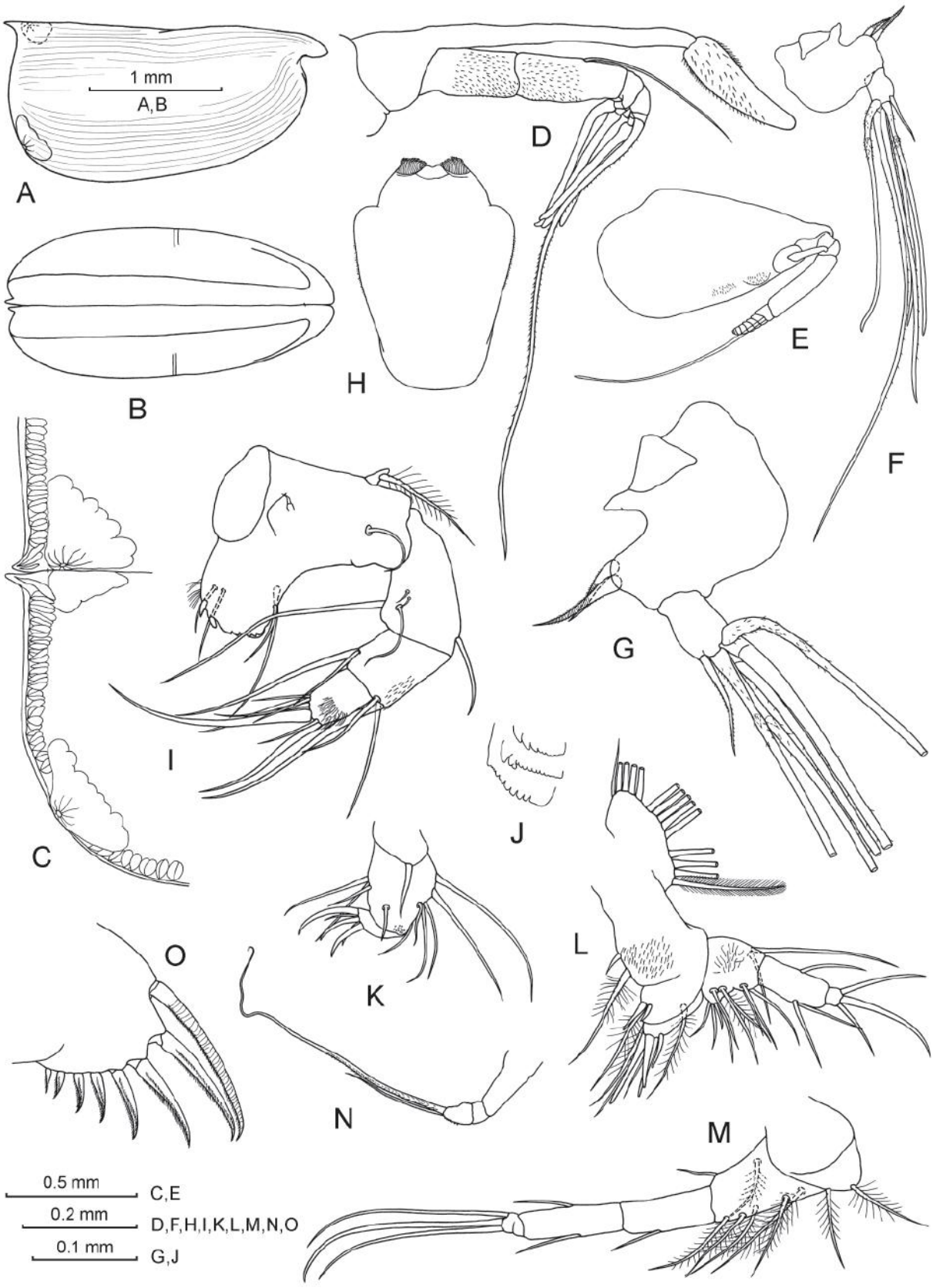


Plate 38. ***Orthoconchoecia striola*** s.s., female. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: posterior margins. **D** – FO and An1. An2: **E** – Prp and Exp; **F**, **G** – Enp. **H** – Lb. Md: **I** – Bsp, Exp and Enp; **J** – coxal endite: toothed edge, distal and proximal tooth-lists. **K** – Mx. **L** – P5. **M** – P6. **N** – P7. **O** – CF.

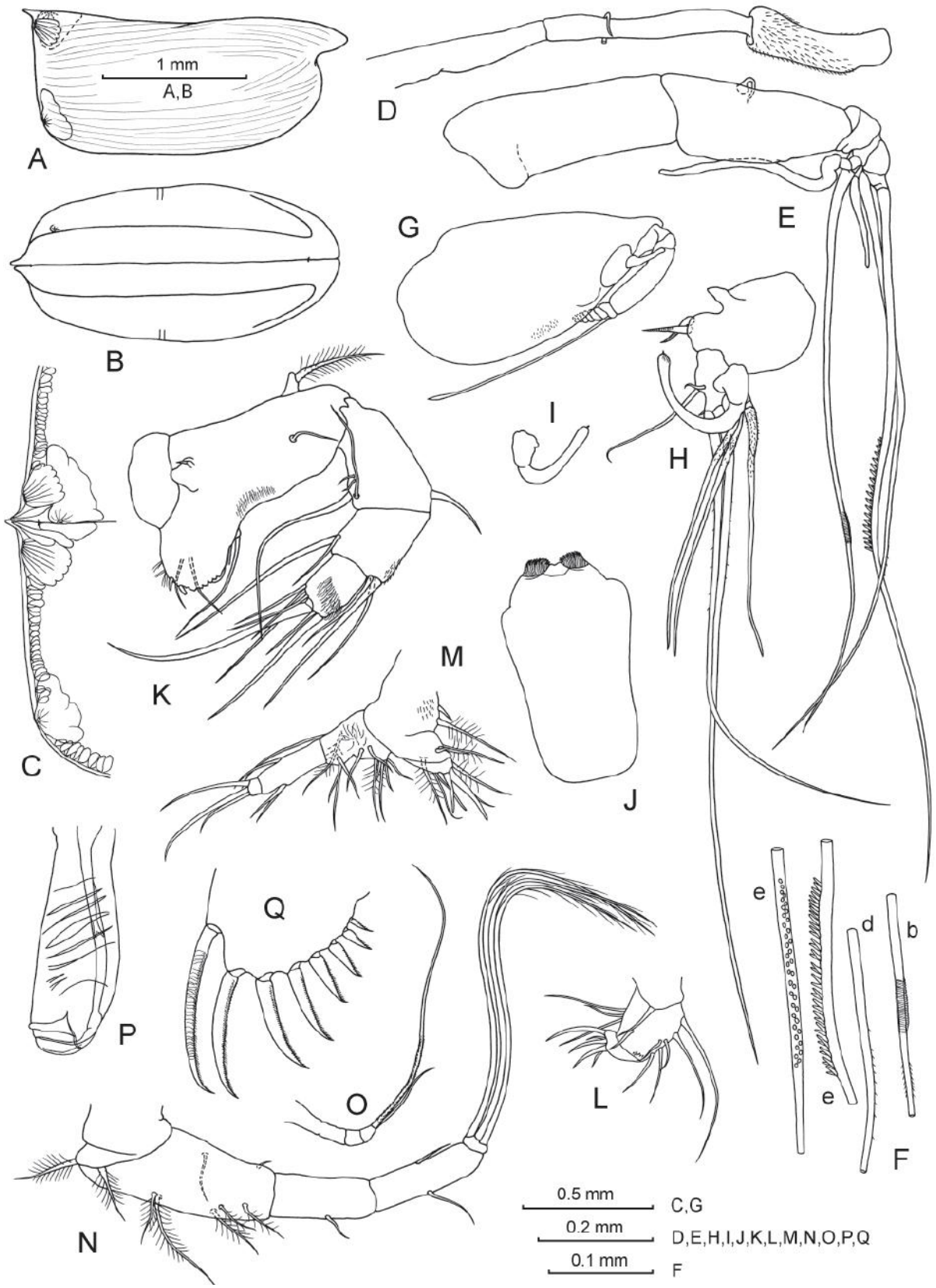


Plate 39. ***Orthoconchoecia striola*** s.s., male. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: posterior margins. **D** – FO. **E** – An1. **F** – An1: armature of b-, d- and e- setae. An2: **G** – Prp and Exp; **H** – right Enp; **I** – left hook appendage. **J** – Lb. **K** – Md without Cxp. **L** – Mx. **M** – P5. **N** – P6. **O** – P7. **P** – CA. **Q** – CF.

similar to those in female. P6 (**N**): most of setae on Bsp and Enp1–2 shorter than in female, especially dorsal seta on Bsp which does not reach distal edge of this segment; all terminal setae on Enp3 about equal and with long hairs. CA (**P**): with straight anterior margin and convex posterior one; has 6–7 muscle bands.

Remarks. *Orthoconchoecia striola* is very close to *O. secernenda* and differs from it mainly by larger posterior dorsal spines and the presence of longitudinal striation on the carapace surface. Males are readily differentiated in armature of An1 e-seta (Angel, 1970; Poulsen, 1973). Females of *O. striola* may confuse with females of *O. secernenda* in cases when the longitudinal striation is almost invisible. One more closely-related species, *O. bispinosa*, is similar to *O. secernenda* but has smaller sizes.

Specimens of *O. striola* s.s. from the Arabian Sea Region are similar in length to those described by Müller (1906a) and Poulsen (1973) from the Indian Ocean and tropical region of Pacific, but smaller than individuals from the East Pacific Ocean (Müller, 1906a: p. 91, females 2.8–3.0, male 2.6 mm; Poulsen, 1973: table 10, females 2.6–2.9, males 2.4–2.6 mm). Most possibly the larger specimens of *O. striola* are another species.

Distribution. *Orthoconchoecia striola* is recorded from the Indian and Pacific Oceans, mainly in tropical zone, records from the Atlantic Ocean unknown; "occurs with about the same frequency and abundance right from 20 m and down to 2000 m; the highest figures are for 300–1000 m" (Poulsen, 1973). In the investigated area (Fig. 46), *O. striola* s.s. was found in 18% of tows. Maximum abundances were recorded at depths 50–300 m (Fig. 47).

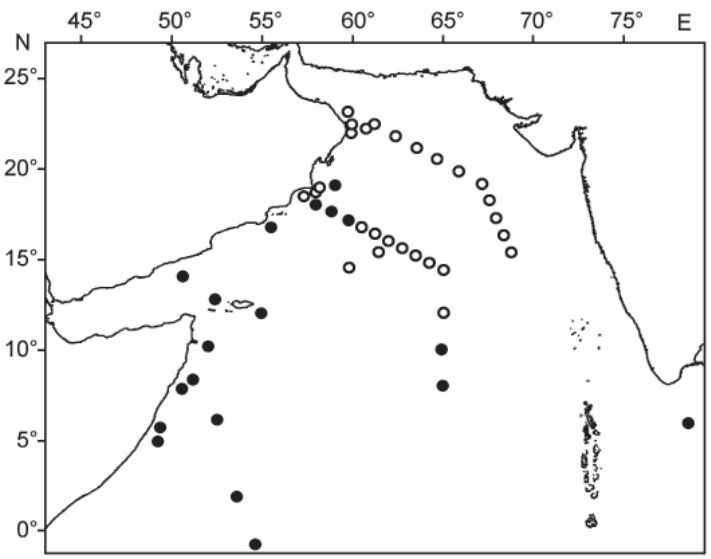


Fig. 46. Occurrence of ***Orthoconchoecia striola*** s.s. at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

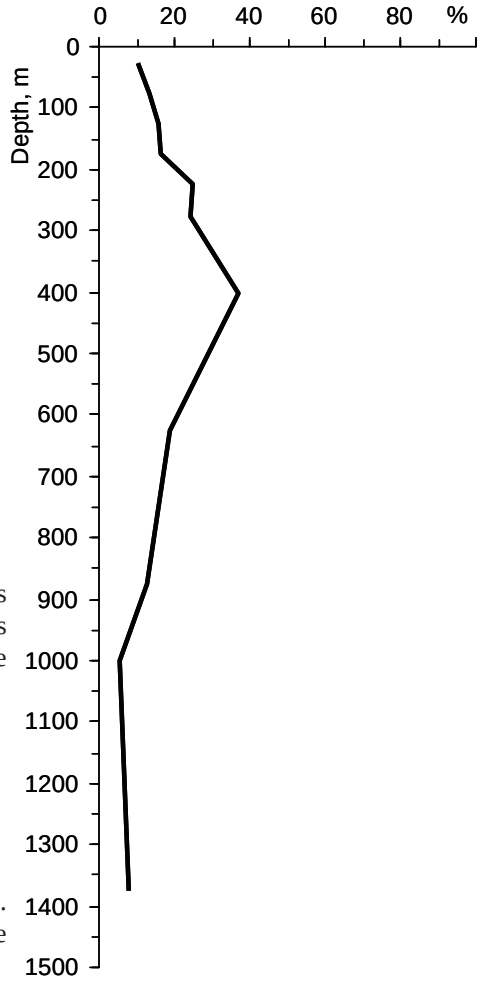


Fig. 47. Occurrence of ***Orthoconchoecia striola*** s.s. at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

Genus ***Paraconchoecia*** Claus, 1890

This genus is one of the most doubtful in the tribe Conchoeciini and needs revision. After Poulsen (1973), the main genus character is the presence of long outstanding hairs on the proximal half of female An1 e-seta.

Seven species have been identified in the analyzed material: *P. allotherium* (Müller, 1906); *P. cophopyga* (Müller, 1906); *P. echinata* (Müller, 1906); *P. inermis* Claus, 1890; *P. mamillata* (Müller, 1906); *P. oblonga* Claus, 1890, forms A and B; *P. spinifera* Claus, 1890 (Table 3, Appendix 1, 2). Four of these species, *P. allotherium*, *P. echinata*, *P. inermis* and *P. oblonga*, are described below, including two forms of *P. oblonga* presented separately.

The general characters of *Paraconchoecia* species described herein are the following:

Carapace is elongated (H < 45% of L), with distinct anterior ventral striation; Md Enp1 with 3 or 4 setae; CF without unpaired dorsal seta.

Females. FO is clearly divided on stem and capitulum, the latter slightly bent downwards; e-seta on Ant1 with long outstanding hairs on proximal half of the anterior margin.

Males. An1 e-seta has a comb of long, paired spines directed proximally, and a few spines directed distally below comb; b-seta opposite e-comb with a double row of densely placed short spines or rather large finger-like spines; ventral terminal seta on P6 Enp3 thinner and has no long hairs.

The key to all species of *Paraconchoecia* identified in the investigated material is presented below. In the species *P. cophopyga*, *P. mamillata* and *P. spinifera*, which are not described in detail in the present book, only carapace characteristics (Fig. 48) are used for identification.

Key to the species of ***Paraconchoecia*** (adult females and males):

1 RAG moved dorsally on posterior margin ……..…….…. 2

1a RAG in usual place near PVC or moved anteriorly on ventral margin ……...…...……. 3

2 L < 2 mm;
carapace with cellular sculpture; left PDC and right posterior margin with tubercles;
LAG and RAG open on these tubercles (Fig. 48A, B) ……..…. ***P. mamillata***

2a L > 3 mm;
carapace with longitudinal striation; tubercles absent;
LAG open in usual place near PDC on dorsal margin (Fig.48C) ……..…...… ***P. cophopyga***

3 Shoulder vaults strongly developed and sharp-edged (Fig. 48D, E) ……..…..… ***P. spinifera***

3a Shoulder vaults not sharp-edged ……..……..……..……..…….. 4

4 PDCs with no spines, these corners rounded (Pls 7A, 44A, B, 45A, C) ..…….…..... ***P. inermis***

4a Right PDC with spine, left rounded ...……..……...…....……. 5

5 PVCs clear;
in females: An1 with short dorsal seta; tip of FO capitulum rounded;
in males: An1 b-seta with a double row of large, closely set, finger-like spines
(Pls 7A, 42A, D, 43A, E, F) ……..……..……...…....… ***P. echinata***

5a PVCs well rounded;
in females: An1 with long dorsal seta; tip of FO capitulum pointed;
in males: An1 b-seta with double row of densely placed fine spines directed distally …....…… 6

6 Shoulder vaults relatively weak;
Md Enp1 with 4 ventral setae;
longer disto-ventral seta on Md End2 powerful and furnished with long strong teeth;
2nd to 4th claws of CF larger and curved (especially 4th), last 4 claws short and straight
(Pls 7A, 40A, I, N, 41A, L, R) ..... ***P. allotherium***

6a Shoulder vaults well developed;
Md Enp1 with 3 ventral setae,
longer disto-ventral seta on Md End2 and its armature visibly weaker;
2nd to 5th claws of CF larger and curved (especially 5th), last 3 claws short and straight 7

7 RAG opens in usual place near PVC;
CF with relatively long and narrow 1st to 5th claws
(Pls 7A, 46A, C, N, 47A, C, T) ..... ***P. oblonga***, form A

7a RAG moved anteriorly;
CF with more powerful and shorter 1st to 5th claws
(Pls 7A, 48A, M, 49A, C, Q) ..... ***P. oblonga***, form B

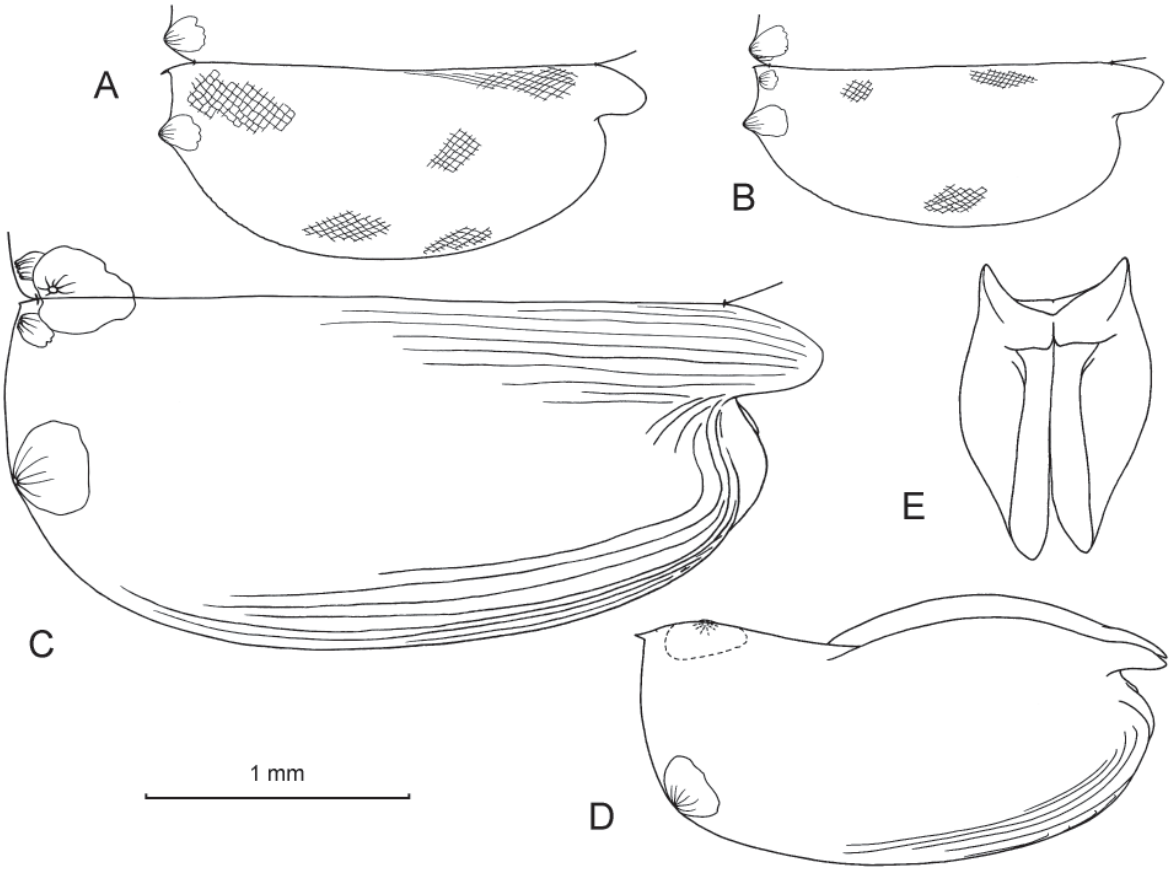


Fig. 48. Carapace outlines of the species of genus ***Paraconchoecia*** identified in the analyzed material but not described in detail in the present book. *P. mamillata*, female (**A**) and male (**B**). *P. cophopyga*, male (**C**). *P. spinifera*, female: lateral (**D**) and anterior (**E**) views.

Paraconchoecia allotherium (Müller, 1906)

(Pict. 20; Pls 40, 41; Figs 49, 50)

Conchoecia allotherium Müller, 1906a, p. 59, pl. XI figs 15–19.
Conchoecia allotherium: Deevey, 1974, p. 361, fig. 2j–n; 1982, p. 479, figs 8, 9a–d, f–k, 10b–d.
Paraconchoecia allotherium: Poulsen, 1973, p. 23, fig. 7; Angel, 1999, pp. 821, 834, fig. 9.92.
Not *Paraconchoecia gerdhartmanni*: Martens, 1979, p. 334, figs 15, 17.

Pict. 20. ***Paraconchoecia allotherium***. **A** – female; **B** – male.

Females. L = 1.51–1.70 mm (1.60 ± 0.05 mm; N = 16); H/L = 39.3 ± 2.4% (N = 15).

Plate 40**A**–**N**. Carapace (**A**–**C**): elongated, slightly tapered anteriorly, with rather long narrow rostrum; has posterior dorsal spine and 1–2 smaller additional spines on right valve; PVCs well rounded; shoulder vaults relatively weak; LAG and RAG in usual places. FO (**D**): capitulum covered with short hairs, pointed, its ventral side has swelling distally. An1 (**D**): long and slim; with very long dorsal seta having fine spines; e-seta has long outstanding hairs on proximal half of its anterior side and short spines distally; posterior side of e-seta with hairs decreasing in size distally, below sensory setae. An2 (**E**, **F**): medial bulge on Prp weak and bare; a- and b- setae on Enp1 with tiny spines; g-seta slightly flattened distally and bearing spinules. Lb (**G**): in dorsal projection slightly tapered anteriorly, anterior edge almost straight with rounded corners. Md (**H**, **I**): Bsp elongated, its epipodial appendage with very small seta; Enp1 has non-plumose dorsal seta and 4 ventral setae; longest seta on ventral side of Enp2 powerful and furnished with long strong teeth. Mx (**J**): Bsp with single seta reaching slightly over half of Enp1; Exp1 with 6 setae on anterior side (2 of them plumose), 3 setae on posterior, lateral seta and group of small spines near distal edge. P5 (**K**): Cxp1–2 covered with long hairs; Cxp3 with 6 setae in ventral group; Bsp has 6 setae in proximal ventral group (one of them plumose) and 3 setae in distal ventral group. P6 (**L**): Cxp1 covered with long hairs; Bsp with 5 rather long plumose ventral setae, plumose dorso-lateral seta and short dorsal seta. P7 (**M**): longer terminal seta with a double row of tiny spines proximally; second seta very short, ~2 lengths of terminal segment. CF (**N**): 2nd to 4th claws larger and curved (especially 4th); 5th to 8th claws short and straight; unpaired dorsal seta absent.

Males. L = 1.42–1.51 mm (1.46 ± 0.03 mm; N = 14); H/L = 40.4 ± 1.2% (N = 11).

Plate 41**A**–**Q**. Carapace (**A**–**C**): ventral and dorsal margins almost parallel; in ventral view rostrum visibly broader than in female; MGGs present. FO (**D**): capitulum elongated, slightly thickened distally; with rounded tip; covered with very short hairs ventrally and dorsally. An1 (**E**, **F**): e-seta with comb consisting of ~ 30 pairs of long pointed spines (distal spines slightly shorter than others) directed proximally and 1–2 pairs of very short spines directed distally; b-seta opposite distal part of e-comb has rather short double row of densely placed fine spines directed distally, and below these a few rarerly placed spinules; d-seta with a few spinules opposite e-comb.

Plate 40. ***Paraconchoecia allotherium***, female. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside. **D** – FO and An1. An2: **E** – Prp and Exp; **F** – Enp. **G** – Lb. Md: **H** – Bsp and Exp; **I** – Enp. **J** – Mx. **K** – P5. **L** – P6. **M** – P7. **N** – CF.

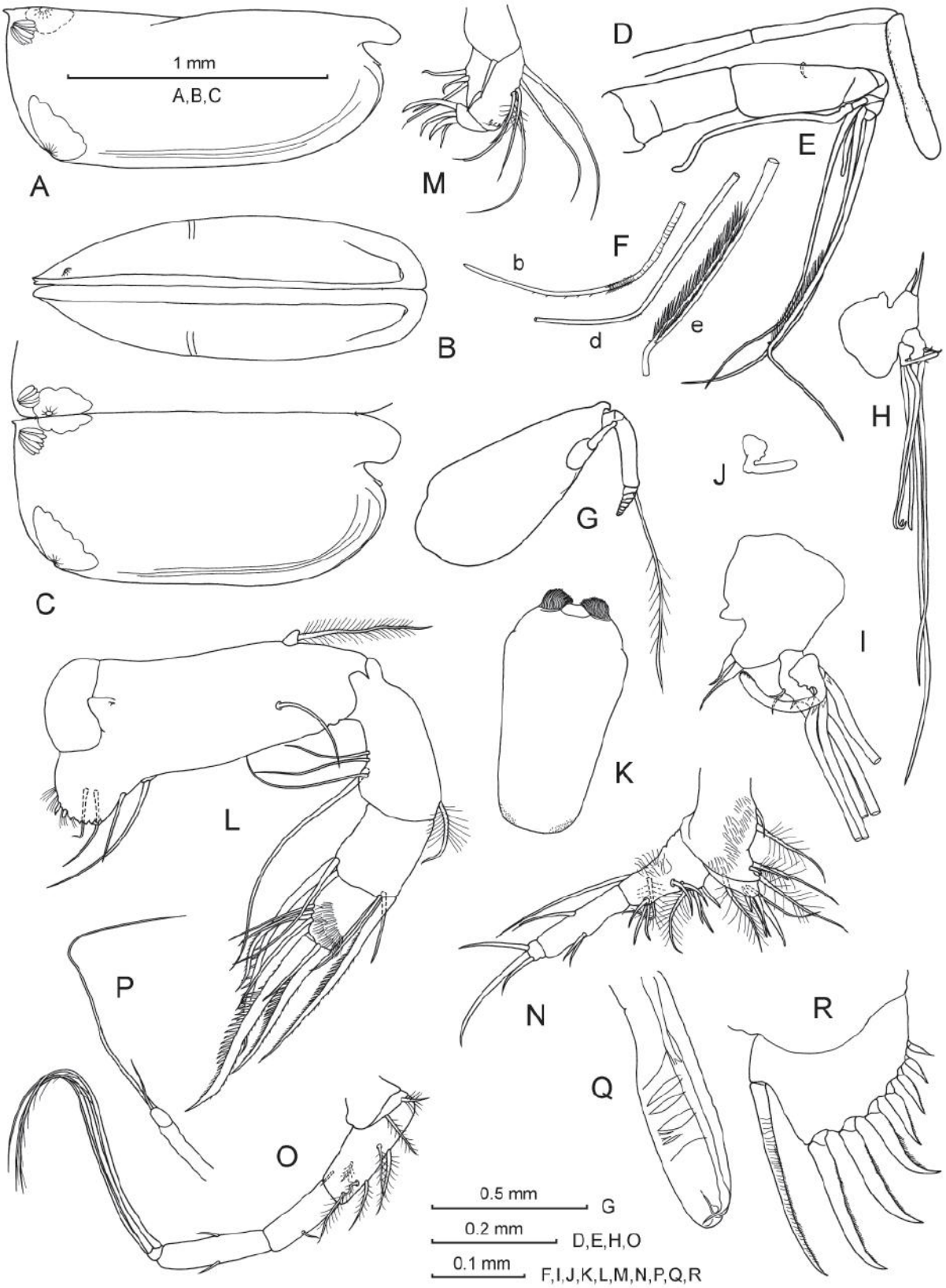


Plate 41. ***Paraconchoecia allotherium***, male. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside. **D** – FO. **E** – An1. **F** – An1: armature of b-, d- and e- setae. An2: **G** – Prp and Exp; **H**, **I** – left and right Enps; **J** – left hook appendage. **K** – Lb. **L** – Md without Cxp. **M** – Mx. **N** – P5. **O** – P6. **P** – P7. **Q** – CA. **R** – CF.

An2 (**G**–**J**): inner surface of Prp bare; a- and b- setae with tiny spines; e-seta rather long; right hook appendage strongly curved, its middle part not swollen; left appendage far smaller, bent at almost right angle, almost straight distally, has bulge on the knee; both appendages with 2 small processes on inner side of bases and rounded tips. Lb (**K**): in dorsal projection more elongated than in female. Md (**L**): Bsp more elongated than in female; Enp1 with plumose dorsal seta. Mx (**M**), P5 (**N**), P7 (**P**), CF (**R**): similar to those in female. P6 (**O**): all setae on Bsp and Enp1–2 shorter than in female; most distal ventral seta on Bsp reaching about half Enp1; ventral terminal seta on Enp3 thinner and has no long hairs. CA (**Q**): elongated, straight, slightly narrowed proximally, with rounded tip; has 4 muscle bands.

Remarks. Except the weaker shoulder vaults and small additional spines on right PDC, *P. allotherium* is very similar outwardly to *P. oblonga*, form A (Pls 7A, 46A–C, 47A–C), but it has many differences in the structure of appendages, which are the following: **a**) different shapes of FO capitulums in both sexes; **b**) shorter and thickened distal parts of b-, d- and e- setae on male An1; **c**) differing shapes of hook appendages on male An2; **d**) 4 ventral setae on Enp1 of Md; **e**) far more powerful one of two ventral setae (which is longer) on Md Enp2 and its armature; **f**) visibly longer distal ventral setae on Bsp of male P6; **g**) different structure of CF. See these in the Pls 40, 41, and for comparison, in Pls 46, 47.

Distribution. *Paraconchoecia allotherium* is recorded from all oceans; geographical range is from 28°N to 40°S; shallow mesopelagic species, most abundant at depths 100–500 m (Angel et al., 2008). In the Arabian Sea Region, adult males and females of *P. allotherium* were found in the southern part of the investigated area (Fig. 49), in 7% of tows. Maximum abundances were recorded at depths 200–500 m (Fig. 50).

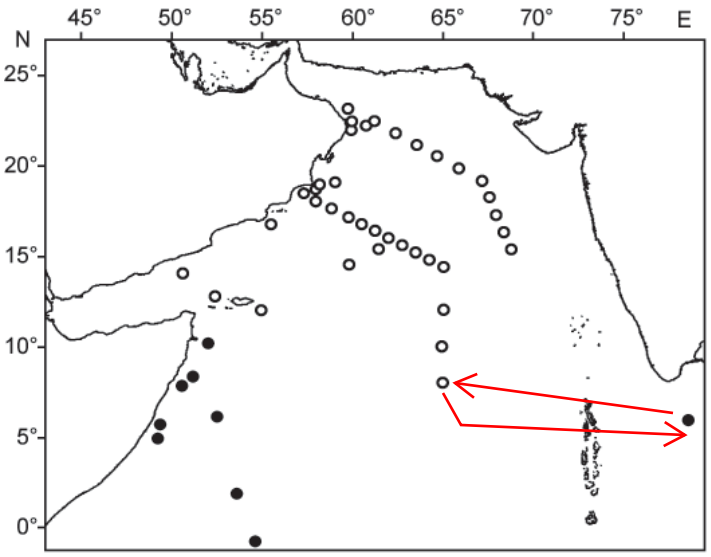


Fig. 49. Occurrence of ***Paraconchoecia allotherium*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adult males and females of the species were found.

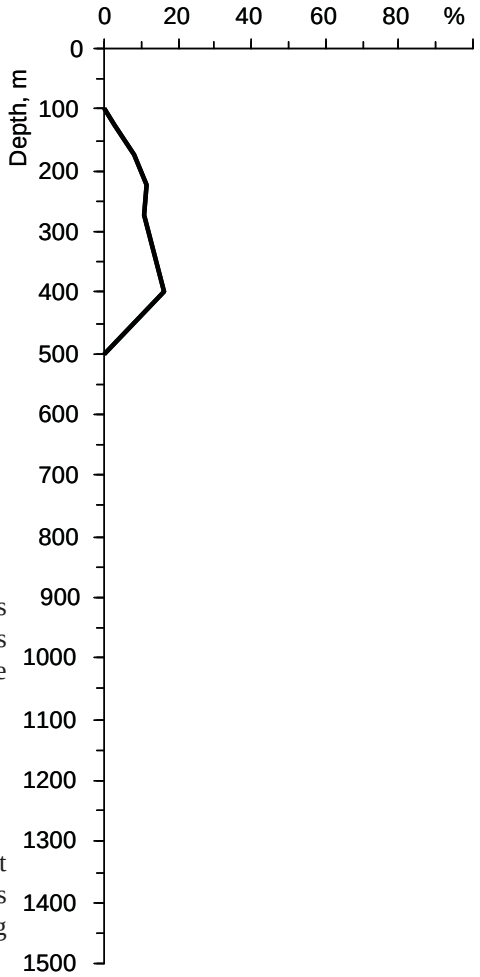


Fig. 50. Occurrence of ***Paraconchoecia allotherium*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

Paraconchoecia echinata (Müller, 1906)

(Pict. 21; Pls 42, 43; Figs 51, 52)

Conchoecia echinata Müller, 1906a, p. 61, pl. X figs 14–24.
Conchoecia echinata: Poulsen, 1969a, p. 147; Deevey, 1970, p. 806, figs 3, 4.
Paraconchoecia echinata: Poulsen, 1973, p. 21, fig. 6; Angel, 1999, pp. 821, 834, fig. 9.97.
"*Paraconchoecia*" *echinata*: Martens, 1979, p. 340, fig. 20 (male).

Pict. 21. ***Paraconchoecia echinata***. **A** – female; **B** – male.

Females. L = 1.89–2.06 mm (1.96 ± 0.05 mm; N = 16); H/L = 41.0 ± 1.6% (N = 12).

Plate 42**A**–**N**. Carapace (**A**–**C**): elongated, tapered anteriorly, with pointed spine on PDC of right valve; posterior margin almost straight and forms almost right angles with dorsal and ventral margins; LAG and RAG in usual places; small LGGs present and open on posterior margins of both valves just below PDCs. FO (**D**): large (in comparison with An1), projected well beyond terminal segment of An1; capitulum with very short hairs mainly on ventral surface. An1 (**D**): small and weak, with short dorsal seta on 2nd segment; e-seta has a row of long hairs on proximal half of its anterior side, and this row shorter than in females of *P. allotherium* and *P. oblonga* (Pls 40D, 46D, 48D); below sensory setae e-seta bears short spines mainly on posterior side. An2 (**E**, **F**): inner surface of Prp bare; Enp1 with a-seta as long as about half of b-seta, and b-seta thin and long. Lb (**G**): in dorsal projection tapers anteriorly; with rounded anterior edge. Md (**H**, **I**): Bsp has epipodial appendage with seta bearing tiny spines; Enp1 has non-plumose dorsal seta and 4 ventral setae (2 of them far shorter than 2 others). Mx (**J**): Bsp with single seta reaching over half of Enp1; Exp1 with 6 setae on anterior side (all setae non-plumose), 3 setae on posterior, and group of spines near distal edge; Enp2 with long hairs on its disto-anterior surface. P5 (**K**): Cxp1 covered with long hairs; Cxp3 with 6 setae in ventral group; Bsp with 6 setae in proximal ventral group (one of them plumose) and 3 setae in distal ventral group. P6 (**L**): Cxp1–2 covered with long hairs; Bsp with 5 long plumose ventral setae, plumose dorso-lateral seta and dorsal seta reaching almost half Enp1. P7 (**M**): longer terminal seta with double row of tiny spines proximally. CF (**N**): with powerful 1st to 4th claws; remaining 4 claws considerably shorter and weaker; unpaired dorsal seta absent.

Males. L = 1.65–1.79 mm (1.73 ± 0.05 mm; N = 14); H/L = 41.5 ± 1.1% (N = 13).

Plate 43**A**–**R**. Carapace (**A**–**C**): similar to female, but slightly less elongated, with straight posterior margin and without LGGs; MGGs present. FO (**D**): capitulum with round end, slightly curved, covered with short hairs proximally. An1 (**D**–**F**): a-seta relatively short, not reaching proximal edge of 2nd segment; e-seta with comb consisting of 17–18 pairs of long finger-like teeth directed proximally and 2 pairs of spines directed distally just below comb; b-seta has a single small process on its surface a quarter of way down its length, and opposite distal part of e-comb a short double series of rather large, closely set, finger-like spines, which are larger in the middle of series; the number of these spines different in each of rows and in

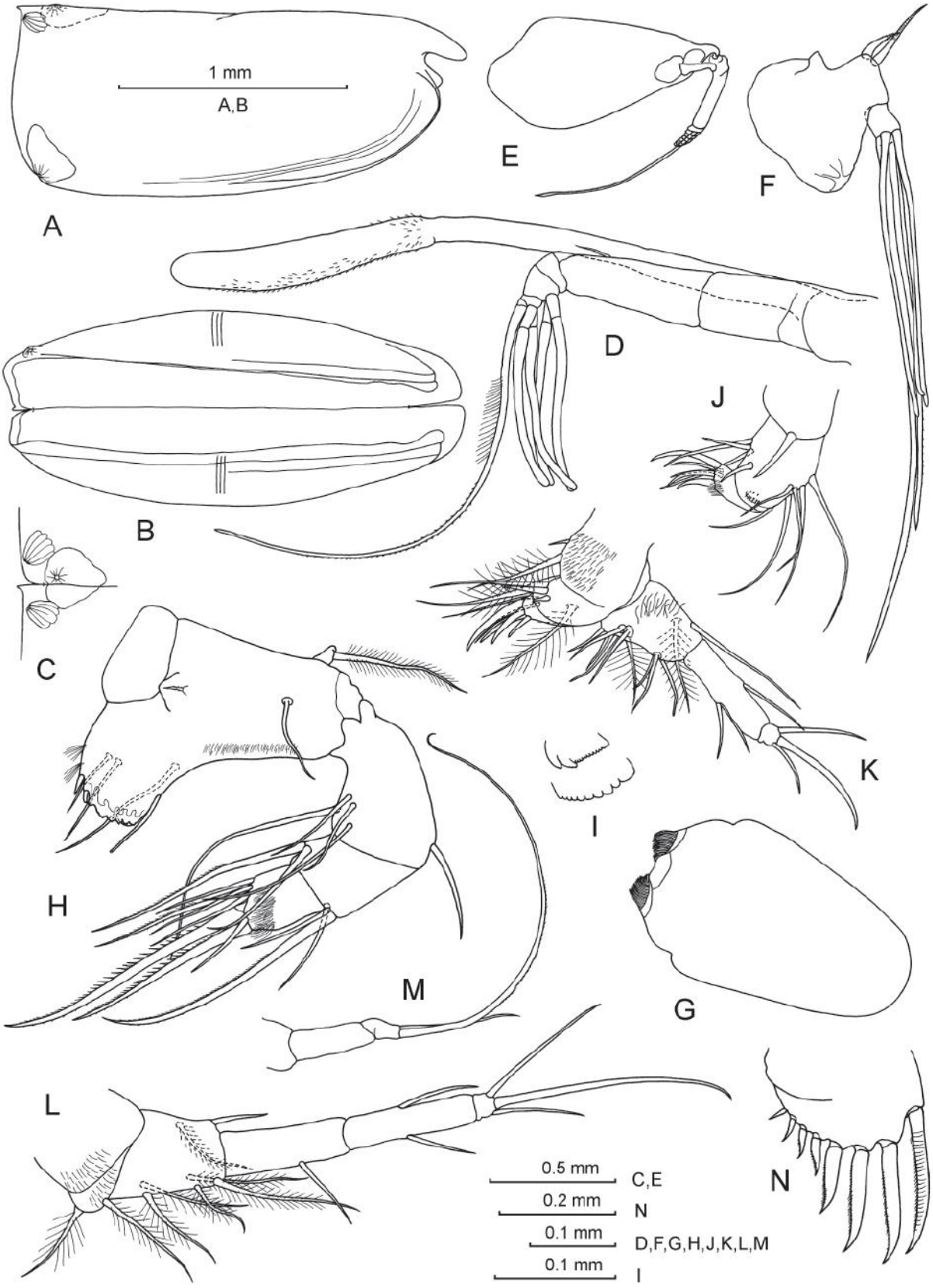


Plate 42. ***Paraconchoecia echinata***, female. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: PDCs. **D** – FO and An1. An2: **E** – Prp and Exp; **F** – Enp. **G** – Lb. Md: **H** – Bsp, Exp and Enp; **I** – coxal endite: toothed edge and distal tooth-list. **J** – Mx. **K** – P5. **L** – P6. **M** – P7. **N** – CF.

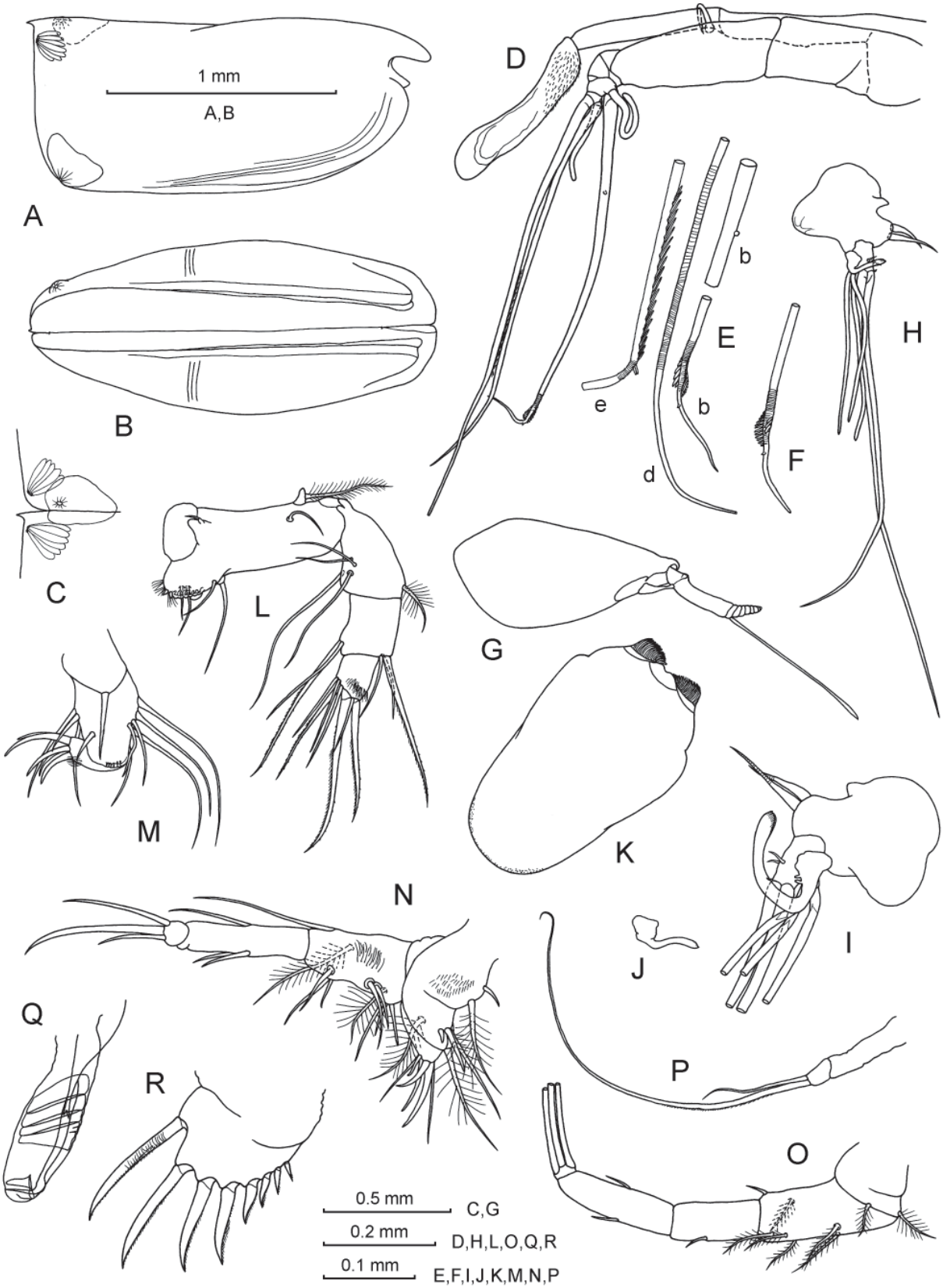


Plate 43. ***Paraconchoecia echinata***, male. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: PDCs. **D** – FO and An1. An1: **E** – armature of b-, d- and e- setae; **F** – other specimen: armature of e-seta. An2: **G** – Prp and Exp; **H**, **I** – left and right Enps; **J** – left hook appendage. **K** – Lb. **L** – Md without Cxp. **M** – Mx. **N** – P5. **O** – P6. **P** – P7. **Q** – CA. **R** – CF.

different specimens, and can be from 3 to 12; slightly distally from series of spines b-seta bears a triangular, short, pointed spine; d-seta bare. An2 (**G**–**J**): inner surface of Prp bare; a- and b-setae on Enp1 slender and long; c- and d- setae short; e-seta present; h-, i- and j- setae bare and have narrow shafts; right hook appendage large, strongly curved, with 2 finger-like processes on inner side of base; left appendage far smaller, with distal part bent up; both appendages have rounded tips with very small papillae. Lb (**K**), Mx (**M**), P5 (**N**), P7 (**P**), CF (**R**): similar to those in female. Md (**L**): Bsp more elongated than in female; Enp1 with plumose dorsal seta; all ventral setae on Enp1 non-plumose. P6 (**O**): all setae on Cxp, Bsp and Enp1–2 shorter than in female; ventral terminal seta on Enp3 thinner and has no long hairs (cut off in the drawing). CA (**Q**): rather short, with widened mid-part and rounded end; has 4 muscle bands.

Distribution. *Paraconchoecia echinata* is recorded from all oceans, mostly from the tropical latitudes; predominantly shallow mesopelagic species inhabiting subthermocline waters between 100–300 m (Angel et al., 2008). In the Arabian Sea Region, *P. echinata* was found mainly in the south-western part of the investigated area (Fig. 51), in 7% of tows. Maximum abundances were recorded at depths 100–300 m (Fig. 52).

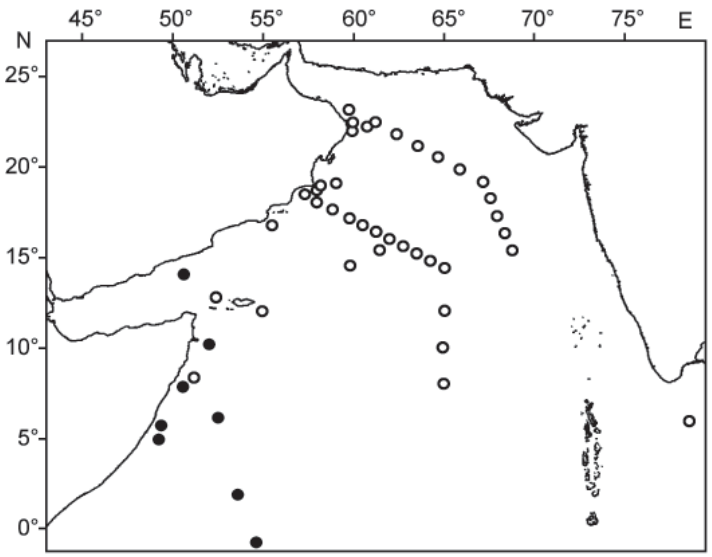


Fig. 51. Occurrence of ***Paraconchoecia echinata*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

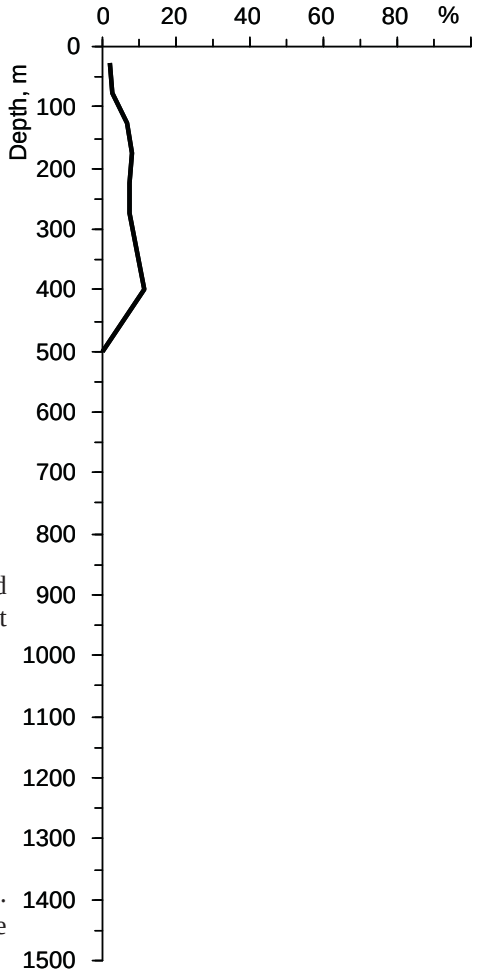


Fig. 52. Occurrence of ***Paraconchoecia echinata*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

Paraconchoecia inermis Claus, 1890

(Pict. 22; Pls 44, 45; Figs 53, 54)

For synonymy before 1906, see Müller, 1906a.
Conchoecia inermis: Müller, 1906a, p. 62, pl. IX figs 26–28, pl. X figs 4–7, pl. XI fig. 25; Poulsen, 1969a, p. 148; Deevey & Brooks, 1980, p. 81, fig. 19.
Paraconchoecia inermis: Poulsen, 1973, p. 20, fig. 5; Angel, 1999, pp. 821, 833, fig. 9.99.

Pict. 22. ***Paraconchoecia inermis***. Male.

Females. L = 1.96–2.15 mm (2.07 ± 0.08 mm); H/L = 38.6 ± 1.6%; N = 4.

Plate 44**A**–**L**. Carapace (**A**, **B**): elongated; ventral and dorsal margins almost parallel; posterior margin straight and forms almost right angles with dorsal and ventral margins; both PDCs broadly rounded; RAG in usual place; LAG opens on posterior margin just below carapace fusion. FO (**C**): capitulum long and narrow, slightly widened distally, bent downwards, covered with short hairs mostly on ventral surface and on dorsal one proximally. An1 (**C**): with very long, bare dorsal seta which is as long as 1st and 2nd segments together; e-seta has long outstanding hairs on proximal half of its anterior side and short spines distally; posterior side of e-seta with hairs decreasing in size distally. An2 (**D**, **E**): medial bulge on Prp weak and bare; a- and b-setae on Enp1 rather long, but slender and bare; g-seta well flattened distally and bears marginal spinules. Lb (**F**): in dorsal projection strongly tapered anteriorly; with hairs laterally; anterior edge well rounded. Md (**G**): Bsp elongated, with short lateral seta; its epipodial appendage bears rather long seta; Enp1 has non-plumose dorsal seta and 4 ventral setae (2 of them are short). Mx (**H**): Bsp with single seta reaching over the half of Enp1; Enp1 with 6 setae on anterior side (all setae non-plumose), 3 setae on posterior, 1 lateral seta and group of more than 15 small spines near distal edge. P5 (**I**): Cxp1 covered with long hairs; Cxp2 furnished with short spines; Cxp3 with 6 setae in ventral group; Bsp has 6 setae in proximal ventral group (one of them plumose) and 3 setae in distal ventral group. P6 (**J**): Cxp1–2 covered with long hairs; all setae typical for Conchoeciini present. P7 (**K**): terminal segment with tiny spines distally; spines on terminal setae invisible. CF (**L**): 8th claw distinctly slenderer than others; unpaired dorsal seta absent.

Males. L = 1.87–2.03 mm; H/L = 38.9 ± 0.7%; N = 2.

Plate 45**A**–**S**. Carapace (**A**–**C**): similar to that in female; MGGs present. FO (**D**): capitulum bare, long, more than half of An1 shaft; its distal half slightly widened, the end rounded. An1 (**D**, **E**): a-seta reaches slightly over proximal edge of 2nd segment; c-seta long, about as long as 2nd segment; e-seta with comb of more than 80 pairs of long, thin, pointed, hair-like spines directed proximally, distal spines of comb slightly shorter than others; just distally of comb there are 5–7 pairs of fine spines directed distally; b-seta opposite distal part of e-comb has rather short double row of densely placed fine spines directed distally; d-seta with a few

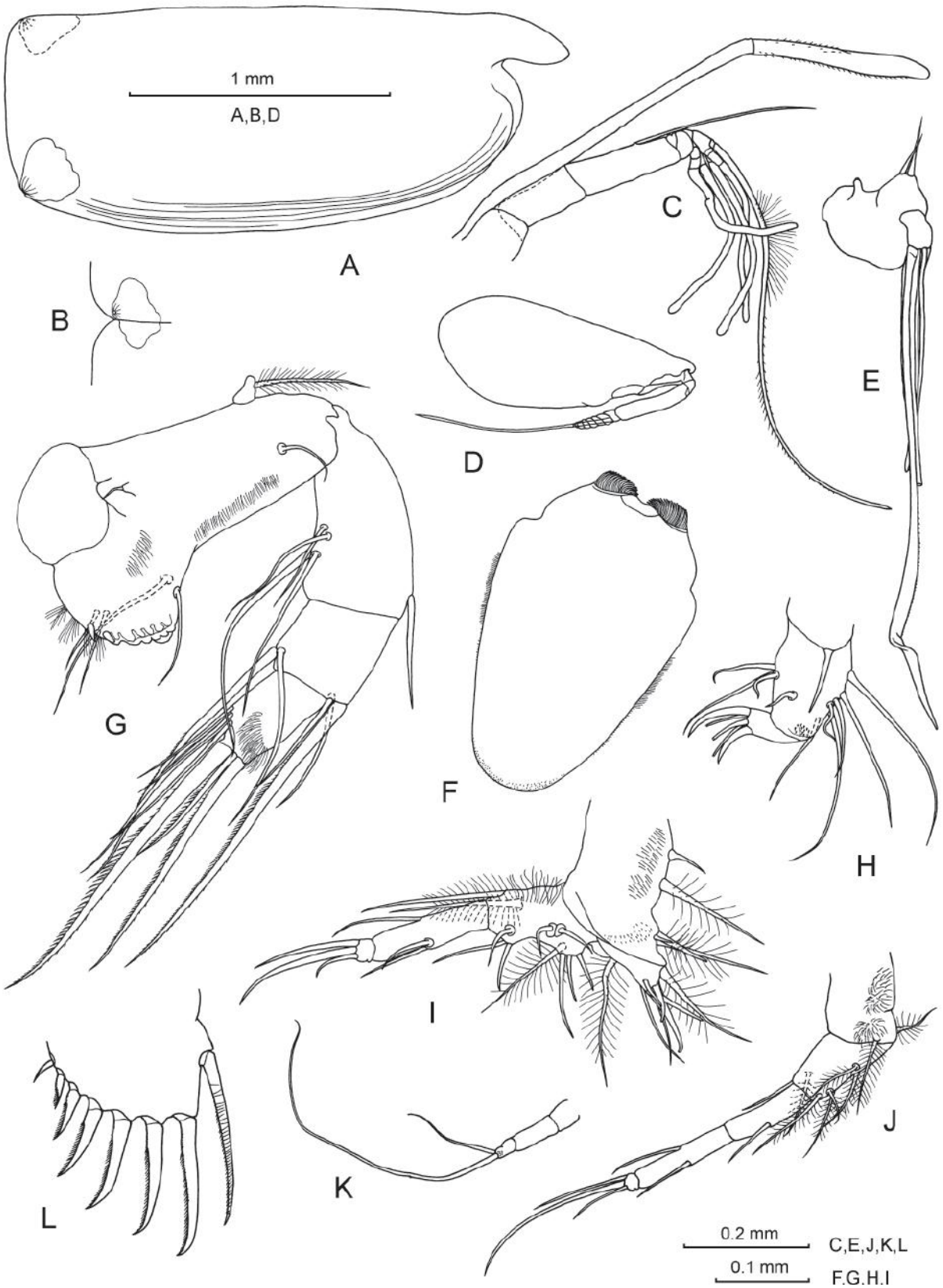


Plate 44. ***Paraconchoecia inermis***, female. Carapace: **A** – lateral; **B** – both valves outside: PDCs. **C** – FO and An1. An2: **D** – Prp and Exp; **E** – Enp. **F** – Lb. **G** – Md without Cxp. **H** – Mx. **I** – P5. **J** – P6. **K** – P7. **L** – CF.

Plate 45. ***Paraconchoecia inermis***, male. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside. **D** – FO and An1. **E** – An1: armature of b-, d- and e- setae. An2: **F** – Prp and Exp; **G, H** – right and left Enps; **I** – right hook appendage. **J** – Lb. Md: **K** – Bsp and Exp; **L** – Enp; **M** – coxal endite: toothed edge, distal and proximal tooth-lists. **N** – Mx. **O** – P5. **P** – P6. **Q** – P7. **R** – CA. **S** – CF.

tiny spines opposite e-comb. An2 (**F**–**I**): inner surface of Prp bare; a- and b- setae relatively long, slender and bare; c- and d- setae short; e-seta present; h-, i- and j- setae bare, thin, as long as third of g-seta; f- and g- setae flattened distally and have marginal spinules; right hook appendage long, narrow, strongly curved backward, its mid-part swollen; left appendage smaller, far less curved, almost straight distally; both appendages with rounded tips having tiny terminal papillae. Lb (**J**): in dorsal projection more elongated, and with shorter lateral hairs than in female. Md (**K**, **L**): Bsp more elongated than in female; Enp1 with plumose dorsal seta. Mx (**N**), P5 (**O**), P7 (**Q**), CF (**S**): similar to those in female. P6 (**P**): all setae on Cxp, Bsp and Enp1–2 shorter than in female, especially 3 distal ventral setae on Bsp; ventral terminal seta on Enp3 thinner, and has no long hairs (cut off in the drawing). CA (**R**): with widened mid-part; narrows towards end that is rounded; has 4 muscle bands.

Distribution. Species is recorded from all oceans mostly in the temperate and tropical latitudes; geographical range is from 50°N to 35°S, most records are from latitudes < 35°; mesopelagic species, most abundant at depths 400–800 m in temperate latitudes and 300–600 m in lower latitudes (Angel et al., 2008). In the investigated area, *P. inermis* was found only at two stations (Fig. 53), at depths up to 500 m (Fig. 54).

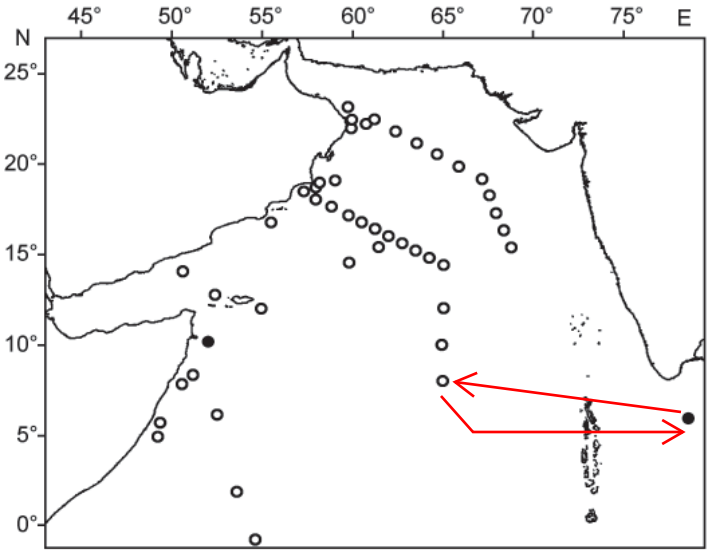


Fig. 53. Occurrence of ***Paraconchoecia inermis*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

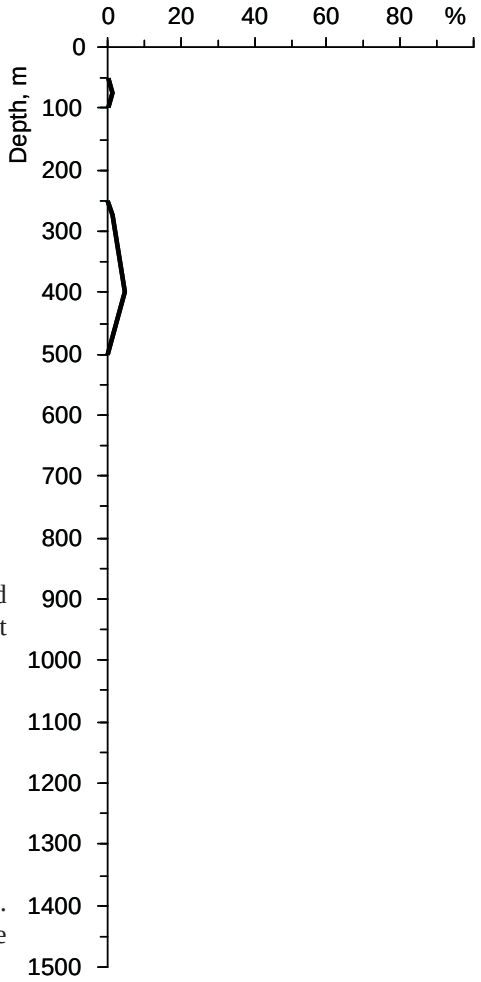
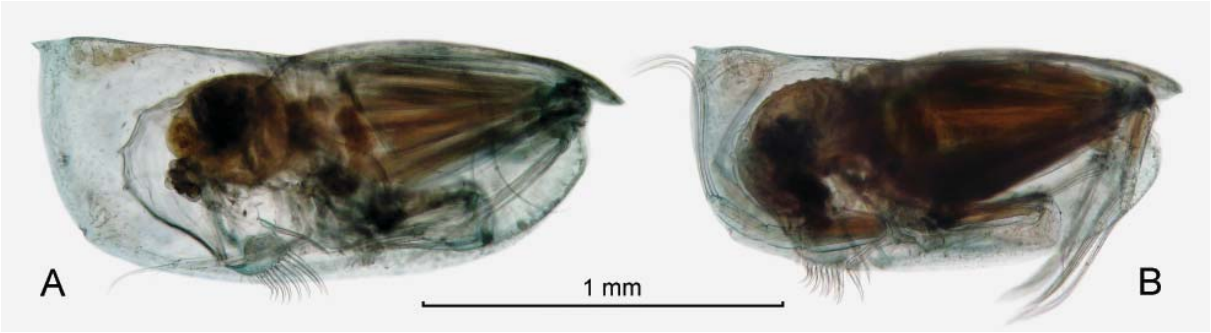


Fig. 54. Occurrence of ***Paraconchoecia inermis*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

Paraconchoecia oblonga Claus, 1890; form A

(Pict. 23; Pls 46, 47; Figs 55, 56)

For synonymy before 1906, see Müller, 1906a.
Conchoecia oblonga, Form a: Müller, 1906a, p. 58, pl. IX figs 11–12, 16–25; Skogsberg, 1920, p. 617, fig. CXVI; Deevey, 1968a, p. 33, figs 10, 11 (A and B forms); 1982, p. 479, figs 9e, 10a, e, f.
Paraconchoecia oblonga: Poulsen, 1973, p. 16, fig. 4; Martens, 1979, p. 337, fig. 16; Angel, 1999, pp. 821, 834, fig. 9.103.



Pict. 23. ***Paraconchoecia oblonga***, form A. **A** – female; **B** – male.

Females. L = 1.51–1.77 mm (1.63 ± 0.06 mm; N = 15); H/L = 39.7 ± 1.7% (N = 13).

Plate 46**A**–**N**. Carapace (**A**–**C**): elongated, slightly tapered anteriorly; has posterior dorsal spine on right valve; PVCs rounded; shoulder vaults well developed; LAG and RAG in usual places. FO (**D**): capitulum pointed, covered with very short hairs mainly on ventral surface and posteriorly on dorsal, slightly broader than in female of *P. allotherium* (Pl. 40D). An1 (**D**): has very long bare dorsal seta, which is longer than total length of 1st and 2nd segments; e-seta has long hairs (rarer and longer than in *P. allotherium* in Pl. 40D) on proximal half of its anterior side and short spines mainly on posterior side below sensory setae; these hairs decreasing distally. An2 (**E**, **F**): inner surface of Prp bare; a- and b- setae on Enp1 with almost invisible spines, a-seta only slightly longer than half of b-seta. Lb (**G**): in dorsal projection slightly tapered anteriorly. Md (**H**, **I**): epipodial appendage on Bsp with extremely small seta; Enp1 has non-plumose dorsal seta and 3 ventral setae; longest seta on ventral side of Enp2 and its armature visibly weaker than in *P. allotherium* (Pl. 40I). Mx (**J**): has a group of spines near distal edge of Enp1. P5 (**K**): Cxp1 covered with long hairs; Cxp3 with 6 setae in ventral group; Bsp has 6 setae in proximal ventral group (one of them plumose) and 3 setae in distal ventral group. P6 (**L**): both endites of Cxp covered with hairs. P7 (**M**): both terminal setae with a double row of tiny spines proxymally; shorter seta relatively longer than in *P. allotherium* (Pl. 40M). CF (**N**): 2nd to 5th claws visibly larger than 6–8th; 5th claw strongly curved and in addition has stronger secondary teeth than those on other claws; unpaired dorsal seta absent.

Males. L = 1.32–1.44 mm (1.38 ± 0.03 mm; N = 17); H/L = 43.5 ± 0.8% (N = 10).

Plate 47**A**–**T**. Carapace (**A**–**C**): ventral and dorsal margins almost parallel; in ventral view rostrum visibly broader than in female. FO (**D**, **E**): capitulum elongated, a little broader proximally, slightly bent upwards, with rounded tip; has a double row of spines ventrally and short spines on proximal half dorsally. An1 (**D**, **F**): e-seta comb consists of ~ 30 pairs of pointed spines directed proximally; distal spines of comb shorter than proximal; just distally of comb there are 3 pairs of fine spines directed distally; b-seta opposite distal part of e-comb has rather short double row of densely placed fine spines directed distally, and further a few rarely placed tiny spines; d-seta with a few tiny spines opposite e-comb. An2 (**G**–**J**): inner surface of Prp bare; b-seta almost two times longer than a-seta; e-seta extremely short; right hook appendage strongly curved, its middle part swollen; left appendage far smaller, bent

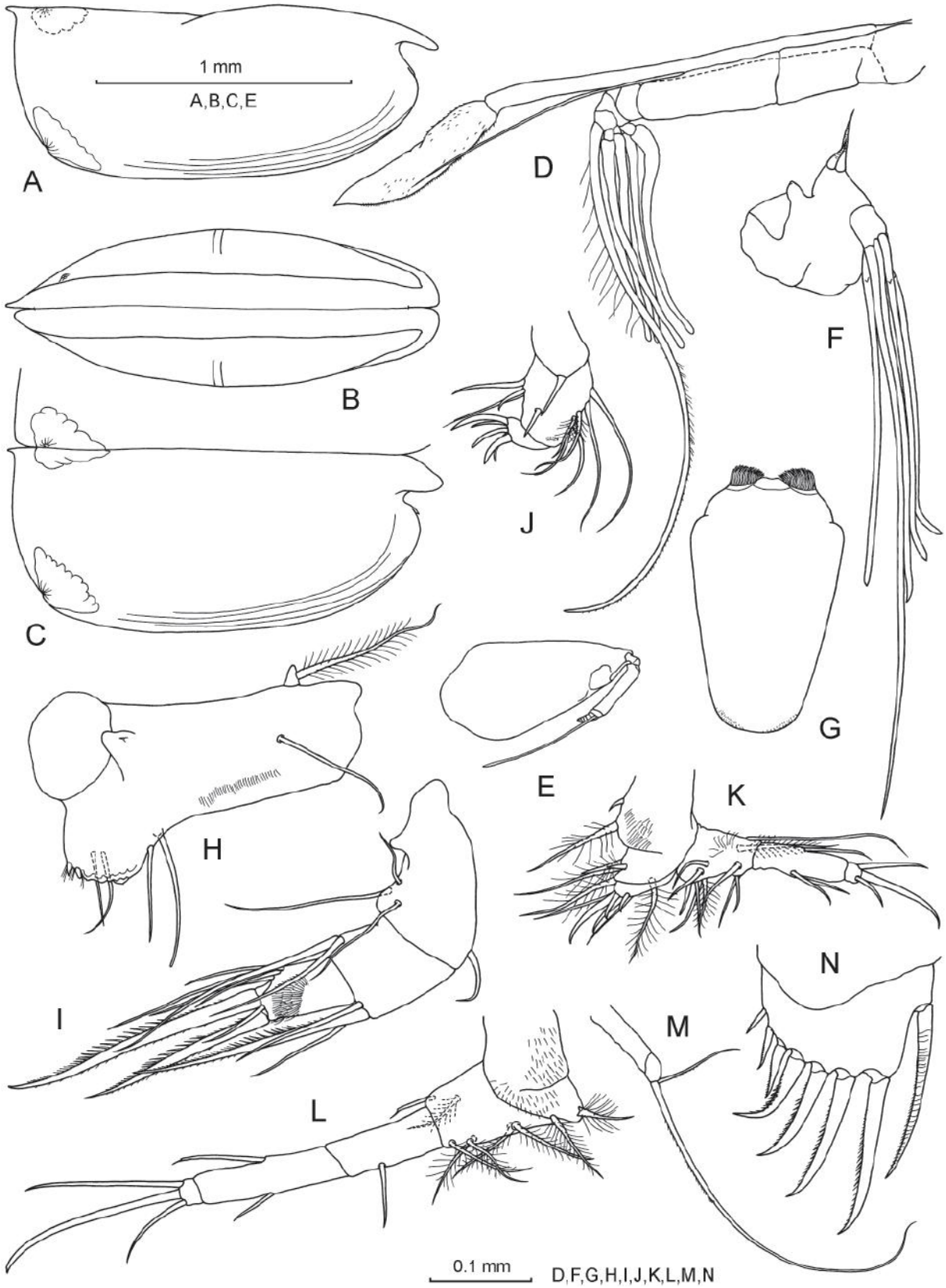


Plate 46. ***Paraconchoecia oblonga***, form A, female. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside. **D** – FO and An1. An2: **E** – Prp and Exp; **F** – Enp. **G** – Lb. Md: **H** – Bsp and Exp; **I** – Enp. **J** – Mx. **K** – P5. **L** – P6. **M** – P7. **N** – CF.

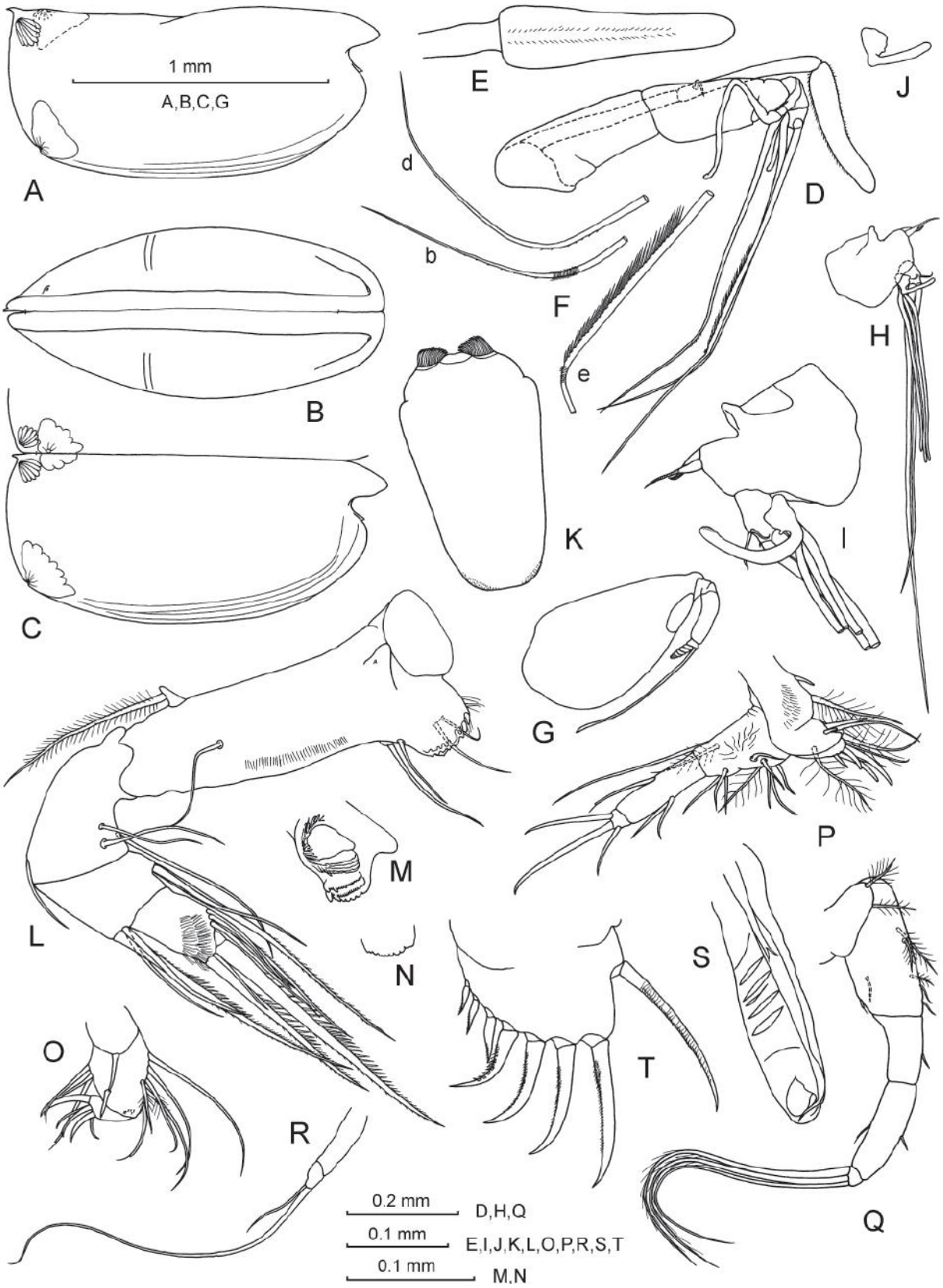


Plate 47. ***Paraconchoecia oblonga***, form A, male. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside. **D** – FO and An1. **E** – FO ventrally. **F** – An1: armature of b-, d- and e- setae. An2: **G** – Prp and Exp; **H, I** – left and right Enps; **J** – left hook appendage. **K** – Lb. Md: **L** – Bsp, Exp and Enp; **M** – coxal endite; **N** – coxal endite: toothed edge. **O** – Mx. **P** – P5. **Q** – P6. **R** – P7. **S** – CA. **T** – CF.

at almost right angle, its distal part almost straight and relatively longer and thinner than in male of *P. allotherium* (Pl. 41J), has bulge on the knee; both appendages with a small process on inner side of bases and with rounded tips. Lb (**K**), Mx (**O**), P5 (**P**), CF (**T**): similar to those in female. Md (**L–N**): Bsp more elongated than in female; Enp1 with non-plumose dorsal seta. P6 (**Q**): all setae on Bsp and Enp1–2 shorter than in female; 3 distal ventral setae on Bsp far shorter than in *P. allotherium* (Pl. 41O); ventral terminal seta on Enp3 thinner and has no long hairs. P7 (**R**): a double row of spines on longer terminal seta not visible. CA (**S**): elongated, straight, with obliquely truncated tip; has 5 muscle bands.

Remarks. According to Müller (1906a) there are two forms *P. oblonga*: form A which has RAG opening at the usual place near the PVC, and form B having this opening slightly anteriorly. Preliminary investigations on these two forms suggest they are not specifically different (Deevey, 1968a; Angel et al., 2008). However, the Arabian Sea specimens of *P. oblonga*, forms A and B, have some distinguishing characters in addition to the position of RAG (see Remarks, p.131), and need redescription as separate species.

Distribution. *Paraconchoecia oblonga* (including both forms A and B) is a common and widespread species, recorded from all oceans; mostly at the lower latitudes than 40°, epi- and mesopelagic species, most abundant at depths 100–300 m (Angel et al., 2008). There are some observations suggesting a shallower distribution of form A (Angel, 1969). In the Arabian Sea Region, adult specimens of *P. oblonga*, form A, were found mainly in the southern part of the investigated area (Fig. 55), in 7% of tows, and the main part of its population were recorded at shallower depths than that of form B (Figs 56, 58).

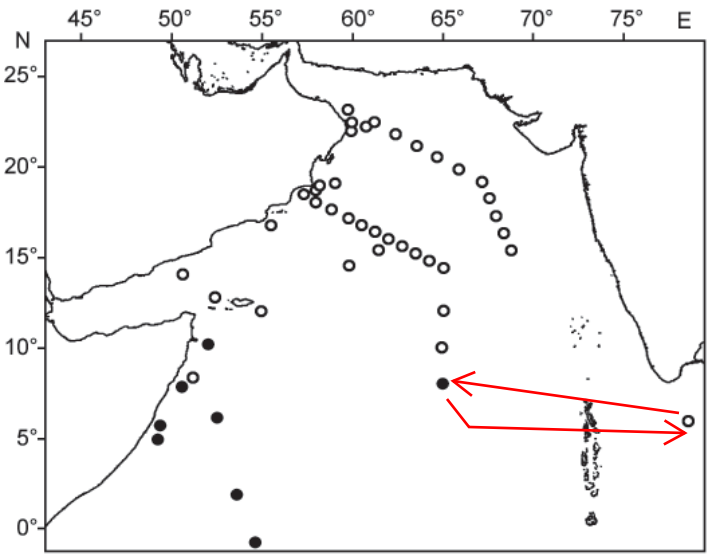


Fig. 55. Occurrence of ***Paraconchoecia oblonga***, form A, at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adult males and females of the species were found.

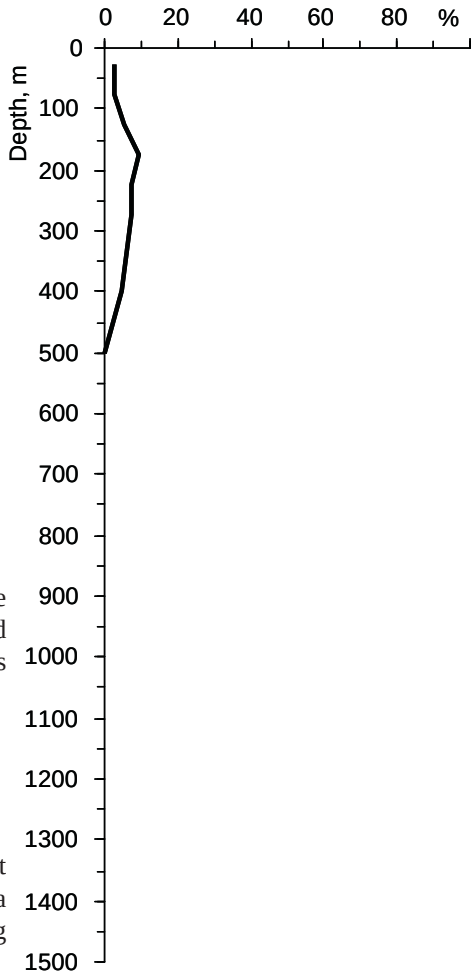


Fig. 56. Occurrence of ***Paraconchoecia oblonga***, form A, at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

Paraconchoecia oblonga Claus, 1890; form B

(Pict. 24; Pls 48, 49; Figs 57, 58)

Conchoecia oblonga, Form b: Müller, 1906a, p. 58, pl. IX figs 13, 24?; Deevey, 1968a, p. 33, figs 10, 11 (A, B forms).

Paraconchoecia oblonga: Poulsen, 1973, p. 16, fig. 4 (A, B forms).

Pict. 24. ***Paraconchoecia oblonga***, form B. **A** – female; **B** – male.

Females. L = 1.65–1.75 mm (1.69 ± 0.04 mm; N = 6); H/L = 40.0 ± 2.5% (N = 3).

Plate 48**A**–**M**. Carapace (**A**–**C**): elongated; posterior dorsal spine with small, slender, basal spine; LAG in usual place, RAG moved anteriorly. FO (**D**): capitulum relatively longer and narrower than in form A (Pl. 46D). An1 (**D**): has long dorsal seta furnished with fine spines; this seta shorter than total length of 1st and 2nd segments. An2 (**E**, **F**): b-seta on Enp1 relatively shorter than in form A (Pl. 46F). Lb (**G**): in dorsal projection with almost straight anterior edge. Md (**H**), Mx (**I**), P5–P7 (**J**–**L**): similar to those in form A. CF (**M**): 1st to 5th claws more powerful and relatively shorter than in form A (Pl. 46N).

Males. L = 1.42–1.51 mm (1.48 ± 0.03 mm; N = 8); H/L = 43.8 ± 0.9% (N = 6).

Plate 49**A**–**Q**. Carapace (**A**–**C**): basal spine near PDC invisible (or missing); LAG in usual place, RAG moved anteriorly; MGGs present. FO (**D**): capitulum similar to that in male of form A (Pl. 47D, E). An1 (**D**, **E**): similar to that in form A, but just distally of e-comb, furnished with 1–2 pairs of spines, witch are larger than in form A (Pl. 47F). An2 (**F**–**I**): b-seta on Enp1 relatively shorter than in form A (Pl. 47H, I); left hook appendage has less developed bulge on the knee than in form A in Pl 47J. Lb (**J**), Md (**K**), Mx (**L**), P5–P7 (**M**–**O**), CF (**Q**): similar to that in female. CA (**P**): similar to that in form A.

Remarks. Arabian Sea specimens of *P. oblonga*, form B, differ from those of form A generally by the following characters observed in both sexes: **a**) position of RAG somewhat anterior from PVC; **b**) the presence of small basal spine on PDC; **c**) relatively shorter b-seta on Enp1 of An2; **d**) almost straight anterior edge of dorsal projection of Lb; **e)** more powerful and shorter 1st to 5th claws on CF. Also, females of form B have the slenderer capitulum of FO, and the shorter, haired dorsal seta on An1. For comparison, see Pls 46A, C, F, G, N, D, 47A, C, I, K, T.

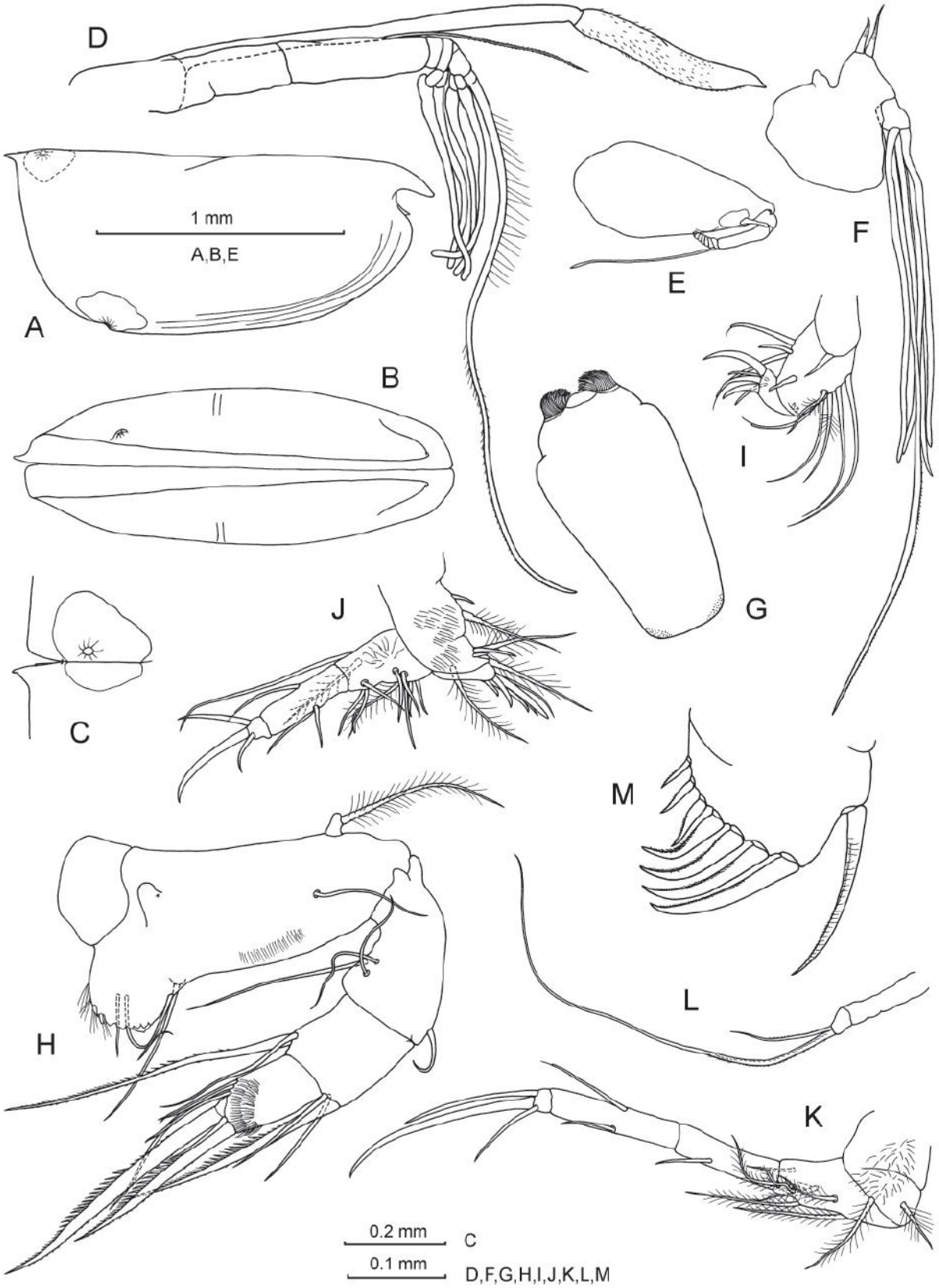


Plate 48. ***Paraconchoecia oblonga***, form B, female. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside. **D** – FO and An1. An2: **E** – Prp and Exp; **F** – Enp. **G** – Lb. **H** – Md without Cxp. **I** – Mx. **J** – P5. **K** – P6. **L** – P7. **M** – CF.

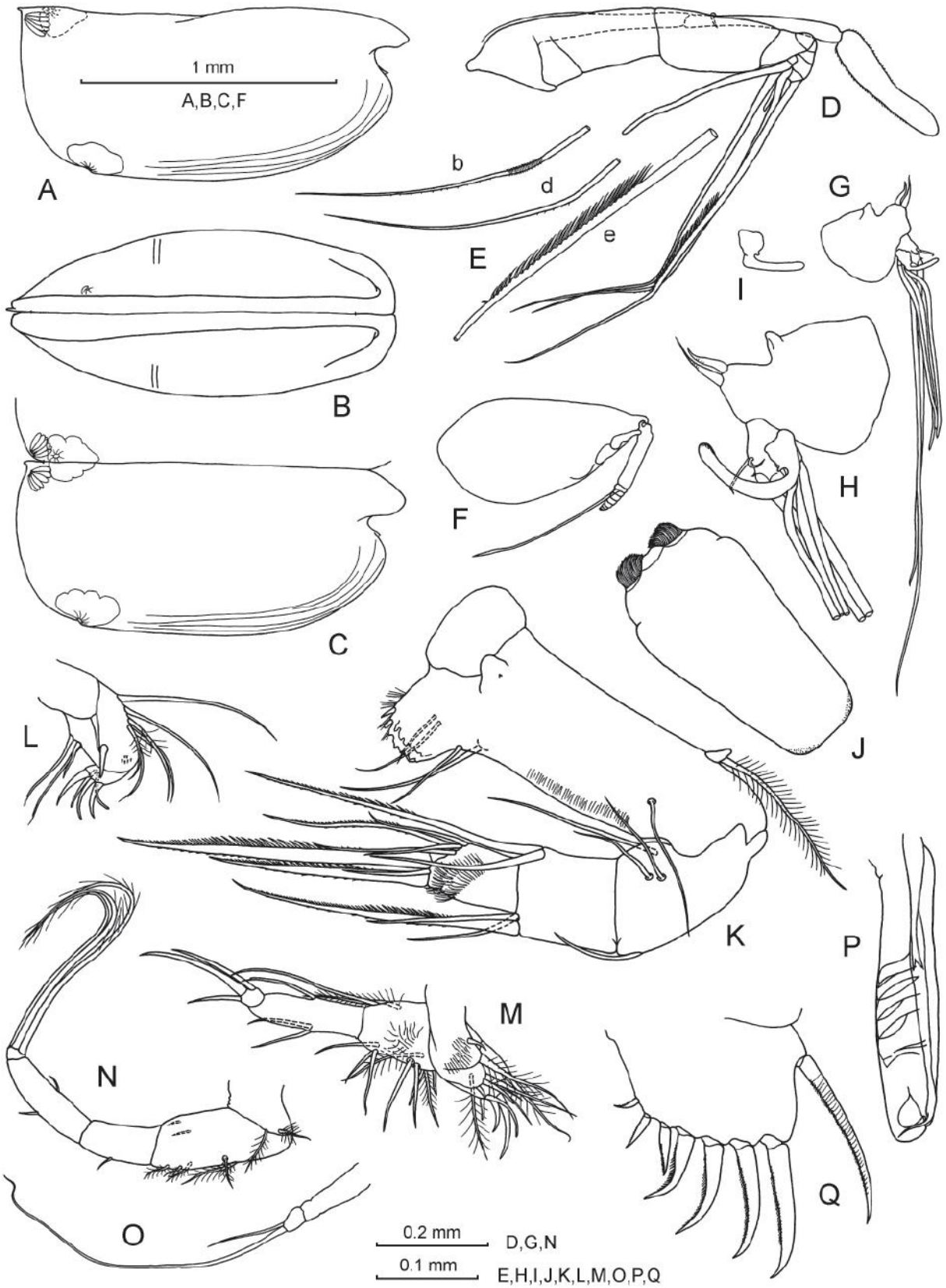


Plate 49. ***Paraconchoecia oblonga***, form B, male. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside. **D** – FO and An1. **E** – An1: armature of b-, d- and e- setae. An2: **F** – Prp and Exp; **G, H** – left and right Enps; **I** – left hook appendage. **J** – Lb. **K** – Md without Cxp. **L** – Mx. **M** – P5. **N** – P6. **O** – P7. **P** – CA. **Q** – CF.

Distribution. In the Arabian Sea Region, adult specimens of *P. oblonga*, form B, were found mainly in the south-western part of the investigated area (Fig. 57), in 4% of tows. They were recorded deeper than those of form B; the records from depths shallower than 100 m absent (Figs 58, 56).

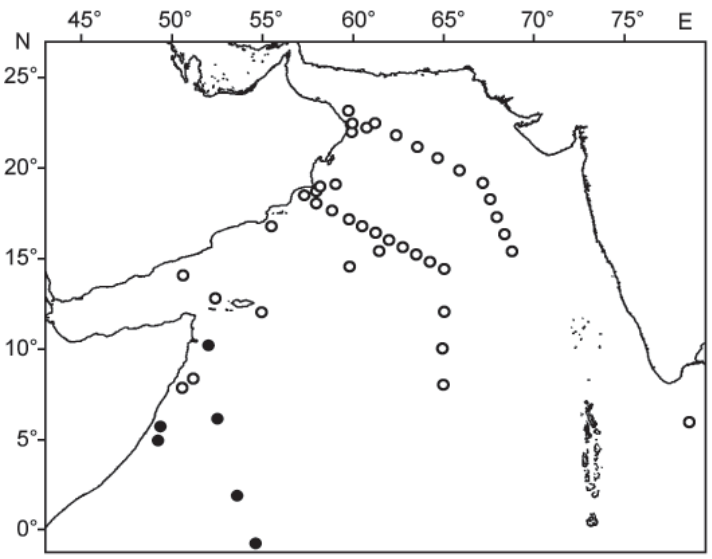


Fig. 57. Occurrence of ***Paraconchoecia oblonga***, form B, at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adult males and females of the species were found.

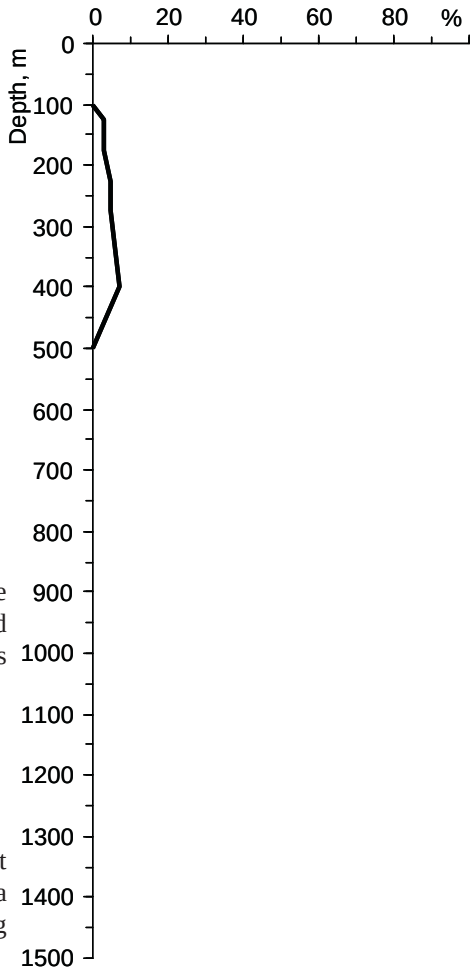


Fig. 58. Occurrence of ***Paraconchoecia oblonga***, form B, at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

Genus ***Paramollicia*** Poulsen, 1973

Genus *Paramollicia* has been proposed by Poulsen (1973) to separate out some species from Müller's (1906a) *mollis*-group. However, he wrote that "this is only quite provisionally" because separated species hardly form a natural group.

Main distinctive features of the genus are the following: **a**) carapace elongated; **b**) there are LGGs near PVCs just above RAG and opposite on left valve (in both sexes), and small LGGs near PDCs (only in female); **c**) female An1 with dorsal seta; **d**) male An1 with e-seta having rather numerous and densely placed paired teeth; **e**) CF with unpaired dorsal seta. (Poulsen, 1973).

A single species of genus *Paramollicia* has been found in the analyzed material (Table 3).

Paramollicia dichotoma (Müller, 1906)

(Pict. 25; Pls 50, 51; Figs 59, 60)

Conchoecia dichotoma Müller, 1906a, p. 111, pl. XXIV figs 23–29, pl. XXV fig. 1.
Conchoecia dichotoma: Deevey, 1968a, p. 104, fig. 55; Deevey & Brooks, 1980, p. 114, fig. 35 (male).
Paramollicia dichotoma: Poulsen, 1973, p. 173, fig. 89; Angel, 1999, p. 821, fig. 9.105.

Pict. 25. ***Paramollicia dichotoma***. **A** – female; **B** – male.

Females. L = 2.17–2.45 mm (2.30 ± 0.08 mm; N = 9); H/L = 48.1 ± 1.8% (N = 9).

Plate 50**A**–**P**. Carapace (**A**–**C**): tapered anteriorly; posterior and dorsal margins form angle slightly less than right; PDCs rounded but on left valve there is very small spine, sometimes almost invisible; PVCs strongly rounded; LAG in usual place, RAG somewhat moved dorsally along posterior margin; two LGGs present on each valve: small dorsal LGGs open below PDCs and large ventral LGGs on posterior margin above RAG and opposite on left valve. FO (**D**, **E**): capitulum thin and long, slightly S-shaped; with strong spines on ventral surface and on dorsal proximally, and with tiny spines on distal dorsal surface; tip pointed. An1 (**D**): with very long dorsal seta; 1st and 2nd segments partly covered with tiny spines; e-seta slightly flattened distally, with fine spines on posterior side; sensory setae (a–d) thickened proximally and evenly narrowed distally. An2 (**F**–**H**): Prp with medial bulge covered with hairs, and with tiny spines posteriorly; a- and b- setae on Enp1 with tiny spines; f- and g- setae flattened distally, especially g-seta. Lb (**I**): in dorsal projection with almost straight anterior edge. Md (**J**, **K**): epipodial seta present; Enp1 with non-plumose dorsal seta and 4 ventral setae (one of them plumose). Mx (**L**): Bsp with long single seta reaching over distal edge of Enp1; Enp1 has 4 strong spines distally. P5 (**M**): Csp1–2 covered with long hairs (longer hairs on Cxp1); Cxp3 with 6 setae in ventral group; Bsp with 7 setae in proximal ventral group and 3 in distal ventral group. P6 (**N**): Cxp1–2 with long hairs; dorsal seta on Bsp reaches distal edge of Enp1. P7 (**O**): terminal setae without spines. CF (**P**): with unpaired dorsal seta; lengths of all claws decreasing from 1st to 8th unevenly: 5th claw about half 4th and its distal part rather strongly curved, 6th–8th short and weak.

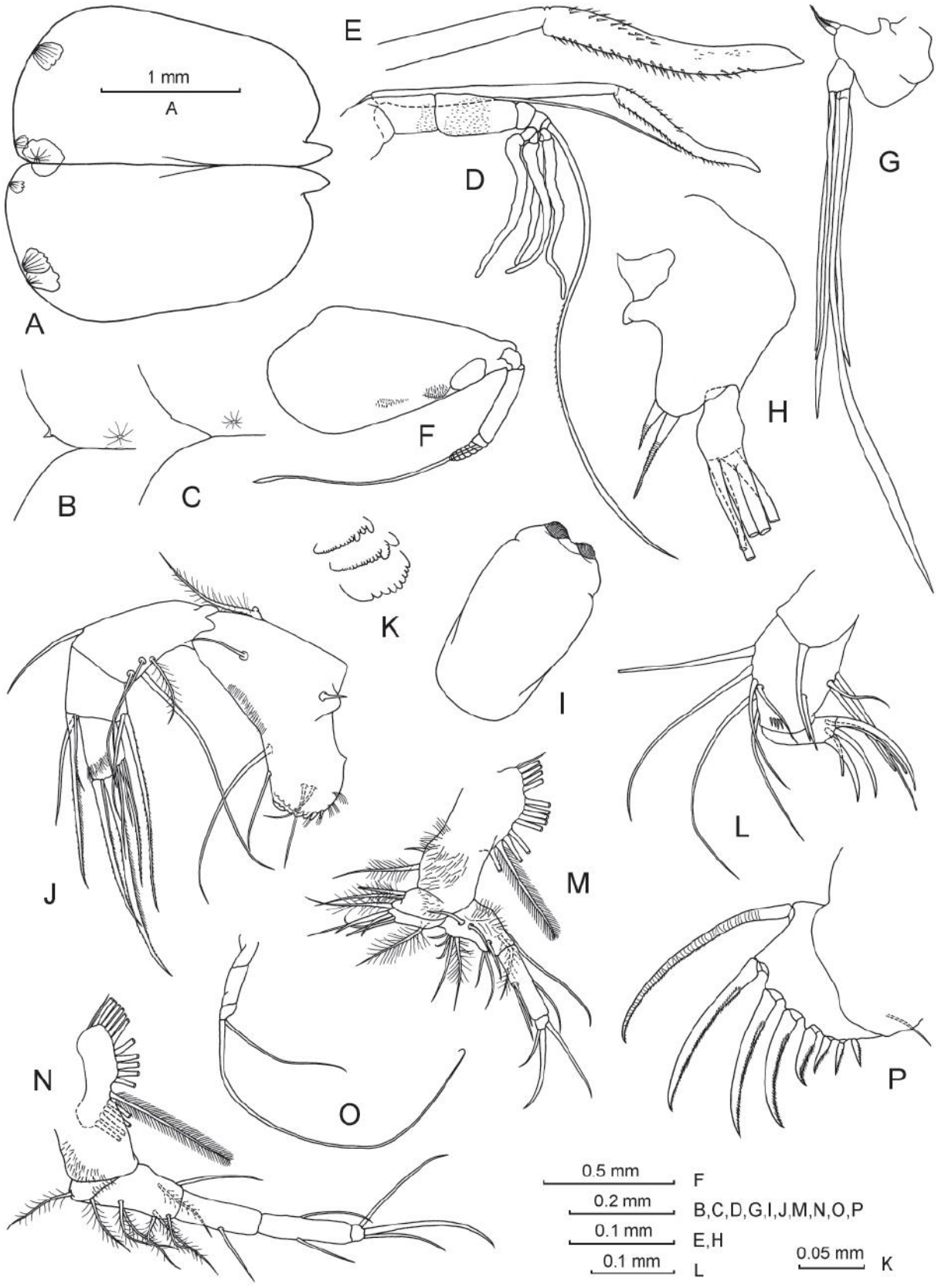


Plate 50. ***Paramollicia dichotoma***, female. Carapace: **A** – both valves outside; **B, C** – PDCs. **D** – FO and An1. **E** – FO: capitulum. An2: **F** – Prp and Exp; **G**, **H** – Enp. **I** – Lb. Md: **J** – Bsp, Enp and Exp; **K** – coxal endite: toothed edge, distal and proximal tooth-lists. **L** – Mx. **M** – P5. **N** – P6. **O** – P7. **P** – CF.

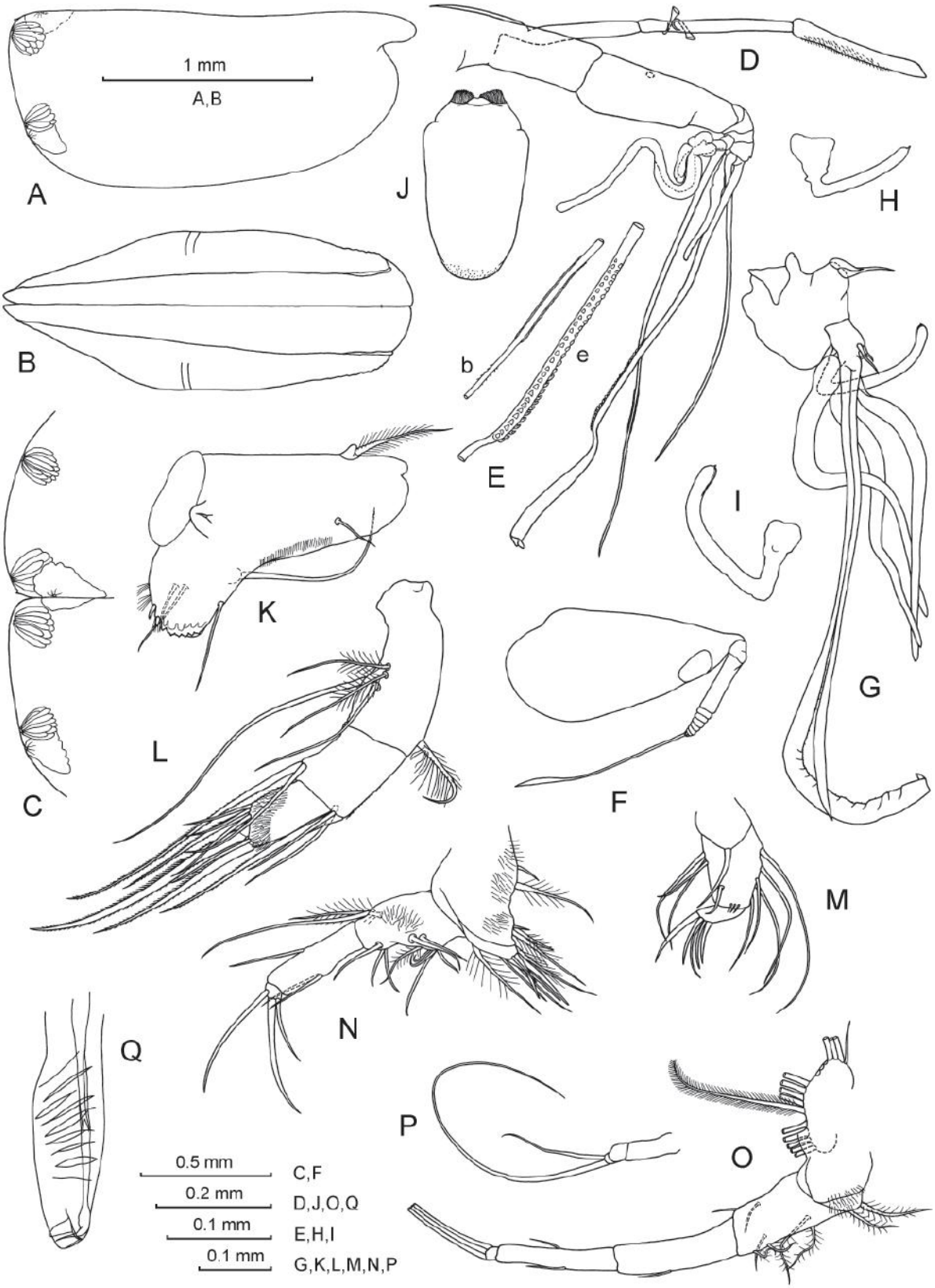


Plate 51. ***Paramollicia dichotoma***, male. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: posterior margins. **D** – FO and An1. **E** – An1: armature of b- and e- setae. An2: **F** – Prp and Exp; **G** – right Enp; **H**, **I** – left and right hook appendages. **J** – labrum. Md: **K** – Bsp and Exp; **L** – Enp. **M** – Mx. **N** – P5. **O** – P6. **P** – P7. **Q** – CA.

Males. L = 1.84–1.93 mm (1.91 ± 0.03 mm; N = 7); H/L = 41.3 ± 1.5% (N = 7).

Plate 51**A**–**Q**. Carapace (**A**–**C**): smaller than in female; $H_{post} \sim H_{ant}$; MGGs present; LAG, RAG and ventral LGGs as in female. FO (**D**): capitulum thin and long, its ventral surface with spines, tip pointed. An1 (**D**, **E**): e-seta has comb with ~ 30 paired short winged teeth directed proximally; distal part of e-seta strongly widened and flattened; a-seta has near its base "a double sac with one rounded end pointing proximally the other distally" (Poulsen, 1973, p. 173); b-seta with elongated oval pad opposite distal part of e-comb and a few pairs of fine spines distally from the pad; d-seta shorted, reaching distal end of e-comb. An2 (**F**–**I**): inner surface of Prp bare; a- and b- setae on Enp1 bare; e-seta rather long; h-, i- and j- setae bare, widened proximally and evenly narrowed towards tips; f- and g- setae strongly widened and flattened distally, especially g-seta; right hook appendage strongly bent, its two arms form acute angle; left appendage bent at almost right angle and further almost straight; both appendages terminate in tiny papillae. Lb (**J**): anterior edge rounded. Md (**K**, **L**): dorsal seta on Enp1 plumose; 2 of 4 ventral setae plumose. Mx (**M**), P5 (**N**), P7 (**P**), CF: similar to those in female. P6 (**O**): anterior surface of Cxp1–2 with long hairs; all setae on Bsp and Enp1–2 shorter than in female; 3 terminal setae on Enp3 almost equal and with long hairs. CA (**Q**): elongated, slightly widened in mid-part; with rounded end; has 7–8 muscle bands.

Distribution. *Paramollicia dichotoma* is widespread in the North Atlantic Ocean, but is seldom found in abundance. Müller (1906a) recorded it from near the Equator in both the Atlantic and Indian oceans; bathypelagic species found principally at depths of 1000–1500 m (Angel et al., 2008). In the investigated area, *P. dichotoma* was found only at five stations (Fig. 59), in 4% of tows, at depths 1000–1500 m (Fig. 60).

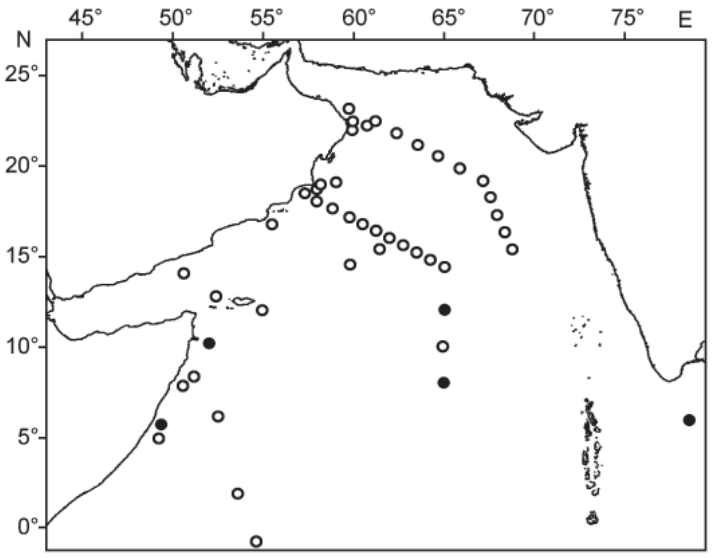


Fig. 59. Occurrence of ***Paramollicia dichotoma*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

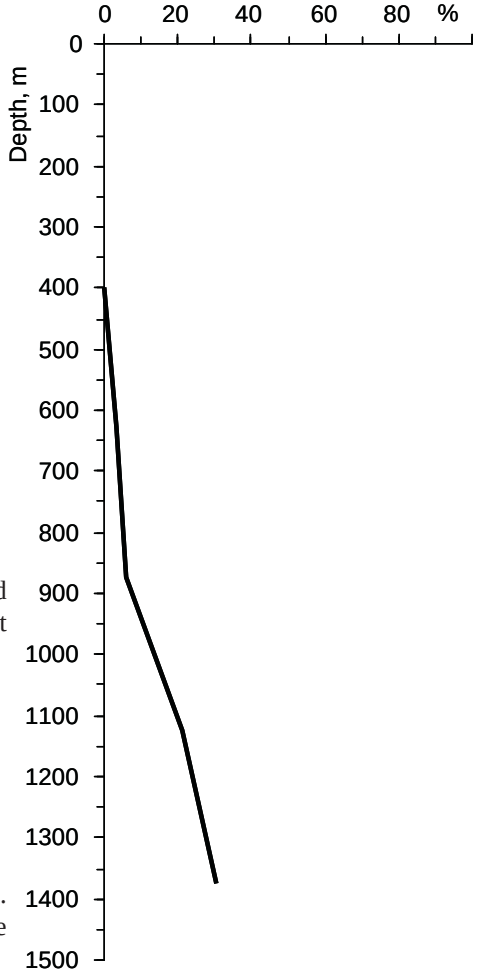


Fig. 60. Occurrence of ***Paramollicia dichotoma*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

Genus ***Platyconchoecia*** Poulsen, 1973

The genus is readily distinguished from all other genera of Conchoeciini by its large, elongate, leaf-like Exp of Md with no seta, and strongly expanded base of ventral seta on Cxp2 of P6 (Poulsen, 1973). In addition, CF has unique structure with 7th– 8th claws being weaker than other ones, and longer than shortest 6th claw.

P. prosadene (Müller, 1906) is a single species in this genus (Table 3, Appendix 2).

Platyconchoecia prosadene (Müller, 1906)

(Pict. 26; Pls 52, 53; Figs 61, 62)

Conchoecia prosadene Müller, 1906a, p. 120, pl. XXIII figs 1–7, 9.
Platyconchoecia prosadena: Poulsen, 1973, p. 109, fig. 54.
Platyconchoecia prosadene: Martens, 1979, p. 360, fig. 28.

Pict. 26. ***Platyconchoecia prosadene***. **A** – female; **B** – male.

Females. L = 2.36–2.78 mm (2.53 ± 0.14 mm; N = 12); H/L = 46.0 ± 1.1% (N = 8).

Plate 52**A**–**Q**. Carapace (**A**–**C**): elongated; tapered anteriorly; PDCs rounded, without spines; PVCs well rounded; LAG opens in usual place; RAG strongly moved forward along ventral margin; ventral LGGs present, and right one opens in place where usually RAG located. FO (**D**, **E**): capitulum covered with short spines, slightly bent down, distally narrowed to tip, which is slightly pointed, or somewhat extended and curved down. An1 (**D**): with long dorsal seta bearing fine spines; 4th segment has a few spines on dorsal surface; lengths of sensory setae about third of e-seta; e-seta furnished with scattered fine spines below sensory setae. An2 (**F**–**H**): Prp has medial bulge covered with tiny hairs; a- and b- setae on Enp2 with spines; h-, i- and j- setae have elongated shafts and bear rare spinules distally from shafts; f- and g- setae have a few spinules, too. Lb (**I**): elongated, strongly tapered anteriorly; anterior edge rounded. Md (**J**): epipodial seta on Bsp present; Exp has unique shape and size, and no seta; it is large, reaching over distal edge of Bsp, broad and flat, with 3 rounded processes proximally, its distal part slightly narrowed, tip pointed or rounded; Enp1 with dorsal seta and 4 ventral setae (all setae non-plumose). Mx (**M**): Bsp with single seta not reaching distal edge of Enp1; Enp1 elongated, has 6 setae on anterior, 3 setae on posterior sides, 1 seta laterally and about 10–13 spines near distal edge. P5 (**N**): Cxp1–2 partly covered with long hairs; Cxp3 with 6 setae in ventral group; Bsp has 6 setae in proximal ventral group and 3 in distal ventral group. P6 (**O, P**): Cxp1–2 partly covered with long hairs; Cxp2 bears plumose seta and a process, which is like strongly expanded base of ventral seta (Poulsen, 1973); no clear differentiation between this process and Cxp; its distal part narrowed, with a few long hairs, tip almost rounded and furnished with thin weak seta having short marginal spines (**P**); dorsal seta on Bsp short. P7 (**Q**): longer terminal setae with a double row of spines proximally. CF (as in male in Pl. 53 T): no unpaired dorsal seta; lengths of claws unevenly decrease from 1st to 8th: 5th claw about half of 4th and its distal part curved, 7th and 8th sharply differ from other claws being far weaker and slightly longer than shortest 6th claw.

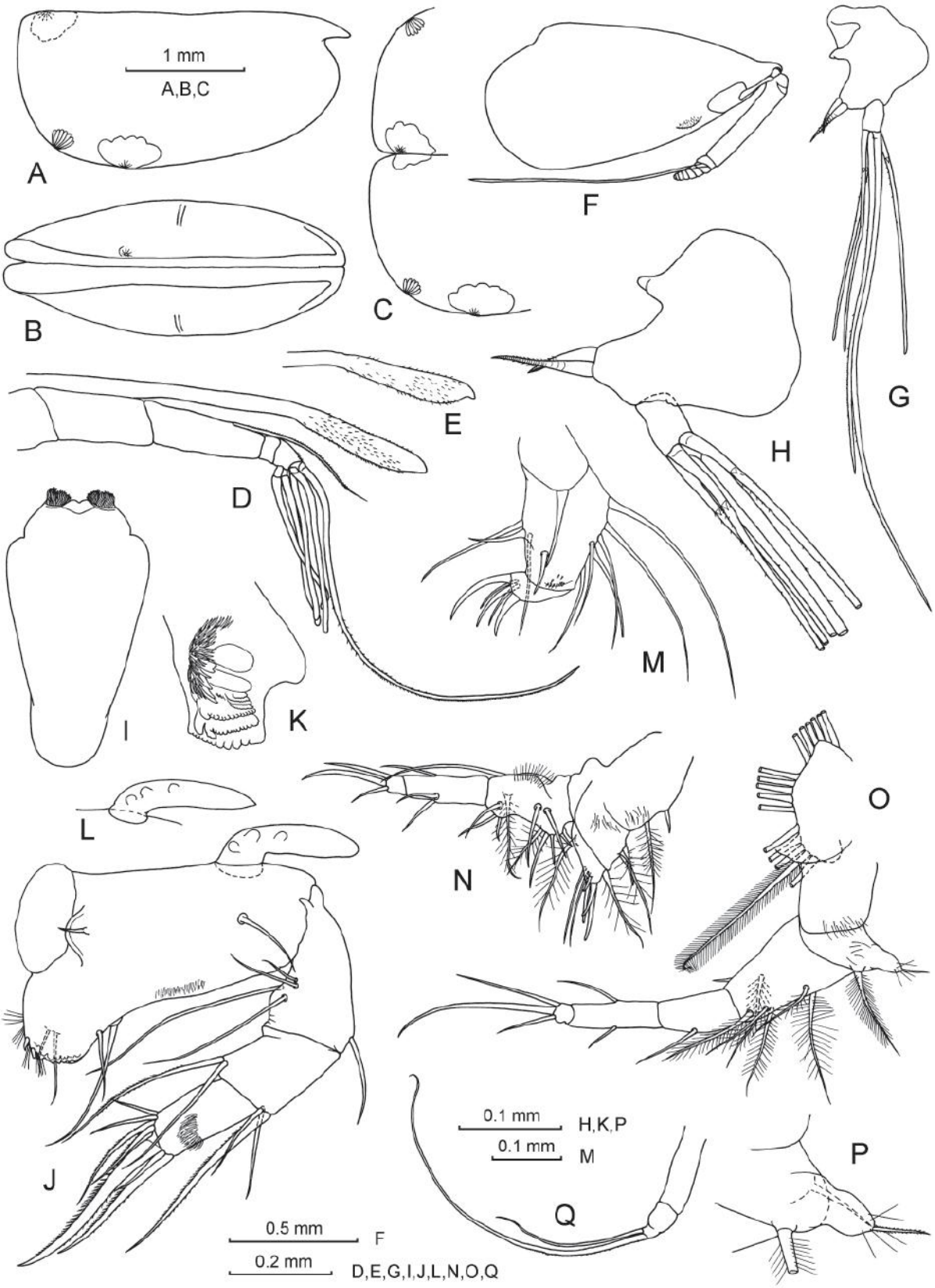


Plate 52. ***Platyconchoecia prosadene***, female. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: posterior part. **D** – FO and An1. **E** – other specimen: capitulum of FO. An2: **F** – Prp and Exp; **G**, **H** – Enp. **I** – Lb. Md: **J** – Bsp, Exp and Enp; **K** – coxal endite; **L** –other specimen: Exp. **M** – Mx. **N** – P5. **O** – P6. **P** – P6: part of Cxp2 (higher magnification). **Q** – P7.

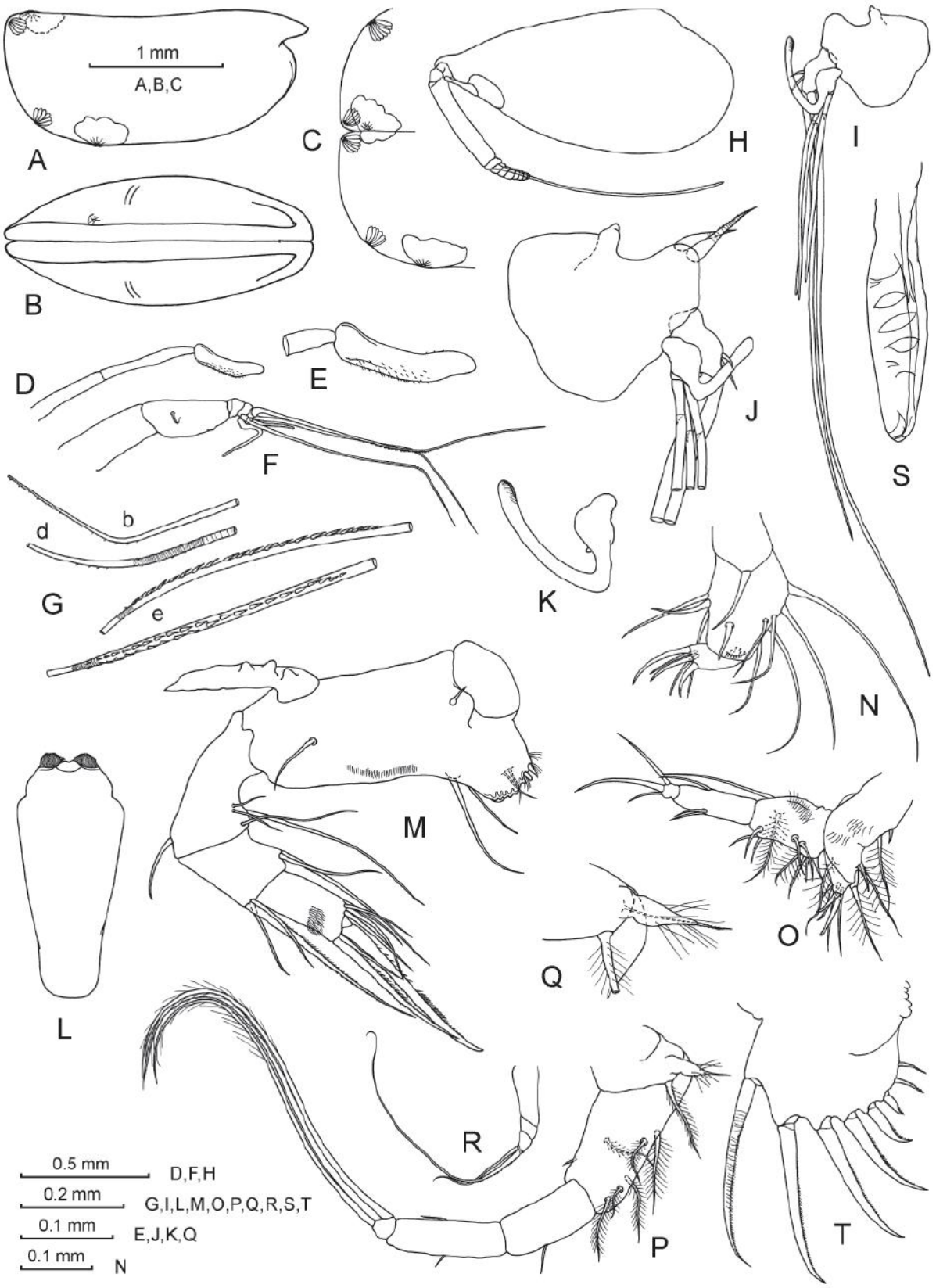


Plate 53. ***Platyconchoecia prosadene***, male. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: posterior part. **D**, **E** – FO. **F** – An1. **G** – An1: armature of b-, d- and e- setae. An2: **H** – Prp and Exp; **I**, **J** – right and left Enps; **K** – right hook appendage. **L** – Lb. **M** – Md: Bsp, Exp and Enp. **N** – Mx. **O** – P5. **P** – P6. **Q** – P6: part of Cxp2 (higher magnification). **R** – P7. **S** – CA. **T** – CF.

Males. L = 2.06–2.29 mm (2.18 ± 0.06 mm; N = 40); H/L = 44.7 ± 1.4% (N = 25).

Plate 53**A**–**T**. Carapace (**A**–**C**): smaller than in female; $H_{ant} \sim H_{post}$; MGGs present. FO (**D**, **E**): capitulum slightly S-shaped, covered with spines mainly on ventral surface; its tip rounded. An1 (**F**, **G**): e-seta has comb with ~ 30 spines directed proximally (8–9 paired spines distally), and just distally from the comb, 1 pair of spines directed distally; largest spines sit in the middle of comb; b- and d- setae with a few tiny spines opposite of e-comb. An2 (**H**–**K**): inner surface of Prp bare; a- and b- setae on Enp1 with tiny spines; e-seta present but extremely small and weak; right hook appendage has a small rounded process on inner side of base, strongly bent, its two arms forms acute angle; left appendage bent at almost right angle and further straight; tips of both appendages rounded. Lb (**L**): dorsal projection more elongated than in female. Md (**M**), Mx (**N**), P5 (**O**), P7 (**R**), CF (**T**): similar to those in female. P6 (**P**, **Q**): Cxp2 has process analogous to female's one but far more tapered distally, pointed and with more numerous long hairs (**Q**); setae on Bsp and Enp1–2 shorter than in female; 3 terminal setae on Enp3 almost equal and with long hairs. CA (**S**): elongated, slightly widened in mid-part; with rounded end; has 4–5 muscle bands.

Distribution. *Platyconchoecia prosadene* is rare species recorded earlier from the Indian (20°N to 4°S), Pacific and Atlantic (near Equator) Oceans (Müller, 1906a; Poulsen, 1973; George & Nair, 1980), and off Chilean coast between 30–35.5°S (Martens, 1979). In the investigated area (Fig. 61), *P. prosadene* was found in 29% of tows. Maximum abundances were recorded at depths 150–250 m (Fig. 62).

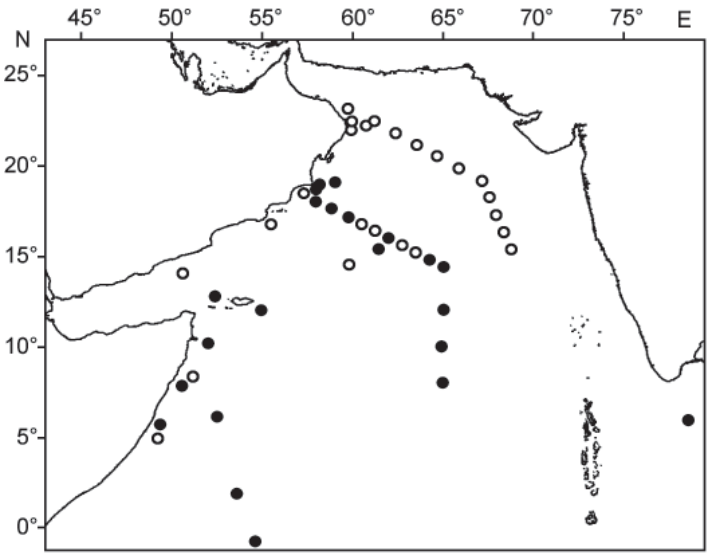


Fig. 61. Occurrence of ***Platyconchoecia prosadene*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

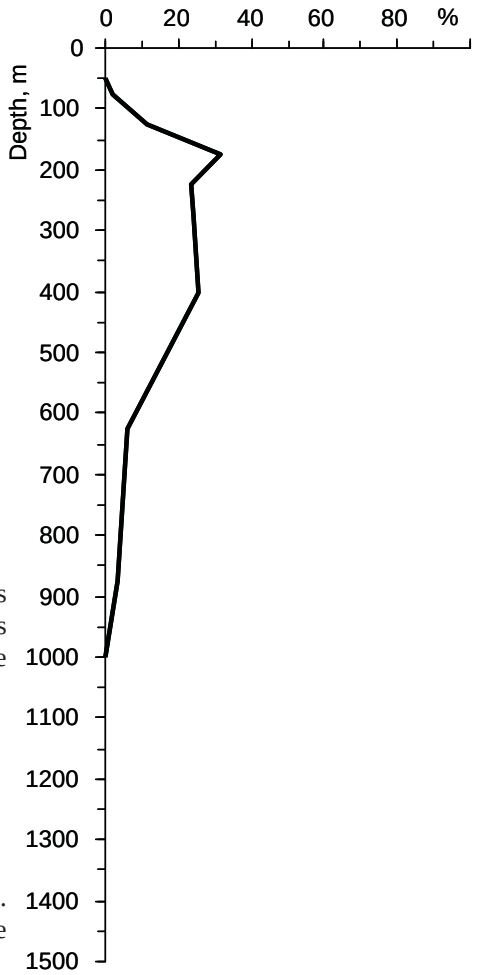


Fig. 62. Occurrence of ***Platyconchoecia prosadene*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

Genus ***Porroecia*** Martens, 1979

Females: Carapace elongated (mean H/L slightly < 50%); $H_{post} > H_{ant}$; posterior margin more or less convex; FO straight and pointed; Md Enp1 with two ventral setae.

Males: Carapace almost rectangular ($H_{post} \sim H_{ant}$); mean H/L slightly < 50%; An1 e-seta has a comb with distal paired spines and proximal unpaired ones; An2 b-seta with a few long hairs, basis of j-seta covered with short hairs; Md Enp1 with two ventral setae; P6 Cxp2 with one plumose seta and one difficultly visible rudimentary seta.

Three species of the genus *Porroecia* have been found in the analyzed material: *P. parthenoda* (Müller, 1906); *P. porrecta* (Claus, 1890) and *P. spinirostris* (Claus, 1874) (Table 3, Appendix 2). All these species are described here.

Key to the species of ***Porroecia***:

Adult females:

1 LAG moved forward on dorsal margin; capitulum of FO haired;
An1 with long dorsal seta; epipodial seta on Md Bsp relatively large;
P5 Bsp with 6 setae in proximal ventral group;
CF with unpaired dorsal seta (Pls 6B, 54A, C, G, J, M) ……..…….....….... ***P. parthenoda***

1a LAG closer to PDC; capitulum of FO without hairs;
An1 either with short dorsal seta or without it; epipodial seta on Md Bsp
extremely short; P5 Bsp with 5 setae in proximal ventral group;
CF without unpaired seta ……..……...……...…….…2

2 Usually L > 1.2 mm; mean H/L ~ 45%; $H_{post} / H_{ant} \sim 1.1$;
An1 with short dorsal seta; in dorsal view Lb with rounded anterior edge
(Pls 6B, 56A, C, F) ……..……..……..……..... ***P. porrecta***

2a Usually L < 1.2 mm; mean H/L ~ 50%; $H_{post} / H_{ant} \sim 1.2$;
An1 with no dorsal seta; in dorsal view Lb with almost straight anterior edge
(Pls 6B, 58A, C, F) ……...……..…….…….. ***P. spinirostris***

Adult males:

1 LAG moved forward on dorsal margin;
all spines on An1 e-seta directed proximally;
CF with unpaired dorsal seta (Pls 6B, 55A, C, E) ..... ***P. parthenoda***

1a LAG closer to PDC; An1 e-seta with distal paired spines of atypical shape
directed perpendicularly to seta axis and unpaired spines directed proximally;
CF without unpaired seta ……..……..……...…….....…..2

2 Usually L > 1.1 mm; mean H/L ~ 46%; carapace posterior edge almost straight;
An1 a-seta reaches boundary between 1st and 2nd segments;
An1 e-seta with ~ 10–11 paired spines and 25–27 unpaired;
in dorsal view Lb with rounded anterior edge
(Pls 6B, 57A, D, E, J) ….....…..... ***P. porrecta***

2a Usually L < 1.1 mm; mean H/L ~ 50%; carapace posterior edge slightly convex;
An1 a-seta visibly longer, reaches basis of 1st segment;
An1 e-seta bears ~ 8 paired spines and 18 unpaired;
in dorsal view Lb with almost straight anterior edge
(Pls 6B, 59A, C, D, E, I) ……....…….……...……...… ***P. spinirostris***

Porroecia parthenoda (Müller, 1906)

(Pict. 27; Pls 54, 55; Figs 63, 64)

Conchoecia parthenoda Müller, 1906a, p. 78, pl. XVI figs 24–29 (female).
Conchoecia parthenoda: Deevey, 1968a, p. 71, figs 33–35; 1970, p. 815, fig. 7 (male); Poulsen, 1969a, p. 153, fig. 10; Angel, 1969b, p. 56, figs 7–9.
Spinoecia parthenoda: Poulsen, 1973, p. 117, fig. 58.
Porroecia parthenoda: Angel, 1999, pp. 821, 833, fig. 9.109.

Pict. 27. ***Porroecia parthenoda***. **A** – female; **B** – male.

Females. L = 1.54–1.77 mm (1.65 ± 0.05 mm; N = 44); H/L = 49.9 ± 1.3% (N = 29).

Plate 54**A**–**M**. Carapace (**A**, **B**): in lateral view posterior half well rounded; LAG moved somewhat forward along dorsal margin (~ 10% of distance between PDC and rostrum tip) and developed into bump visible above margin; RAG in usual place. FO (**C**): straight; no clear division into shaft and capitulum; the latter with spines on whole surface proximally and only on ventral side distally; tip pointed. An1 (**C**): 2nd segment with long dorsal seta; e-seta has fine short hairs on anterior surface of its proximal half and on posterior surface distally. An2 (**D**, **E**): Prp with medial bulge covered with hairs; Enp1 with a- and b- setae having tiny spines; Enp2+3 with a few hairs on anterior surface; longest g-seta ~ 4 times longer than Enp1. Lb (**F**): in dorsal projection elongated and tapered anteriorly. Md (**G**, **H**): epipodial appendage on Bsp with rather large seta; Enp1 with 2 ventral setae and non-plumose dorsal seta. Mx (**I**): Bsp with single seta extending over distal edge of Enp1; Enp1 has 6 setae on anterior side, 3 on posterior, 1 laterally and a few small spines near distal edge. P5 (**J**): Cxp3 with 6 setae in ventral group; Bsp bears 1 plumose dorso-lateral seta, 1 long dorsal seta, 6 setae in proximal ventral group (one of them plumose) and 3 in distal one; epipodite with 4, 5 and 4 long plumose setae in each of three groups. P6 (**K**): Cxp2 with 2 plumose setae; Bsp has 5 ventral setae, 1 dorso-lateral and 1 dorsal; all setae except dorsal one plumose; dorsal seta rather short; epipodite with 5, 5 and 6 long plumose setae in each of three groups. P7 (**L**): longer of 2 terminal setae on end segment with a double series of tiny spines proximally. CF (**M**): unpaired dorsal seta present.

Males. L = 1.42–1.60 mm (1.50 ± 0.05 mm; N = 28); H/L = 48.8 ± 1.4% (N = 22).

Plate 55**A**–**M**. Carapace (**A**–**C**): almost rectangular, posterior margin slightly rounded; LAG moved somewhat forward (~ 12–13% of distance between PDC and rostrum tip); MGGs present. FO (**D**): capitulum with tiny spines mainly on ventral side; its distal third bare, tip rounded. An1 (**D**, **E**): armature of e-seta represented as a comb with 8–9 distal paired spines and proximal alternate ones, ending in a single row; total number of spines ~ 40, all spines directed proximally; b- and d- setae have a few tiny spines opposite distal part of comb. An2 (**F**–**H**): inner surface of Prp bare; a- and b- setae on Enp1 have tiny spines, and in addition b-seta has a few long hairs; Enp2 with extremely short e-seta; g-seta ~ 6 times longer than Enp1; j-seta has slightly swollen base and fine spines proximally; right hook appendage squared,

considerably larger than left. Lb (**I**) and also Mx, P5, P7 (**L**), CF: similar to those in female. Md (**J**): Bsp more elongated than in female; dorsal seta on Enp1 plumose. P6 (**K**): Cxp2 bears 1 plumose seta and 1 very thin rudimentary seta; setae on Bsp and Enp1–2 rudimentary; dorsolateral seta on Bsp missing; 3 terminal setae on Enp3 almost equal and with long hairs (cut off in the drawing). CA (**M**): with 6–7 muscle bands; end rounded.

Remarks. Arabian Sea specimens of *P. parthenoda* have less displaced LAG and more haired capitulum of female FO than in figures of Deevey (1968a: fig. 33a, 35a).

Distribution. *Porroecia parthenoda* is recorded from all oceans; generally at latitudes lower than 40º; shallow mesopelagic species, most abundant at depths 100–500 m (Angel et al., 2008). In the Arabian Sea Region, *P. parthenoda* was found mainly in the upwelling zones and the south of the investigated area (Fig. 63), in 23% of tows. Maximum abundances were recorded at depths 50–150 m (Fig. 64).

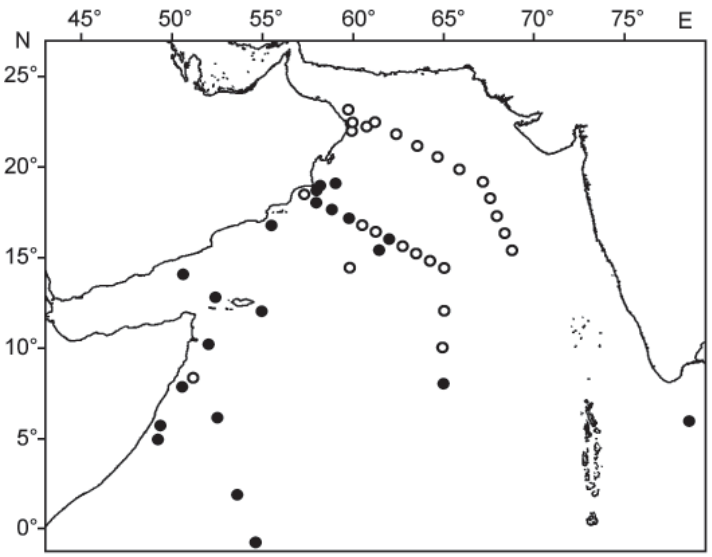


Fig. 63. Occurrence of ***Porroecia parthenoda*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

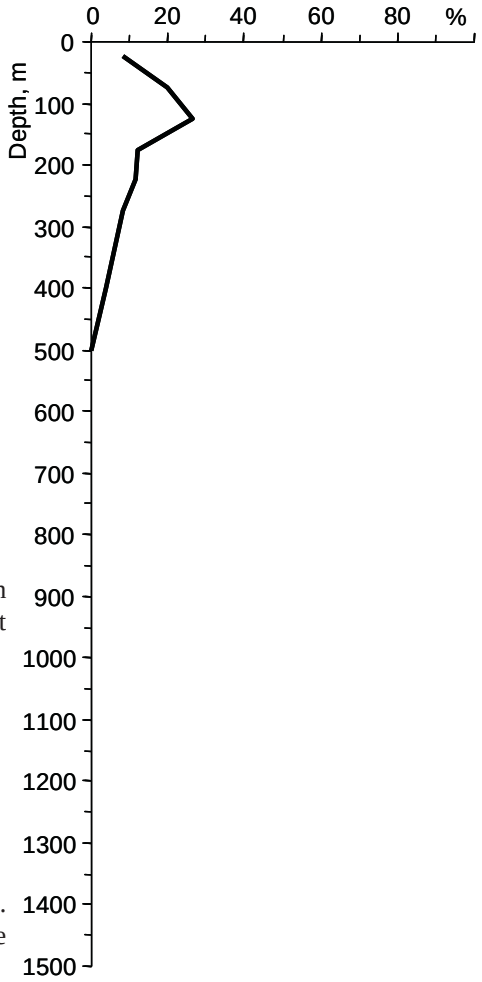


Fig. 64. Occurrence of ***Porroecia parthenoda*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

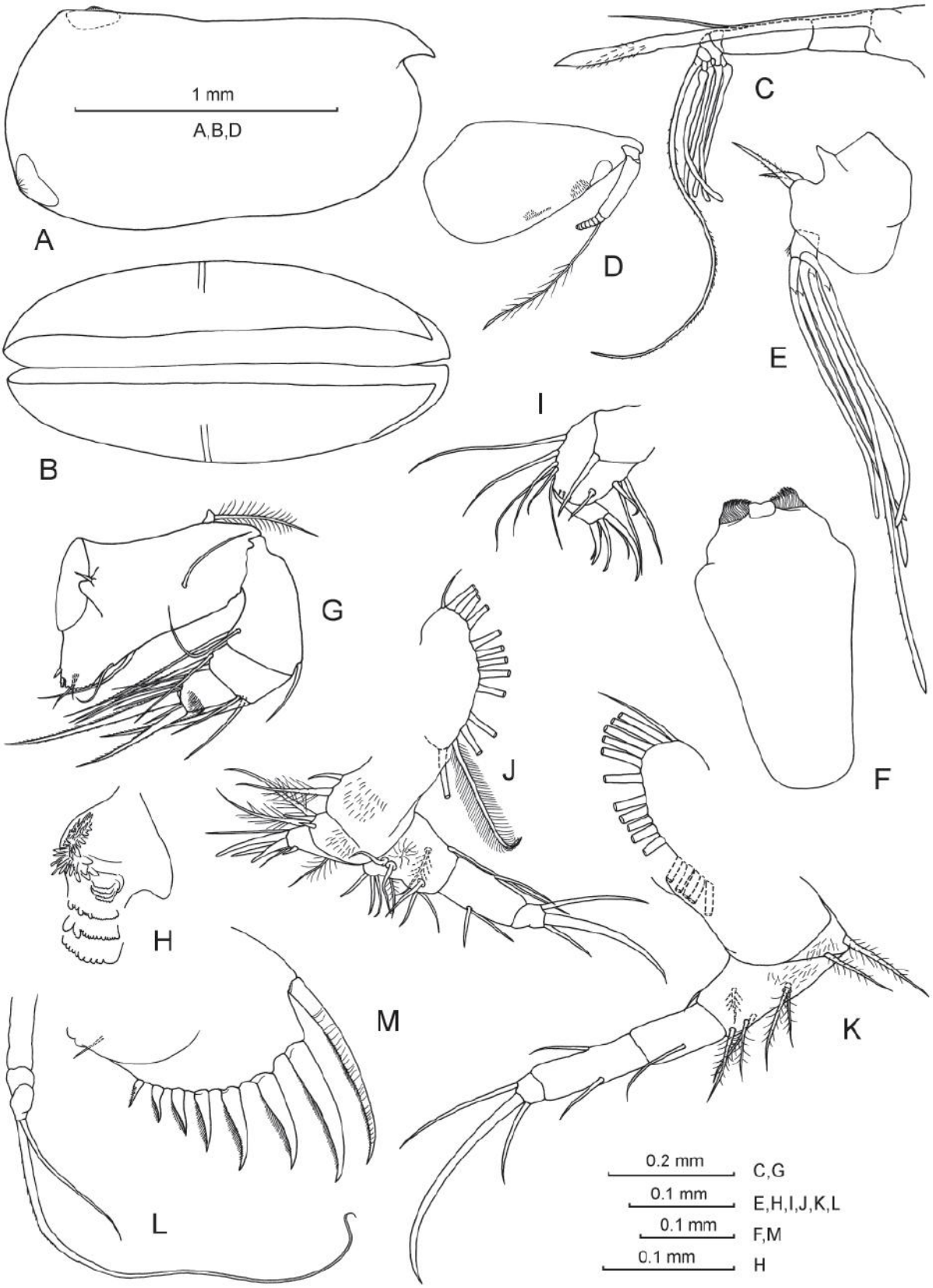


Plate 54. ***Porroecia parthenoda***, female. Carapace: **A** – lateral; **B** – ventral. **C** – FO and An1. An2: **D** – Prp and Exp; **E** – Enp. **F** – Lb. Md: **G** – Bsp, Enp and Exp; **H** – coxal endite: toothed edge, distal and proximal tooth-lists. **I** – Mx. **J** – P5. **K** – P6. **L** – P7. **M** – CF.

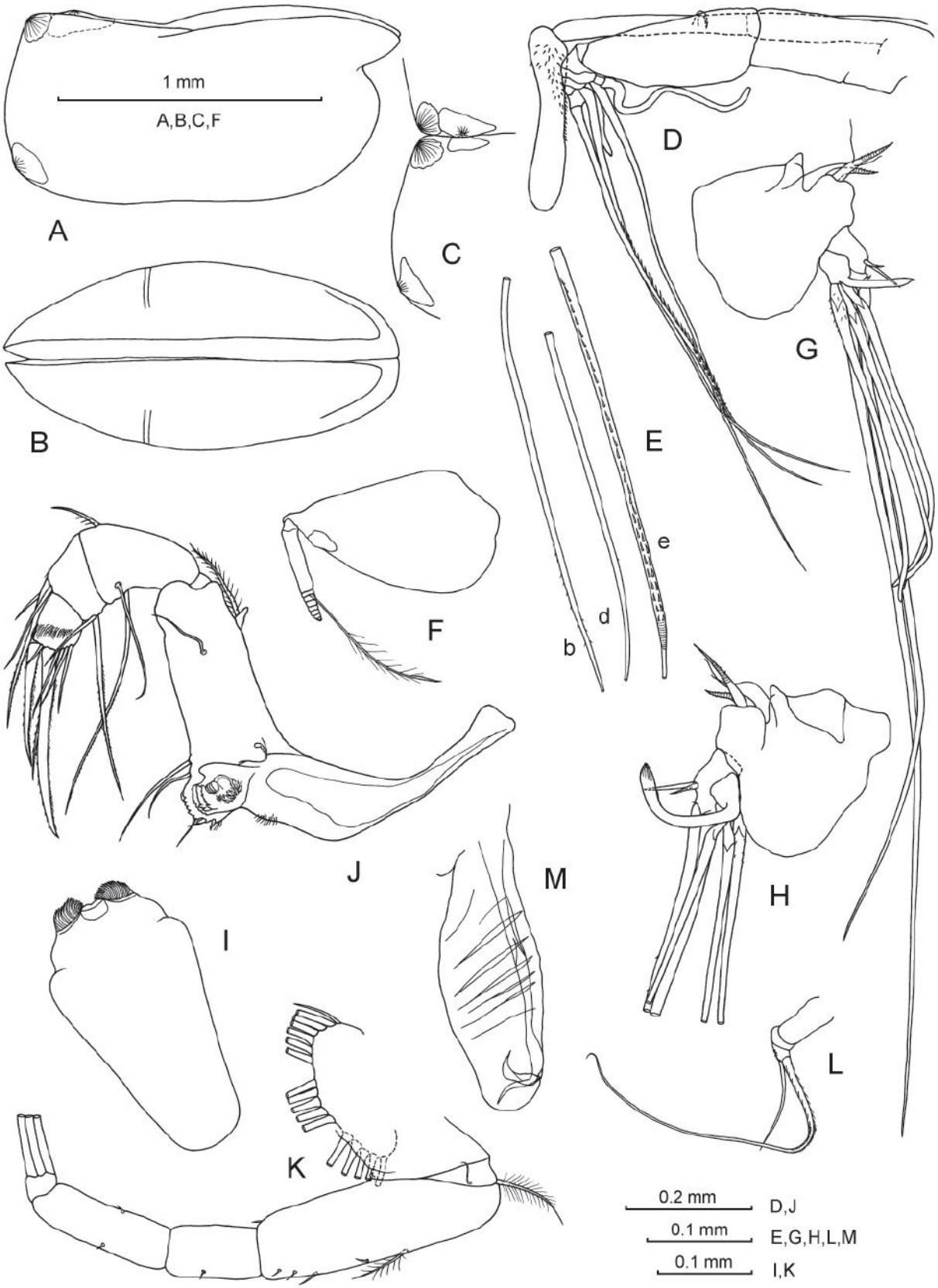


Plate 55. ***Porroecia parthenoda***, male. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: posterior margins. **D** – FO and An1. **E** – An1: armature of b-, d- and e- setae. An2: **F** – Prp and Exp; **G**, **H** – left and right Enps. **I** – Lb. **J** – Md. **K** – P6. **L** – P7. **M** – CA.

Porroecia porrecta (Claus, 1890)

(Pict. 28; Pls 56, 57; Figs 65, 66)

For synonymy before 1906, see Müller, 1906a.
Conchoecia spinirostris: Müller, 1906a, p. 104, pl. XXII figs 21–23, 25–28 (partly).
Conchoecia porrecta: Deevey, 1968a, p. 83, figs 40, 41; Angel, 1969a, p. 35, figs 1–3.
Conchoecia porrecta adriatica: Gooday & Angel, 1977, p. 139, figs 7–9.
Spinoecia porrecta: Poulsen, 1973, p. 114, fig. 56.
Porroecia porrecta pacifica: Martens, 1979, p. 329, fig. 13.
Porrecia porrecta: Angel, 1999, pp. 821, 836, fig. 9.110.

Pict. 28. ***Porroecia porrecta***. **A** – female; **B** – male.

Females. L = 1.23–1.51 mm (1.40 ± 0.05 mm; N = 492); H/L = 45.2 ± 1.6% (N = 63).

Plate 56**A**–**L**. Carapace (**A**, **B**): LAG closer to PDC than in *P. parthenoda* (Pl. 54A); H_{post}/H_{ant} ~ 1.1. FO (**C**): slim and undifferentiated; its surface bare; tip pointed. An1 (**C**): with small dorsal seta on 2nd segment; e-seta bears moderately long fine hairs mainly on anterior surface of its proximal half and short spines on posterior surface distally. An2 (**D**, **E**): Prp with medial bulge covered with hairs; surface of Enp2+3 bare, g-seta ~ 2.5 times longer than Enp1. Lb (**F**): in dorsal projection tapered anteriorly; with rounded anterior edge. Md (**G**, **H**): epipodial seta on Bsp hardly visible; Enp1 with 2 ventral setae and non-plumose dorsal seta. Mx (**I**): Enp1 has smaller spines near distal edge than in *P. parthenoda* (Pl. 54I). P5 (**J**): Cxp3 with 6 setae in ventral group; Bsp has 5 setae in proximal ventral group and 3 setae in distal. P6 (**K**): surfaces of Cxp1 and Bsp partly covered with hairs. P7 (**L**): longer of 2 terminal setae on end segment with double series of tiny spines proximally. CF (as in male in Pl. 57P): unpaired dorsal seta missing.

Males. L = 1.13–1.32 mm (1.23 ± 0.04 mm; N = 445); H/L = 46.1 ± 1.4% (N = 28).

Plate 57**A**–**P**. Carapace (**A**–**C**): posterior edge almost straight; MGGs present. FO (**D**): capitulum with spines on whole surface proximally and only on ventral side distally; distal spines tiny little. An1 (**D**, **E**): a-seta reaches boundary between 1st and 2nd segments; armature of e-seta consists of a comb with 8–10 paired spines directed at right angles to axis of seta, and 25–27 unpaired spines directed proximally; total number of spines 45–50; distal spines have unusual shape described in detail by Skogsberg (1920, p. 699). An2 (**F**–**I**): b-seta on Enp2 has a few long hairs; e-seta extremely short; g-seta ~ 4 times longer than Enp1; h-, i- and j- setae less than half of g-seta; j-seta with fine spines proximally. Lb (**J**) and also Mx (**L**), P5 (**M**), P7 (**O**), CF (**P**): similar to those in female. Md (**K**): Bsp more elongated than in female; Enp1 with plumose dorsal seta. P6 (**N**): Cxp2 with 1 plumose and 1 rudimentary seta; most of setae on Bsp and Enp1–2 either missing or invisible due to extremely small sizes; 3 terminal setae on Enp3 almost equal and with long hairs (cut off in the drawing). CA (**P**): with 6–7 muscle bands; end part rounded and slightly tapered.

Remarks. There are some differences between Arabian Sea specimens of *P. porrecta* and specimens described earlier (Deevey, 1968a; Angel, 1969a; Gooday & Angel, 1977): **a**) the presence of short dorsal seta on 2nd segment of female An1; **b**) smaller number of spines on e-seta of male An1. Carapace lengths of *P. porrecta* from our materials are most close to the lengths of *P. porrecta adriatica* (Gooday & Angel, 1977: females 1.38–1.58 mm, males 1.24–1.36 mm).

Distribution. *Porroecia porrecta* is one of the most dominant species recorded from all oceans mostly at latitudes lower than 40º; shallow mesopelagic species (Angel et al., 2008). In the investigated region, *P. porrecta* was found at all stations (Fig. 65), in 97% of tows. Maximum abundances were recorded at depths 0–150 m (Fig. 66).

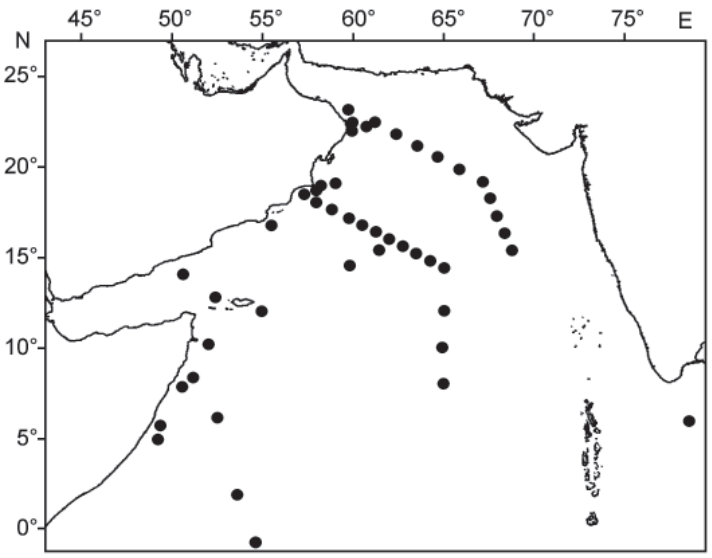


Fig. 65. Occurrence of ***Porroecia porrecta*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

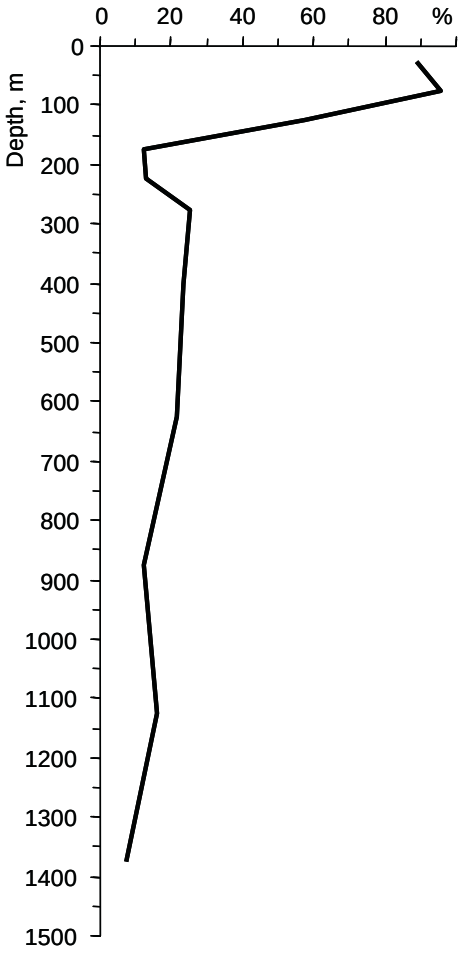


Fig. 66. Occurrence of ***Porroecia porrecta*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

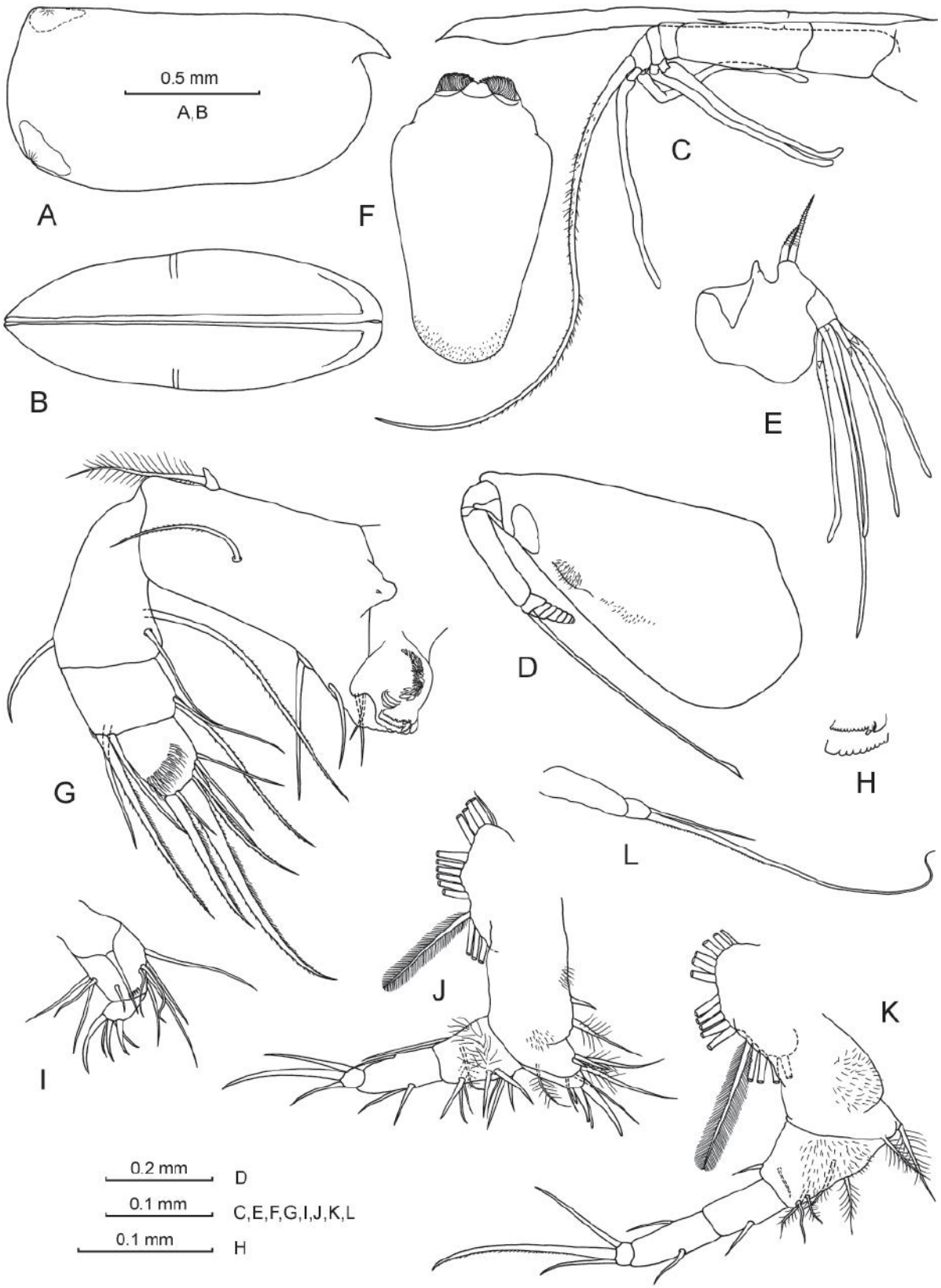


Plate 56. ***Porroecia porrecta***, female. Carapace: **A** – lateral; **B** – ventral. **C** – FO and An1. An2: **D** – Prp and Exp; **E** – Enp. **F** – Lb. Md: **G** – Bsp, Enp and Exp; **H** – coxal endite: toothed edge and distal tooth-list. **I** – Mx. **J** – P5. **K** – P6. **L** – P7.

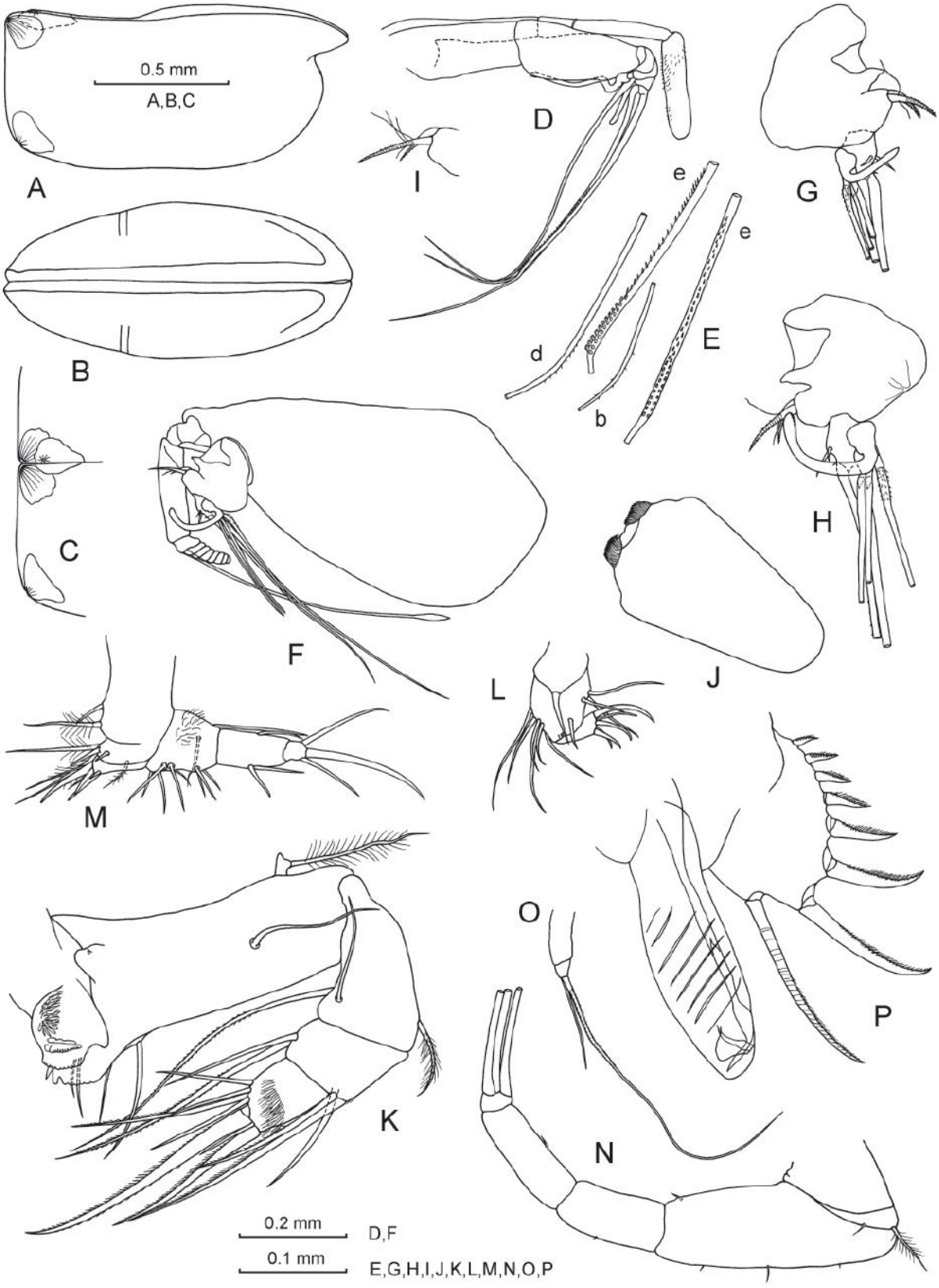


Plate 57. ***Porroecia porrecta***, male. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: posterior margins. **D** – FO and An1. **E** – An1: armature of b-, d- and e- setae. An2: **F** – Prp, Exp and Enp; **G**, **H** – left and right Enps; **I** – Enp2 of other specimen: a- and b- setae. **J** – Lb. **K** – Md. **L** – Mx. **M** – P5. **N** – P6. **O** – P7. **P** – CA and CF.

Porroecia spinirostris (Claus, 1874)

(Pict. 29; Pls 58, 59; Figs 67, 68)

For synonymy before 1906, see Müller, 1906a.
Conchoecia spinirostris: Müller, 1906a, p. 104, pl. XXII figs 21–23, 25–28; Skogsberg, 1920, p. 697, fig. CXXXIV; Deevey, 1968a, p. 80, figs 38, 39; Angel, 1969a, p. 35, figs 4–6; Poulsen, 1969a, p. 173.
Spinoecia spinirostris: Poulsen, 1973, p. 111, fig. 55.
Porroecia spinirostris: Martens, 1979, p. 329.
Porroecia spinirostris: Angel, 1999, pp. 821, 836, fig. 9.112.

Pict. 29. ***Porroecia spinirostris***. **A** – female; **B** – male.

Females. L = 1.07–1.23 mm (1.14 ± 0.05 mm; N = 44); H/L = 49.7 ± 1.1% (N = 22).

Plate 58**A**–**M**. Carapace (**A**, **B**): smaller in lenght, less elongated, relatively higher in posterior part (H_{post} / H_{ant} ~ 1.2) than in *P. porrecta* (Pls 6B, 56A). FO (**C**): similar to that in *P. porrecta* (Pl. 56C). An1 (**C**): without dorsal seta; e-seta with rather long, rare hairs along anterior side of its proximal third; distal half of posterior side of e-seta with hairs, which are decrease in size distally. An2 (**D**, **E**): Prp with medial bulge covered with hairs; a- and b- setae with tiny spines. Lb (**F**): in dorsal projection with almost straight anterior edge. Md (**G**, **H**): epipodial appendage on Bsp with very short seta; Enp1 with 2 ventral setae and non-plumose dorsal seta. Mx (**I**): Bsp with single long seta extending over distal edge of Enp1; Enp1 with a few tiny spines distally. P5 (**J**): Bsp with 5 setae in proximal ventral group (one of them plumose) and 3 setae in distal one. P6 (**K**): surface of Cxp and Bsp without hairs. P7 (**L**): one of two terminal setae on end segment very short, about 2 times longer than this segment. CF (**M**): unpaired dorsal seta absent.

Males. L = 0.92–1.07 mm (0.96 ± 0.04 mm; N = 29); H/L = 49.9 ± 1.2% (N = 15).

Plate 59**A**–**O**. Carapace (**A**–**C**): less elongated than in *P. porrecta* (Pls 6B, 57A); posterior edge slightly covex. FO (**D**): capitulum more elongated and slender than in *P. porrecta* (Pl. 57D), without tiny spines on distal part of ventral surface. An1 (**D**, **E**): a-seta reaches basis of 1st segment; e-seta with 8 paired spines and ~ 18 unpaired (total number of spines ~ 34); structure of spines and their position towards axis of seta as in *P. porrecta* (Pl. 57E). An2 (**F**–**H**): b-seta with a few long hairs; e-seta present; h-, i- and j- setae longer than half of biggest g-seta; j-seta with fine spines proximally; right hook appendage more angled in its proximal part than in other species of genus (Pls 55H, 57H). Lb (**I**) and also Mx (**K**), P5 (**L**), P7 (**N**), CF (**O**): similar to those in female. Md: Bsp more elongated than in female; Enp1 with plumose dorsal seta. P6 (**M**): Cxp2 with 1 plumose and 1 rudimentary seta; all setae on Bsp and Enp1–2 reduced, some of them missing, only one of ventral and dorsal seta more or less visible; 3 terminal setae on Enp3 almost equal and with long hairs. CA (**O**): with 6 muscle bands; end part rounded and tapered.

Distribution. *Porroecia spinirostris* is recorded from all oceans at latitudes lower than 40º; neustonic and shallow mesopelagic species (Angel et al., 2008). In the Arabian Sea Region, *P. spinirostris* was found mainly in the south-west of the investigated area (Fig. 67), in 13% of tows. Maximum abundances were recorded at depths 0–150 m (Fig. 68).

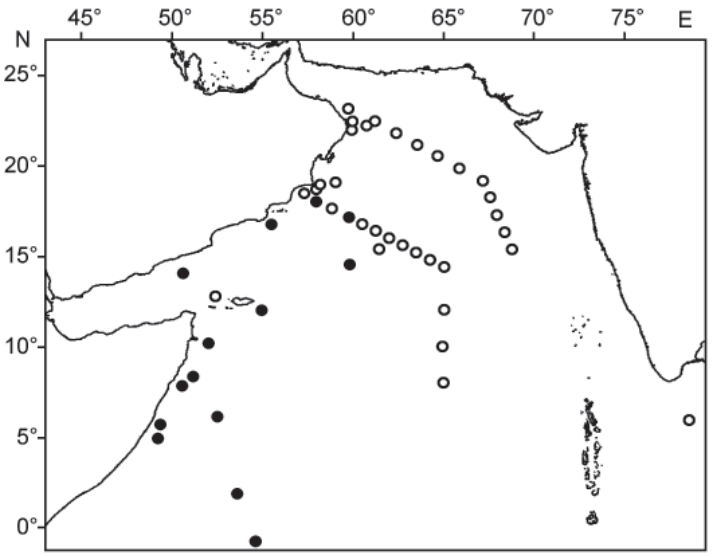


Fig. 67. Occurrence of ***Porroecia spinirostris*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

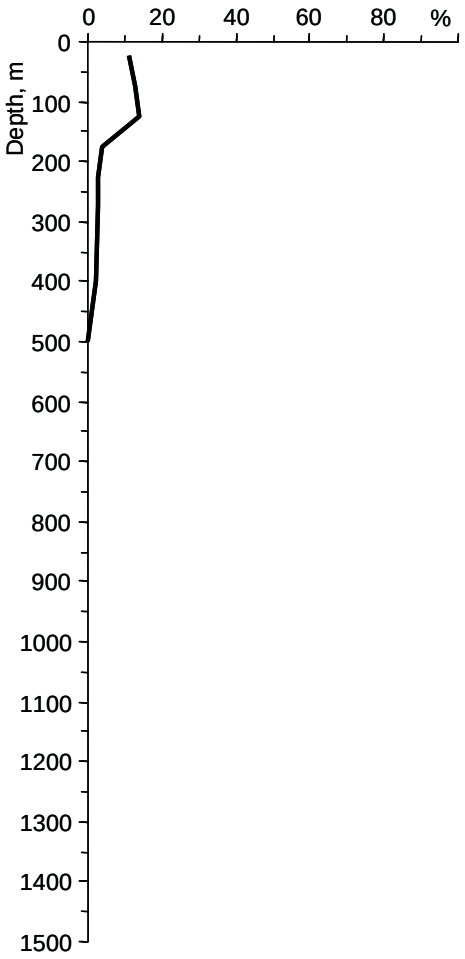


Fig. 68. Occurrence of ***Porroecia spinirostris*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

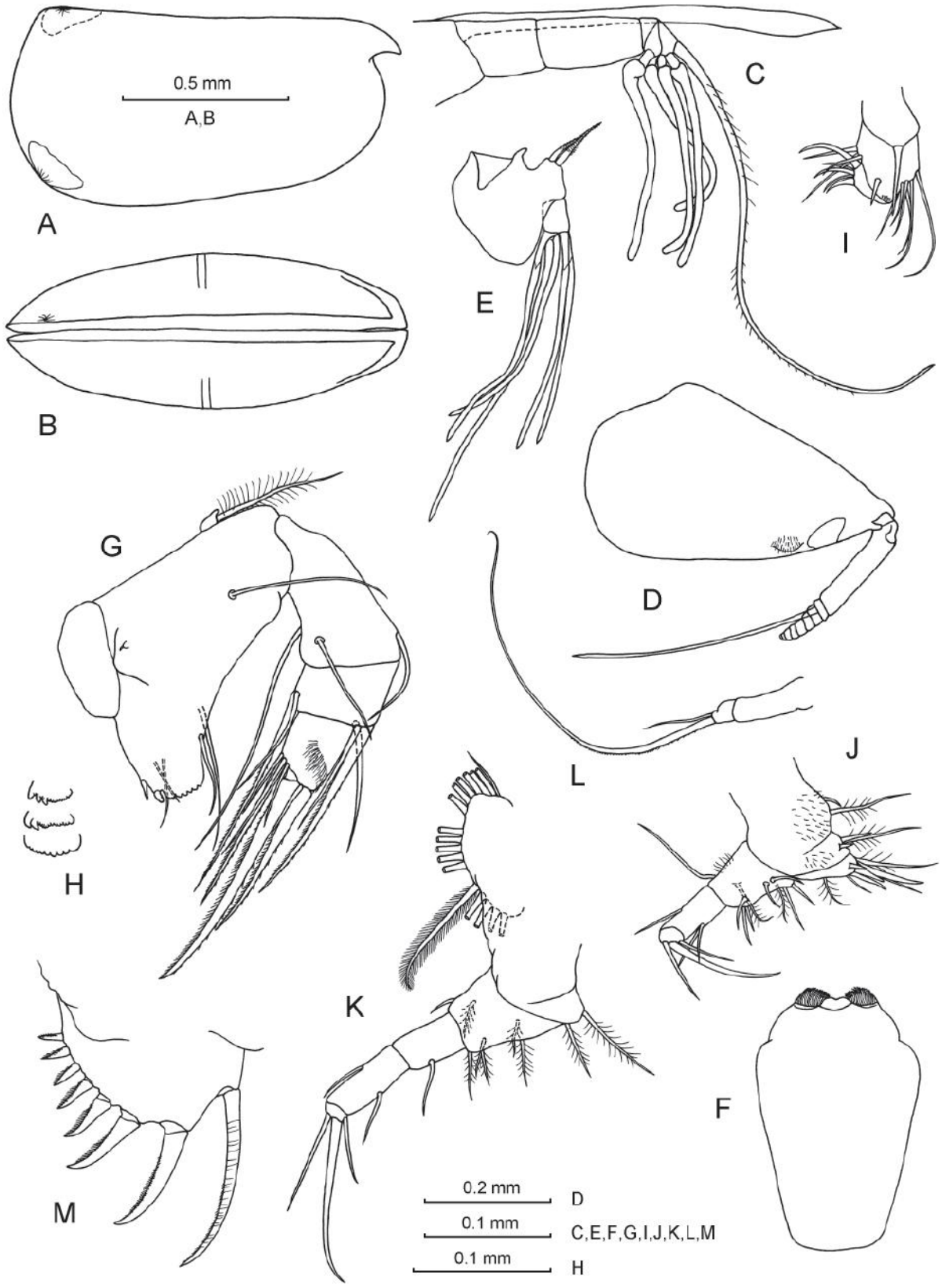


Plate 58. ***Porroecia spinirostris***, female. Carapace: **A** – lateral; **B** – ventral. **C** – FO and An1. An2: **D** – Prp and Exp; **E** – Enp. **F** – Lb. Md: **G** – Bsp, Enp and Exp; **H** – coxal endite: toothed edge, distal and proximal tooth lists. **I** – Mx. **J** – P5. **K** – P6. **L** – P7. **M** – CF.

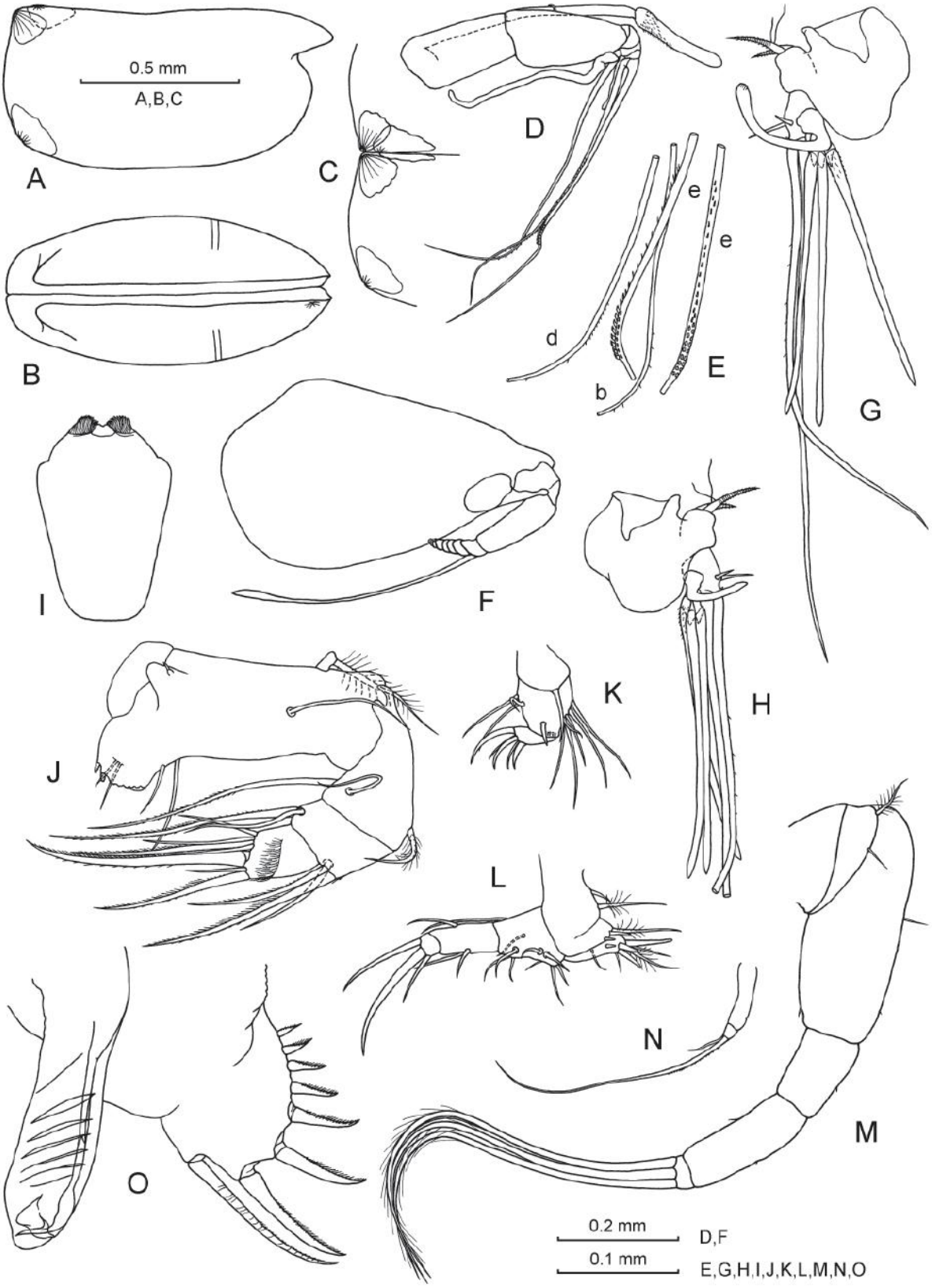


Plate 59. ***Porroecia spinirostris***, male. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: posterior margins. **D** – FO and An1. **E** – An1: armature of b-, d- and e- setae. An2: **F** – Prp and Exp; **G**, **H** – right and left Enps. **I** – Lb. **J** – Md without Cxp. **K** – Mx. **L** – P5. **M** – P6. **N** – P7. **O** – CA and CF.

Genus ***Proceroecia*** Kock 1992

Carapace is delicate, usually with more or less developed spine or a tiny point at the PDC of right valve.

Females. FO long, extended well beyond An1, no clear division on stem and capitulum; distal part of capitulum widened and usually with short hairs.

Males. Capitulum of FO has long hairs on the ventral surface; h-, i- and j- setae on the An2 Enp very short, approximately one-fifth as long as longest g-seta.

Five species have been identified in the analyzed material: *P. brachyaskos* (Müller, 1906), small shallower-living and large deep-living forms; *P. decipiens* (Müller, 1906); *P. macroprocera* (Angel, 1971); *P. microprocera* (Angel, 1971) and *P. procera* (Müller, 1906) (Table 3, Appendices 1, 2). All species except the deep form of *P. brachyaskos* are described here.

Key to the species of ***Proceroecia***:

Adult females:

1 PDCs without spines; LAG slightly moved forward along dorsal margin; RAG near PVC; An1 with short dorsal seta; Md Enp1 with a single rudimentary ventral seta; dorsal seta on P5 Enp1 missing (Pls 7C, 60A, C, D, E, J, N) ..... ***P. brachyaskos***

1a Right PDC either with spine or without it, left rounded; LAG in usual place near PDC; RAG moved forward along ventral margin; An1 with no dorsal seta; Md Enp1 with 2 ventral setae; dorsal seta on P5 Enp1 present ….....……..……..……..…. 2

2 Right PDC with well developed spine directed backwards; An2 Enp1–2+3 bare; both ventral setae on Md Enp1 relatively long; P5 Bsp with 7 setae in proximal ventral group and 3 in distal; P7 with both terminal setae well developed (Pls 7C, 62A, C, F, H, L, N) ……..……..... ***P. decipiens***

2a Right PDC with spine directed somewhat down or with no spine; surface of An2 Enp1–2+3 with a few hairs; one of ventral setae on Md Enp1 extremely short; P5 Bsp with 5 setae in proximal ventral group and 2 in distal; P7 with both terminal setae shortened, smaller of them extremely short or missing (Pls 7C, 64, 66, 68) …..……..……..……..…..…… 3

3 L usually <1.1 mm; right PDC with spine; RAG ~ 15–17% L from posterior margin; FO ~ 2 times longer than An1; Mx Enp1 with 5 anterior setae (Pls 7C, 66A, C, D, J) …....……..……..... ***P. microprocera***

3a L usually >1.1 mm; right PDC with small point or without it; RAG located more anteriorly; FO more than 2 times longer than An1; Mx Enp1 with 6 setae on anterior side ……..……..……..…..…….. 4

4 L usually <1.2 mm; right PDC usually with small point; RAG ~ 17–20% L from posterior margin; in dorsal view Lb with rounded anterior edge (Pls 7C, 68A, C, I) …..……..... ***P. procera***

4a L usually >1.2 mm; right PDC with tiny point or without it; RAG ~ 25–27% L from posterior margin; in dorsal view Lb with almost straight anterior edge (Pls 7C, 64A, C, I) ....….. ***P. macroprocera***

Adult males:

1 Both PDCs without spines;
LAG slightly moved forward along dorsal margin; RAG near PVC;
An1 e-seta comb with short spines sitting almost at right angles to seta,
b- and d- setae strongly shortened;
Md Enp1 with a single rudimentary ventral seta;
dorsal seta on P5 Enp1 missing
(Pls 7C, 61A, C, D, F, L, N) .... ***P. brachyaskos***

1a Right PDC either with spine or without it, left rounded;
LAG in usual place; RAG moved forward along ventral margin;
An1 e-seta comb with long thin spines directed proximally,
b- and d- setae not much shorter than e-seta;
Md Enp1 with 2 ventral setae;
dorsal seta on P5 Enp1 present ……………………………………………………………… 2

2 Right PDC with well developed spine directed backwards;
An1 e-comb with about 30 paired, pointed spines which are
decreasing in size proximally;
Md Enp1 has relatively long ventral setae;
P5 Bsp with 7 setae in proximal ventral group and 3 in distal;
P7 with both terminal setae well developed
(Pls 7C, 63A, C, F, K, N) ……………………………………………………………… ***P. decipiens***

2a Right PDC with spine directed somewhat down or with no spine;
An1 e-comb with 10–27 paired, pointed spines which are
decreasing in size distally;
Md Enp1 has extremely short one of ventral setae;
P5 Bsp with 5 setae in proximal ventral group and 2 in distal;
smaller of terminal seta on P7 extremely short or missing
(Pls 7C, 65, 67, 69) ……………………………………………………………………… 3

3 L usually <1.0 mm;
right PDC with spine; RAG ~ 12–13% L from posterior margin;
An1 e-seta comb with 10–12 pairs of spines;
Mx Enp1 has 5 setae on anterior side
(Pl. 67A, C, F, M) ………………………………………………………………… ***P. microprocera***

3a L usually >1.0 mm;
right PDC with small point or without it; RAG located more anteriorly;
An1 e-seta comb with more numerous spines;
Mx Enp1 has 6 setae on anterior side ……………………………………………………… 4

4 L usually <1.1 mm;
right PDC usually with small point; RAG ~ 15–17% L from posterior margin;
An1 e-seta comb with 17–18 pairs of spines;
in dorsal view Lb with rounded anterior edge
(Pls 7C, 69A, C, D, G, K) ……………………………………………………………… ***P. procera***

4a L usually >1.1 mm;
right PDC with very small point or without it; RAG ~ 20–22% L from posterior margin;
An1 e-seta comb with 25–27 pairs of spines;
in dorsal view Lb with almost straight anterior edge
(Pls 7C, 65A, C, D, G, L) ………………………………………………………… ***P. macroprocera***

Proceroecia brachyaskos (Müller, 1906)

(Pict. 30; Pls 60, 61; Figs 69, 70)

Conchoecia brachyaskos Müller, 1906a, p. 70, pl. XIV figs 1–2, 7–14.
Conchoecia brachyaskos: Deevey, 1968a, p. 46, fig. 18; 1974, p. 366, fig. 3a–h (large form).
Paraconchoecia brachyaskos: Poulsen, 1973, p. 53, fig. 24 (female).
Proceroecia brachyaskos: Kock, 1992, p. 84, fig. 21; Angel, 1999, pp. 821, 833, fig. 9.113.

Pict. 30. ***Proceroecia brachyaskos***. **A** – female; **B** – male.

Females. L = 1.23–1.32 mm (1.27 ± 0.04 mm; N = 10); H/L = 47.5 ± 2.4% (N = 9).

Plate 60**A**–**Q**. Carapace (**A**–**D**): slightly tapered anteriorly; both PDCs rounded, but right corner has a small, spine-like projection (more visible at high magnification); posterior margin arched; PDCs well rounded; surface with antero-ventral striation (not shown in drawings); LAG moved somewhat forward along dorsal margin, and developed into bump visible above margin; RAG near PVC; posterior margins with small LGGs near PDCs. FO (**E**): straight; as long as 2 lengths of An1; capitulum bare, slightly widened distally, with pointed tip. An1 (**E**): 2nd segment with short dorsal seta; e-seta has fine spines distally on posterior surface. An2 (**F**–**H**): Prp with weak medial bulge covered with hairs; a- and b- setae on Enp1 bare; Enp2+3 with very short c- and d- setae; g-seta only somewhat longer than other setae on Enp2+3, and has flattened distal part. Lb (**I**): in dorsal projection almost rectangular shape, with rounded anterior corners. Md (**J**–**L**): Bsp has short disto-lateral seta and tiny epipodial seta; Enp1 with non-plumose dorsal seta and single, extremely short ventral seta; Enp2 has 2 disto-ventral setae as in other members of subfamily Conchoeciinae, but longer seta relatively short and weak, and second seta extremely short. Mx (**M**): Bsp with single seta not reaching distal edge of Enp1; Enp1 has 6 setae on anterior side, 3 on posterior, 1 laterally and a few tiny spines near distal edge. P5 (**N**): Cxp3 with 6 setae in ventral group; Bsp bears rather short dorsal seta (extending only somewhat over half Enp1), plumose dorso-lateral seta, 5 setae in proximal ventral group (one of them plumose) and 2 in distal ventral group; dorsal seta on Enp1 missing. P6 (**O**): Cxp2 with 2 plumose setae; Bsp has all setae typical for Conchoeciini; dorsal seta on Bsp rather long, as long as Enp1; longest terminal seta on Enp3 about equal to total length of Enp2–3. P7 (**P**): both terminal setae on end segment with double series of tiny spines proximally. CF (**Q**): unpaired dorsal seta missing.

Males. L = 1.08–1.16 mm (1.11 ± 0.02 mm; N = 18); H/L = 48.1 ± 2.2% (N = 13).

Plate 61**A**–**Q**. Carapace (**A**–**C**): in lateral view similar to that in female; in ventral view rostrum broader than in female; MGGs present. FO (**D**, **E**): capitulum with rounded tip and a double row of long hairs on ventral surface. An1 (**D**, **F**)**:** e-seta with comb of 18–20 short paired spines (larger in mid-part of comb) directed almost at right angles to axis of seta; b- and d- setae strongly shortened: first reaches proximal end of e-comb, second reaches distal end of e-comb; both b- and d- setae have tiny spinules distally. An2 (**G**, **J**): inner surface of Prp bare; a- and b- setae on Enp1 bare; e-seta on Enp2 not seen; c- and d- setae short; h-, i- and j- setae very short, approximately one-fifth of the longest g-seta; j-seta somewhat thicker and shorter than h- and i- setae; right hook

appendage strongly curved, its mid-part slightly swollen, tip rounded; left appendage smaller and less curved. Lb (**K**), and also Mx (**M**), P5 (**N**), P7 (**P**), CF: similar to those in female. Md (**L**): dorsal seta on Enp1 plumose. P6 (**O**): one of 2 setae on Cxp2 non-plumose; all setae on Bsp and Enp1–2 rudimentary; ventral terminal seta on Enp3 thinner and without long hairs (cut off in the drawing). CA (**Q**): with 6 muscle bands; mid-part slightly widened; end rounded.

Remarks. There are two size forms of *P. brachyaskos*, which are almost certainly different species. Large form is recorded at deeper depths than small one (Angel, 1999; Angel et al., 2008). The females of *P. brachyaskos*, large form, from our materials have L 1.46–1.56 mm, the male – 1.27 mm.

Male specimens of *P. brachyaskos*, small form, described here differ from those in the figures of Deevey (1968a: fig. 18i; 1974: fig. 3e), Angel (1999: fig. 9.113H) and Kock (1992: fig. 21k) by the presence of only paired spines on An1 e-seta (Pl. 61F).

Distribution. *Proceroecia brachyaskos* (both size forms) is recorded from all oceans; geographical range is from 61°N to 76°S; meso- and bathypelagic species, occurs predominantly at depths of 800–1500 m (Angel et al., 2008). In the investigated area (Fig. 69), *P. brachyaskos*, small form, was found in 8% of tows. Maximum abundances were recorded at depths 500–1000 m (Fig. 70). The deep form of this species was found only at two stations M4, M7 (see Fig. 1 for abbreviations), and was not collected at depths shallower than 1300 m (Appendix 1).

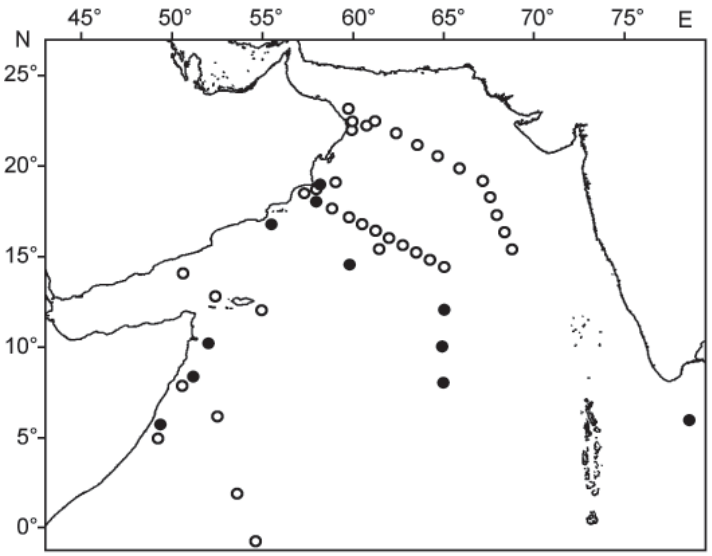


Fig. 69. Occurrence of ***Proceroecia brachyaskos*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

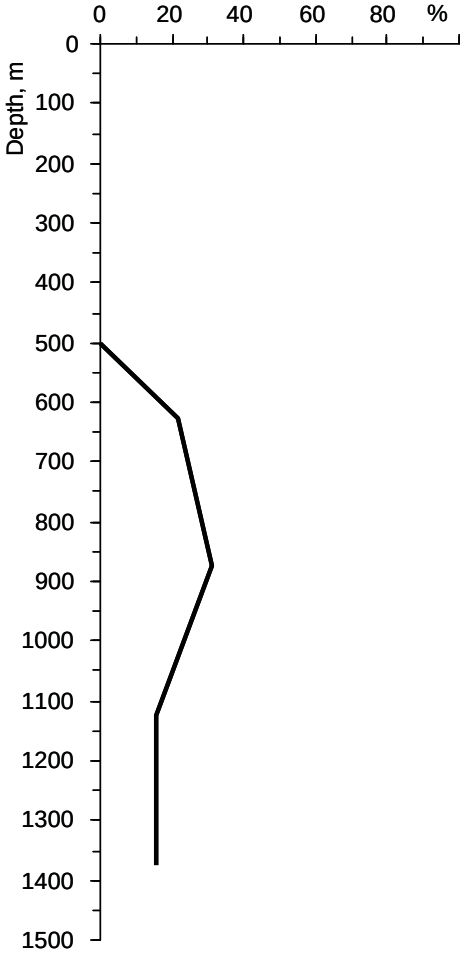


Fig. 70. Occurrence of ***Proceroecia brachyaskos*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

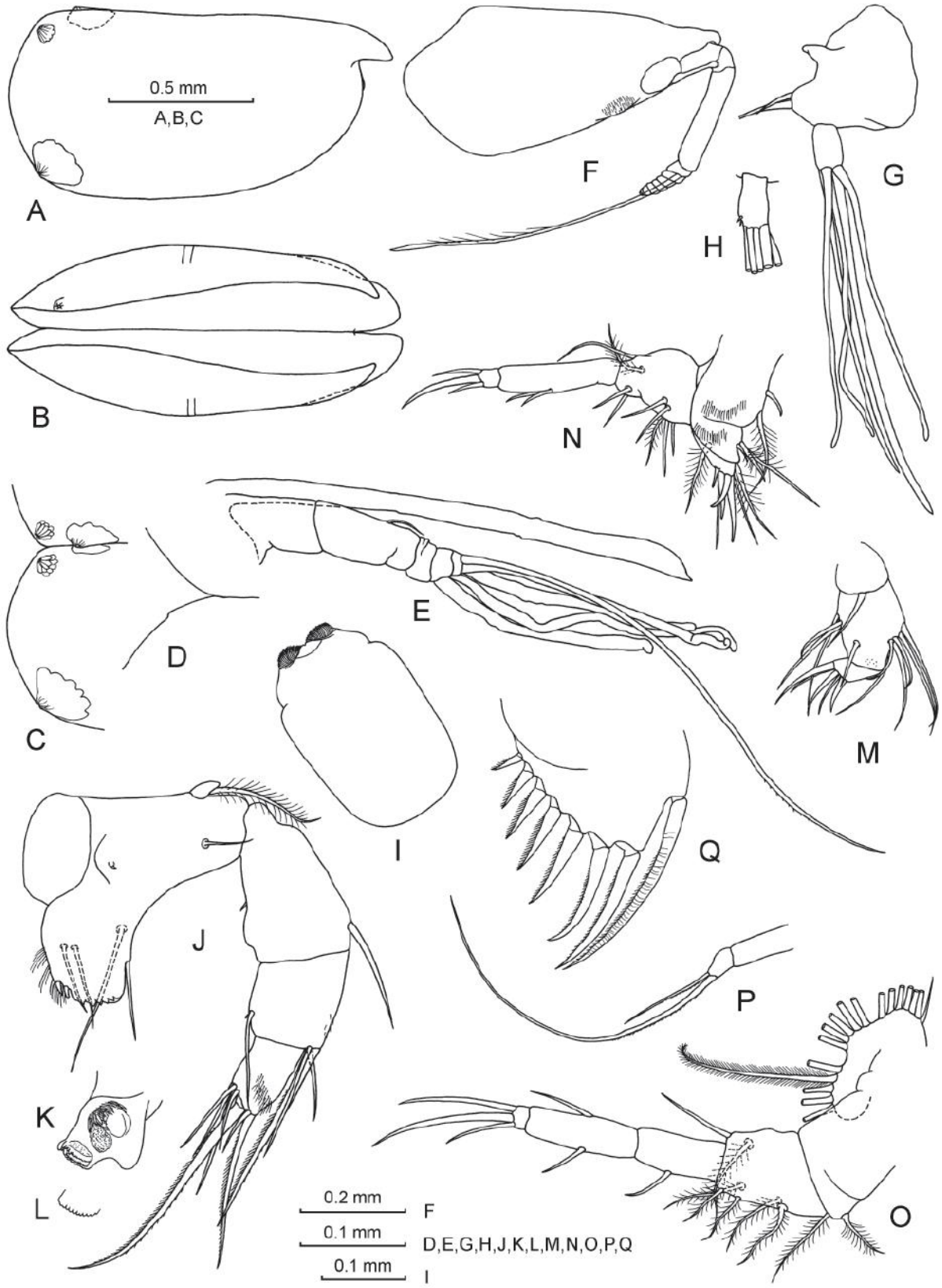


Plate 60. ***Proceroecia brachyaskos***, female. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: posterior part; **D** – PDCs (higher magnification). **E** – FO and An1. An2: **F** – Prp and Exp; **G** – Enp; **H** – other specimen: Enp2+3. **I** – Lb. Md: **J** – Bsp, Exp and Enp; **K**, **L** – coxal endite and its toothed edge. **M** – Mx. **N** – P5. **O** – P6. **P** – P7. **Q** – CF.

Plate 61. ***Proceroecia brachyaskos***, male. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: PDCs. **D** – FO and An1. **E** – FO: ventral. **F** – An1: armature of b-, d- and e- setae. An2: **G** – Prp and Exp; **H**, **I** – left and right Enps; **J** – left hook appendage. **K** – Lb. **L** – Md. **M** – Mx. **N** – P5. **O** – P6. **P** – P7. **Q** – CA.

Proceroecia decipiens (Müller, 1906)

(Pict. 31; Pls 62, 63; Figs 71, 72)

Conchoecia decipiens Müller, 1906a, p. 72, pl. XIII figs 27–36.
Conchoecia decipiens: Angel, 1971, p. 281, figs 12–14.
Paraconchoecia decipiens: Poulsen, 1973, p. 52, fig. 23.
Proceroecia decipiens: Kock, 1992, p. 82.

Pict. 31. ***Proceroecia decipiens***. **A** – female; **B** – male.

Females. L = 1.32–1.58 mm (1.44 ± 0.05 mm; N = 188); H/L = 44.4 ± 1.9% (N = 44).

Plate 62**A**–**O**. Carapace (**A**–**C**): elongated; tapered anteriorly; has large posterior dorsal spine on right valve; posterior margin forms acute angle with dorsal margin; RAG moved somewhat forward along ventral margin and opens at a notch; LAG in usual place; surface without striation. FO (**D**): straight; as long as 2 lengths of An1; capitulum covered with short hairs mainly on distal ventral half; its tip rounded. An1 (**D**): 2nd segment with no dorsal seta; e-seta opposite distal parts of sensory setae has rather long hairs which decrease in size distally. An2 (**E**, **F**): inner surface of Prp bare; Enp1 with a-seta as long as half b-seta, both setae bare; g-seta flattened distally and bears marginal spinules. Lb (**G**): in dorsal projection tapered anteriorly; anterior edge with clear rounded corners covered with short hairs. Md (**H**–**J**): epipodial appendage on Bsp with no seta; Enp1 with non-plumose dorsal seta and 2 ventral setae (one of them far shorter); one of 3 disto-dorsal setae on Enp2 very short. Mx (**K**): Bsp with single seta not reaching distal edge of Enp1; Enp1 has 6 setae on anterior side, 3 on posterior, 1 laterally and a row of ~ 8 short spines near distal edge; above this row there are a few extremely small spines. P5 (**L**): Cxp1–2 covered with long hairs; Cxp3 with 6 setae in ventral group; Bsp bears long dorsal seta, plumose dorso-lateral seta, 7 setae in proximal ventral group (one of them plumose) and 3 setae in distal ventral group. P6 (**M**): more ventral seta on Cxp2 with very short hairs, second seta plumose; most distal ventral seta on Bsp reaches almost half of Enp2; longest terminal seta very long, noticeably longer than Enp2–3. P7 (**N**): longest terminal seta on end segment with a double series of tiny spines proximally. CF (**O**): unpaired dorsal seta missing.

Males. L = 1.13–1.30 mm (1.20 ± 0.03 mm; N = 160); H/L = 44.1 ± 1.5% (N = 36).

Plate 63**A**–**O**. Carapace (**A**–**D**): less tapered anteriorly; in ventral view rostrum far broader than in female; MGGs present. FO (**D**): capitulum with long hairs on middle third of ventral surface and shorter hairs proximally; its tip rounded. An1 (**D**–**F**)**:** a-seta reaches proximal edge of 2nd segment; e-seta with comb of ~ 30 paired, long, pointed spines, which are decreasing in size proximally; b- and d- setae have tiny spines opposite e-comb (more numerous and densely placed on d-seta). An2 (**G**–**I**): inner surface of Prp bare; hairs on a- and b- setae not visible; c-, d- and e- setae on Enp2 rather long; h-, i- and j- setae very short that is typical for this genus; j-seta somewhat thicker and shorter than h- and i- setae; right hook appendage curved backward, its tip strongly narrowed, almost pointed; left appendage smaller and less curved.

Lb (**J**): in dorsal projection more elongated than in female. Md (**K**): dorsal seta on Enp1 plumose. Mx (**L**), P5, P7 (**N**), CF: similar to those in female. P6 (**M**): Cxp2 bears 1 plumose seta and 1 weaker, non-plumose seta; all setae on Bsp and Enp1–2 far shorter than in female; ventral terminal seta on Enp3 thinner and shorter, all 3 setae with long hairs (cut off in the drawing). CA (**O**): with 4–5 muscle bands; mid-part slightly widened; end rounded.

Distribution. *Proceroecia decipiens* is recorded in the tropical zone of Indian and Pacific oceans; most common in depths 50–100 m (Muller, 1906a; Poulsen, 1973; George (1969), George & Nair, 1980). In the investigated area, *P. decipiens* was found almost at all stations (Fig. 71), in 67% of tows. Maximum abundances were recorded at depths 50–150 m (Fig. 72).

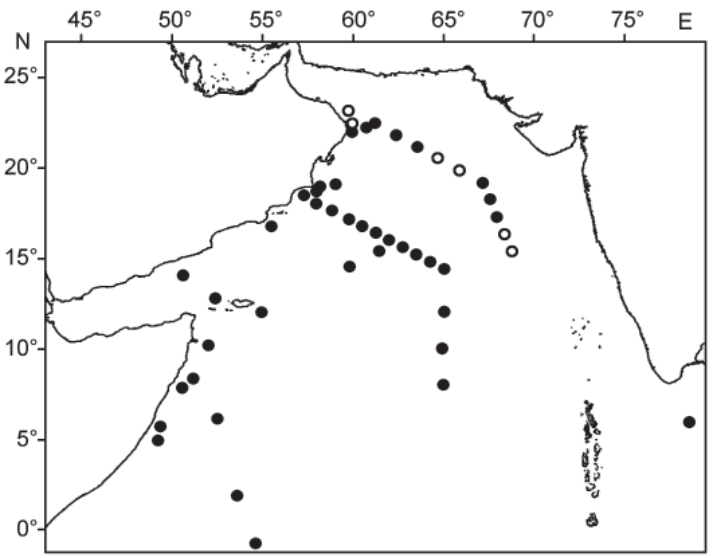


Fig. 71. Occurrence of ***Proceroecia decipiens*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

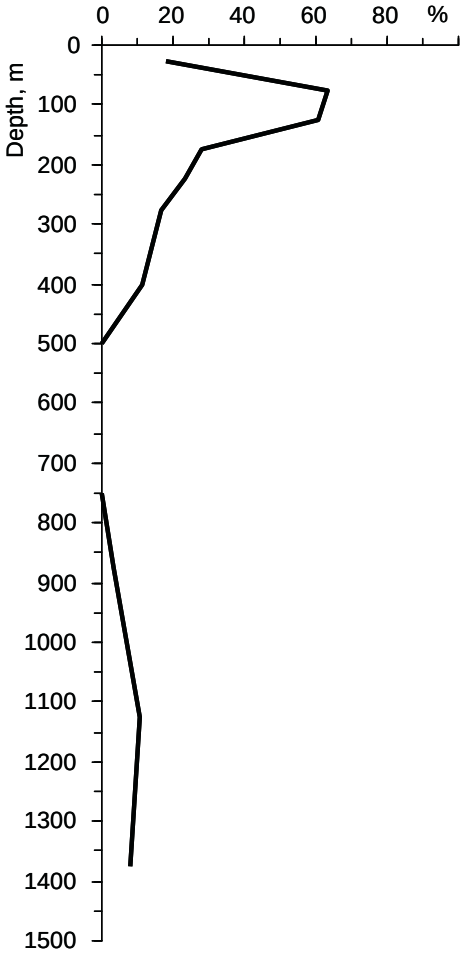


Fig. 72. Occurrence of ***Proceroecia decipiens*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

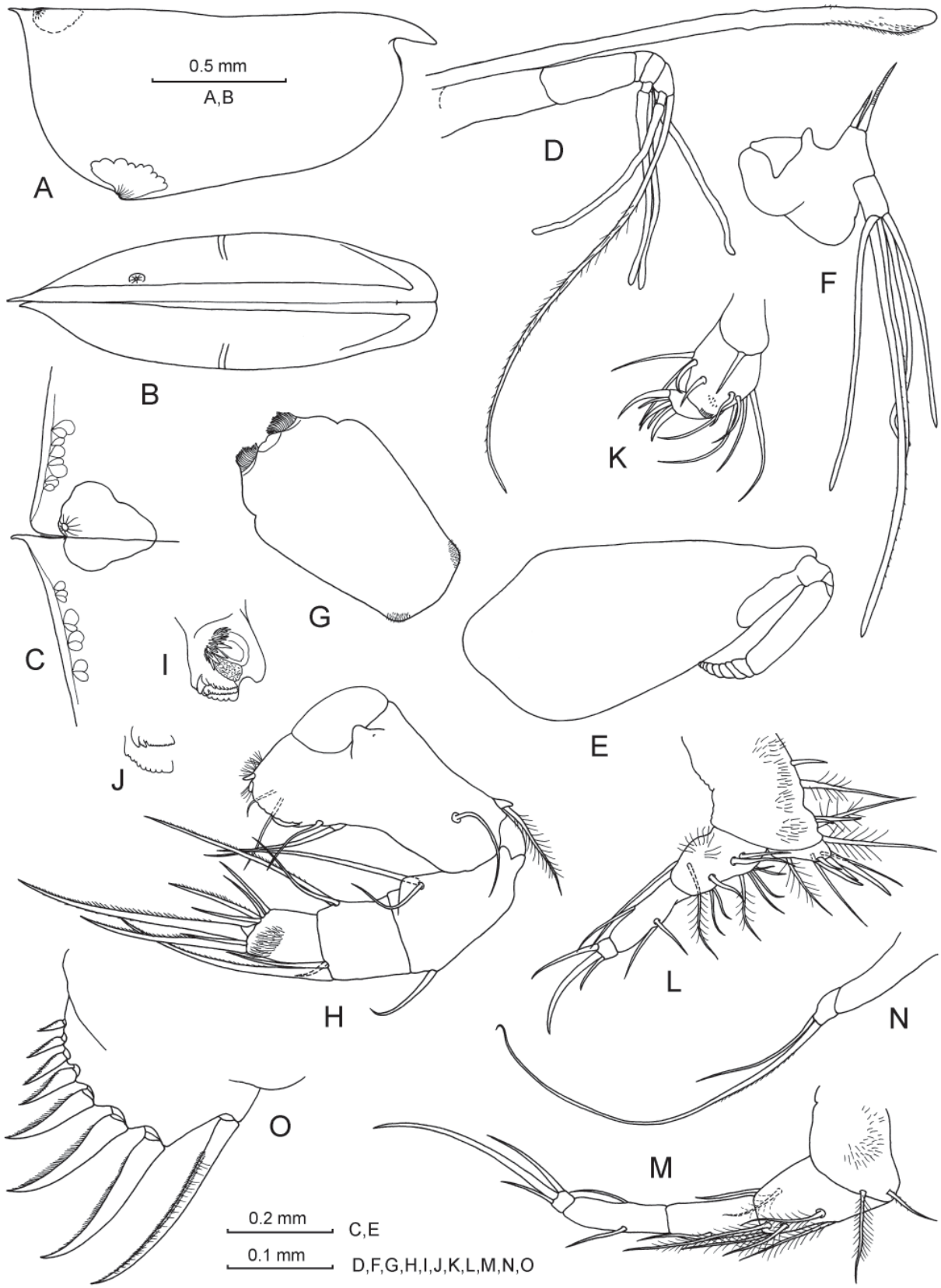


Plate 62. ***Proceroecia decipiens***, female. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: PDCs. **D** – FO and An1. An2: **E** – Prp and Exp; **F** – Enp. **G** – Lb. Md: **H** – Bsp, Exp and Enp; **I**, **J** – coxal endite, its toothed edge and distal tooth-list. **K** – Mx. **L** – P5. **M** – P6. **N** – P7. **O** – CF.

Plate 63. ***Proceroecia decipiens***, male. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: PDCs. **D** – FO and An1. An1: **E** – b-, d- and e- setae; **F** – armature of b-, d- and e- setae (higher magnification). An2: **G** – Prp and Exp; **H** – left Enp; **I** – right hook appendage. **J** – Lb. **K** – Md without Cxp. **L** – Mx. **M** – P6. **N** – P7. **O** – CA.

Proceroecia macroprocera (Angel, 1971)

(Pict. 32; Pls 64, 65; Figs 73, 74)

Conchoecia macroprocera Angel, 1971, p. 270, figs 7–9.
Proceroecia macroprocera: Kock, 1992, p. 82; Angel, 1999, pp. 821, 834, fig. 9.115.

Pict. 32. ***Proceroecia macroprocera***. **A** – female; **B** – male.

Females. L = 1.23–1.35 mm (1.28 ± 0.03 mm; N = 67); H/L = 43.1 ± 2.5% (N = 24).

Plate 64**A–O**. Carapace (**A–D**): elongated; tapered anteriorly; left PDC rounded, right one with tiny point or without it; RAG moved forward along ventral margin (25–27% L from posterior margin); LAG near posterior hinge of the valves; surface without striation. FO (**E, F**): more than 2 times longer than An1; no clear division on stem and capitulum; the latter long, slightly bent downwards, widened distally, covered with short hairs on distal ventral half; its tip usually pointed, sometimes rounded. An1 (**E**): 2nd segment without dorsal seta; opposite distal parts of sensory setae, e-seta has rather long hairs which distinctly decrease in size distally. An2 (**G, H**): inner surface of Prp bare; Enp1 with a few short spines near the bases of a- and b- setae; a-seta as long as half of b-seta; b-seta with tiny little spines; Enp2+3 with a few rather long hairs on its surface; g-seta flattened distally and bears marginal spinules. Lb (**I**): in dorsal projection almost rectangular; its anterior edge almost straight, with distinct corners. Md (**J**): epipodial appendage on Bsp without seta; Enp1 with plumose dorsal seta and 2 ventral setae (one of them extremely short); 2 disto-ventral setae on Enp2 relatively short and about equal; outer of them not claw-like. Mx (**K**): Bsp with single seta not reaching distal edge of Enp1; Enp1 has 6 setae on anterior side, 3 on posterior and 1 laterally; spines near distal edge not visible. P5 (**L**): Cxp1–2 partly covered with long hairs; Cxp3 with 6 setae in ventral group; Bsp bears dorsal seta which does not reach distal edge of Enp1, plumose dorso-lateral seta, 5 setae in proximal ventral group (one of them plumose) and 2 in distal ventral group. P6 (**M**): Cxp2 with 2 plumose setae; Bsp with 5 long plumose ventral setae, plumose dorso-lateral seta and non-plumose dorsal seta. P7 (**N**): one of 2 terminal setae extremely short (hardly visible) or missing; longest terminal seta with double row of tiny spines proximally. CF (**O**): unpaired dorsal seta missing.

Males. L = 1.11–1.23 mm (1.15 ± 0.02 mm; N = 55); H/L = 42.5 ± 1.9% (N = 15).

Plate 65**A**–**S**. Carapace (**A**–**D**): RAG moved somewhat forward along ventral margin (20–22% L from posterior margin); in ventral view rostrum far broader than in female; MGGs present. FO (**E**): capitulum elongated, with long hairs in mid-part of ventral surface; its tip rounded. An1 (**F**, **G**): e-seta with comb of ~ 25–27 paired, long, pointed spines directed proximally and decreasing in size distally; just beyond the comb e-seta has 2 pairs of tiny spines directed distally; b-seta with a few tiny spines opposite e-comb; d-seta bare. An2 (**H**–**K**): inner surface of Prp bare; a- and b- setae on Enp1 with tiny little spines; e-seta missing (or not visible due to its small size); h-, i- and j- setae thin and short (typical for genus); right hook appendage strongly curved backwards, its tip with tiny papilla; left appendage smaller and less curved.

Lb (**L**): in dorsal projection shorter than in female. Md (**M**): dorsal seta on Enp1 plumose, as in female. Mx (**N**), P5 (**O**), P7 (**Q**), CF (**S**): similar to those in female. P6 (**P**): Cxp2 with 2 plumose setae, which are shorter than in female; all setae on Bsp and Enp1–2 far shorter than in female; all setae on Bsp plumose except very short dorsal seta; 3 terminal setae on Enp3 almost equal and with long hairs (cut off in the drawing). CA (**R**): with 4 muscle bands; terminal part tapered; end rounded.

R e m a r k s . *P. macroprocera* "was described from the Northeast Atlantic when Angel (1971) showed that the prevailing concept of *Conchoecia procera* was a complex of three species (*macroprocera*, *microprocera* and *procera*) with consistent differences in their carapace sizes" (Angel et al., 2008).

Size ranges of these three species from the Arabian Sea Region were obtained by means of a diagram of size distribution of all males and females that were measured in our materials; certainly, the real size ranges of three species are overlapping.

Descriptions of the Arabian Sea adult specimens of *P. macroprocera* are based on three females (1.27–1.30 mm) and five males (1.16–1.18 mm).

D i s t r i b u t i o n . *Proceroecia macroprocera* is recorded generally from the Atlantic Ocean, and a few records from the Indian and Pacific oceans; geographical range is from 60°N to 52°S; mesopelagic species, occurs slightly deeper than the other two sibling species: 100–400 m in the temperate latitudes, and deeper than 500 m near equator (Angel et al., 2008). In the Arabian Sea Region, *P. macroprocera* was found mainly in the upwelling areas and in the central and southern parts of the investigated area (Fig. 73), in 20% of tows. Maximum abundances were recorded at depths 200–300 m (Fig. 74).

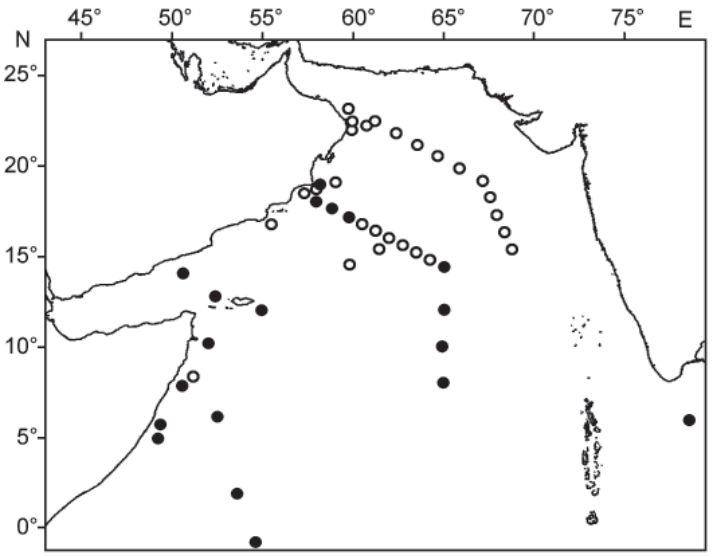


Fig. 73. Occurrence of ***Proceroecia macroprocera*** at the stations listed in Table 1. Open circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

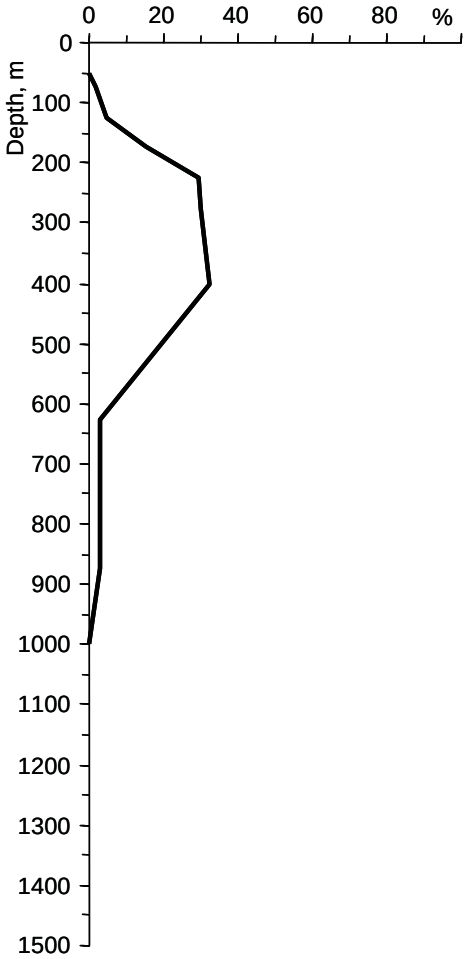


Fig. 74. Occurrence of ***Proceroecia macroprocera*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

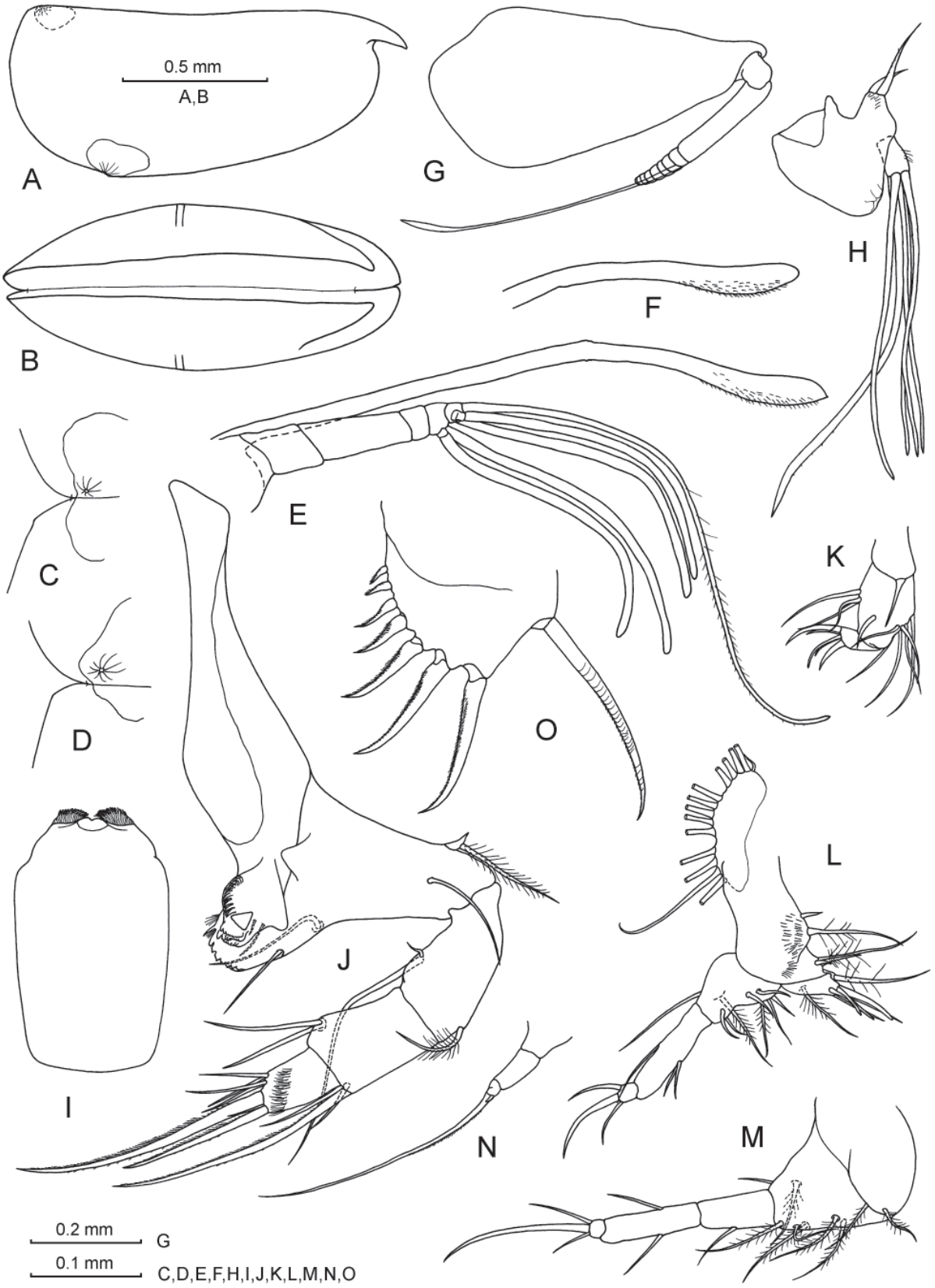


Plate 64. ***Proceroecia macroprocera***, female. Carapace: **A** – lateral; **B** – ventral; **C**, **D** – both valves outside: PDCs (different specimens). **E** – FO and An1. An2: **F** – other specimen: capitulum of FO. **G** – Prp and Exp; **H** – Enp. **I** – Lb. **J** – Md. **K** – Mx. **L** – P5. **M** – P6. **N** – P7. **O** – CF.

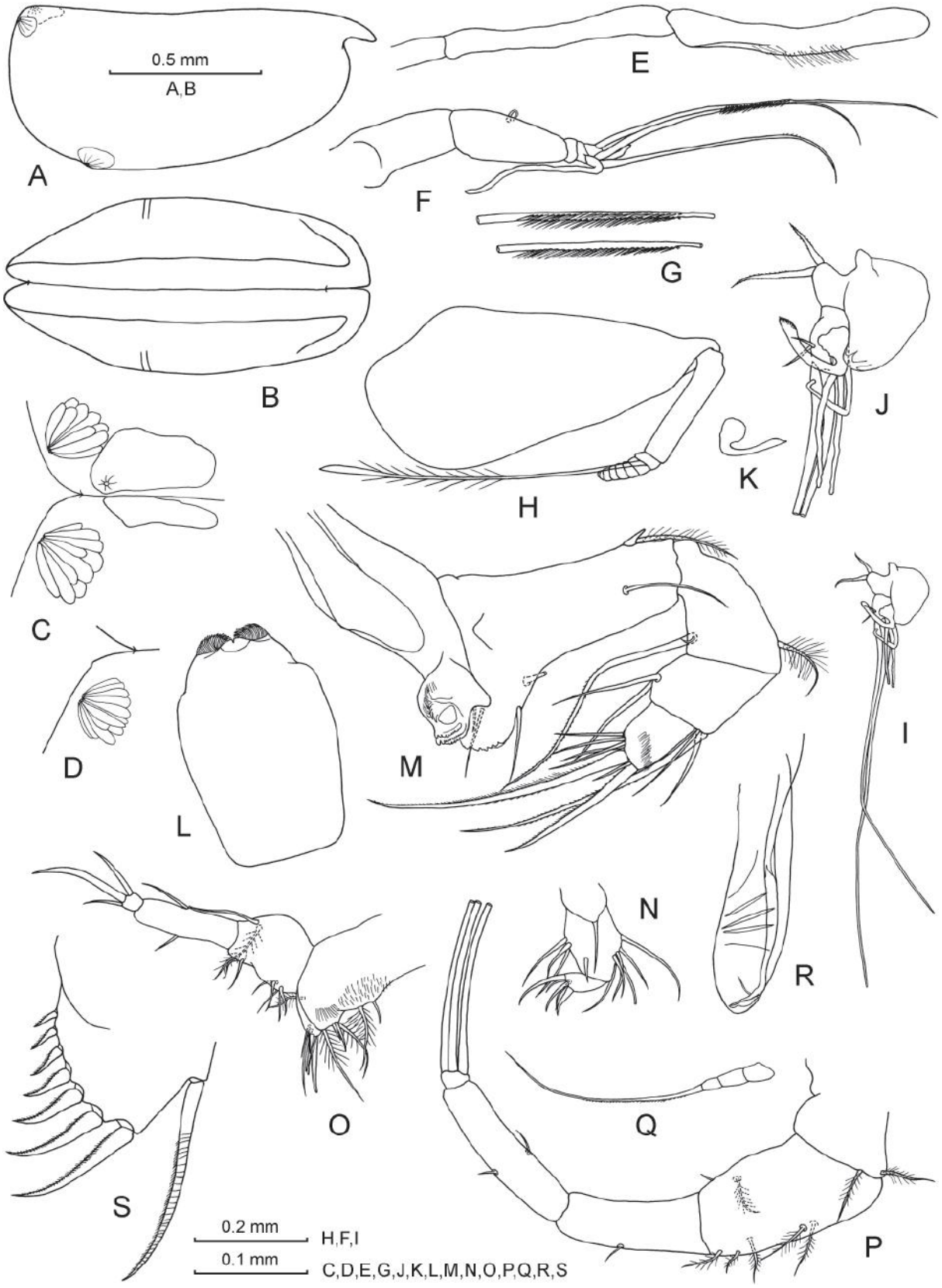
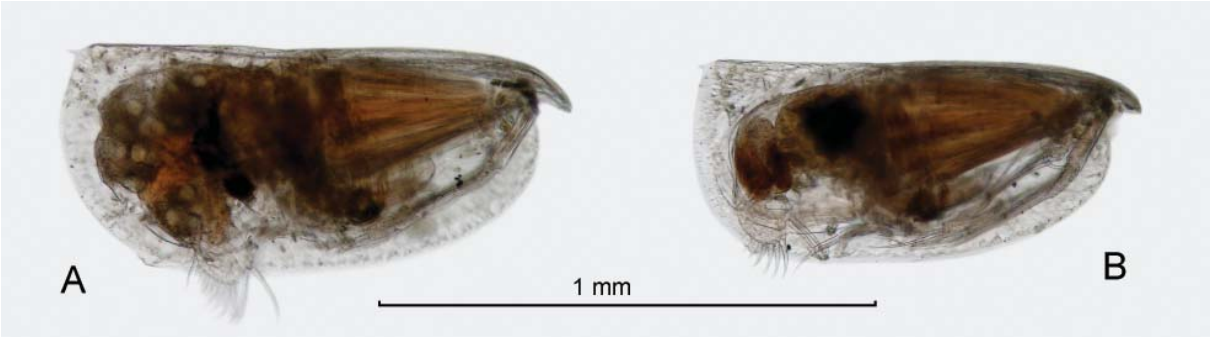


Plate 65. ***Proceroecia macroprocera***, male. Carapace: **A** – lateral; **B** – ventral; **C**, **D** – both valves outside: PDCs (different specimens). **E** – FO. **F** – An1. **G** – An1: e-seta. An2: **H** – Prp and Exp; **I**, **J** – right Enp; **K** – left hook appendage. **L** – Lb. **M** – Md. **N** – Mx. **O** – P5. **P** – P6. **Q** – P7. **R** – CA. **S** – CF.

Proceroecia microprocera (Angel, 1971)

(Pict. 33; Pls 66, 67; Figs 75, 76)

Conchoecia microprocera Angel, 1971, p. 264, figs 4–6.
Proceroecia microprocera: Kock, 1992, p. 82; Angel, 1999, pp. 821, 834, fig. 9.116.



Pict. 33. ***Proceroecia microprocera***. **A** – female; **B** – male.

Females. L = 0.90–1.08 mm (1.02 ± 0.03 mm; N = 597); H/L = 43.1 ± 1.4% (N = 39).

Plate 66**A**−**N**. Carapace (**A**−**C**): similar to that in *P. macroprocera* and *P. procera* (Pls 7C, 64A, 68A), but right PDC has distinct spine directed downwards and RAG less moved along ventral margin (15−17% L from posterior margin). FO (**D**, **E**): about 2 times longer than An1; no clear division on stem and capitulum; the latter slightly bent downwards, somewhat widened distally, usually bare, sometimes covered with rare short hairs on ventral surface terminally; its tip always pointed. An1 (**D**): without dorsal seta; opposite distal parts of sensory setae, e-seta has long hairs which slightly decrease in size distally. An2 (**F**, **G**): similar to that in *P. macroprocera* (Pl. 64G, H), but b-seta on Enp1 has distinct spines and all setae on Enp2+3 relatively shorter. Lb (**H**): dorsal projection slightly tapered anteriorly; its anterior edge rounded. Md (**I**): similar to that in *P. macroprocera* (Pl. 64J), but outer disto-ventral seta on Enp2 longer than inner one. Mx (**J**): similar to that in *P. macroprocera* (Pl. 64K). P5 (**K**): similar to that in *P. macroprocera* (Pl. 64L) but hairs on Cxp1−2 absent and all setae on Bsp non-plumose. P6 (**L**): Cxp2 with 2 non-plumose setae; dorsal seta on Bsp longer than half of Enp1; all setae non-plumose. P7 (**M**): one of 2 terminal setae either missing or not visible due to its extremely small size; longer terminal seta relatively shorter than in *P. macroprocera* (Pl. 64N), with a double row of tiny spines proximally. CF (**N**): unpaired dorsal seta missing; 2nd to 4th claws shorter relative to 5th to 8th than in *P. macroprocera* and *P. procera* (Pls 64O, 68O).

Males. L = 0.83–0.97 mm (0.89 ± 0.02 mm; N = 507); H/L = 43.7 ± 1.9% (N = 20).

Plate 67**A**−**R**. Carapace (**A**−**C**): RAG less moved along ventral margin (12−13% L from posterior margin) than in *P. macroprocera* and *P. procera* (Pls 7C, 65A, 69A). FO (**D**, **E**): capitulum elongated, with long hairs in mid-part of ventral surface and shorter hairs proximally; its tip slightly pointed. An1 (**D**, **F**): similar to that in *P. macroprocera* (Pl. 65F, G), but e-seta comb consists of smaller number of spines (~ 10−12 pairs) and both b- and d- setae have tiny spines opposite e-comb. An2 (**G**−**I**): inner surface of Prp bare; b-seta on Enp1 with clear spines; e-seta present; right hook appendage strongly curved backwards; left appendage smaller and less curved; tips of both appendages slightly pointed. Lb (**J**): dorsal projection shorter than in female. Md (**K**, **L**): similar to that in female, but short ventral seta on Bsp sometimes longer than in female (**L**). Mx (**M**), P5 (**N**), P7 (**P**), CF (**R**): similar to those in female. P6 (**O**): all setae on Cxp2, Bsp and Enp1−2 far shorter than in female and non-plumose; Bsp with most of ventral setae shorter and weaker, and dorsal seta longer than in male of *P. macroprocera* (Pl. 65P); 3 terminal setae on Enp3 almost equal and with long hairs. CA (**Q**): relatively larger than in two sibling species; with 4 muscle bands; terminal part tapered; end rounded.

Remarks. Descriptions of the Arabian Sea adult specimens of *P. microprocera* are based on five females (0.94–1.07 mm) and two males (0.88–0.90 mm).

Distribution. *Proceroecia microprocera* is recorded from the Atlantic and Indian oceans in the tropical and temperate latitudes; the records of *P. procera* from earlier than 1971 (when Angel has described three related species) may have included this species; epi- and mesopelagic species, occurs mostly at depths 50–300 m (Angel et al., 2008). In the investigated area, *P. microprocera* was found at all stations (Fig. 75); it was the most abundant species in the samples (Table 3). Maximum abundances were recorded at depths 50–150 m (Fig. 76).

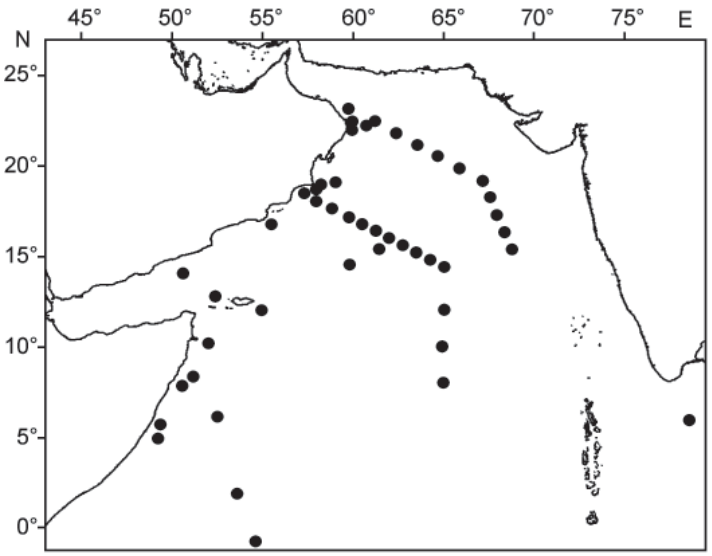


Fig. 75. Occurrence of ***Proceroecia microprocera*** at the stations listed in Table 1. Open circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

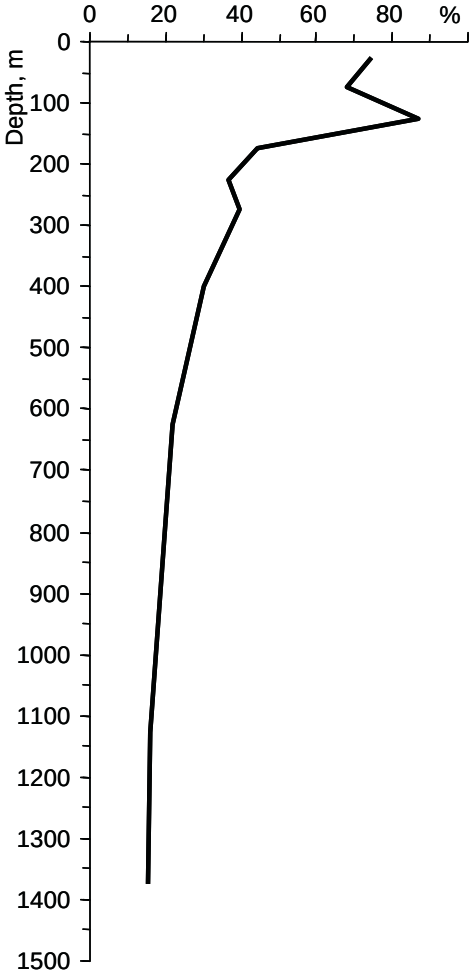


Fig. 76. Occurrence of ***Proceroecia microprocera*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

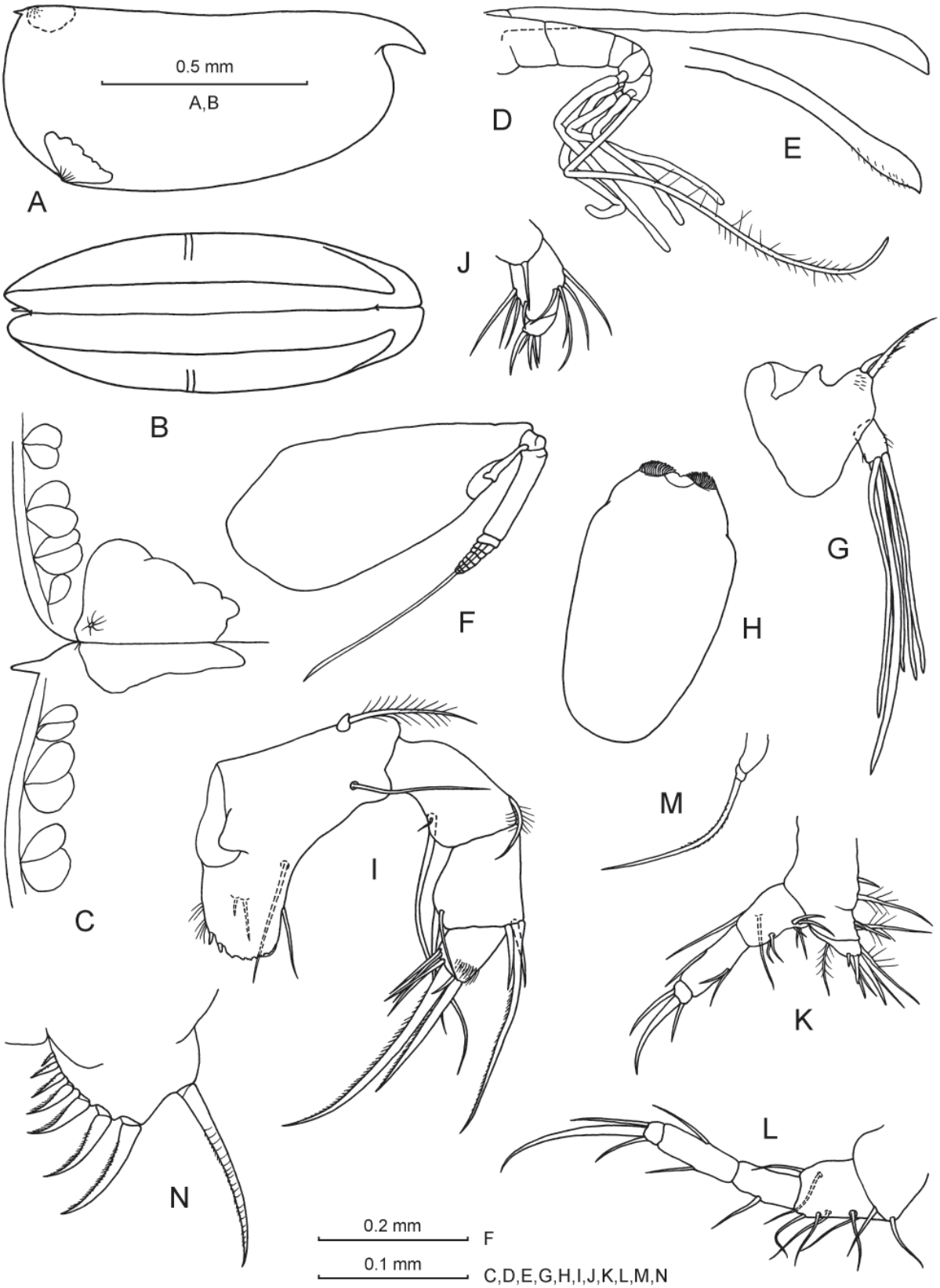


Plate 66. ***Proceroecia microprocera***, female. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: PDCs. **D** – FO and An1. **E** – other specimen: capitulum of FO. An2: **F** – Prp and Exp; **G** – Enp. **H** – Lb. **I** – Md without Cxp. **J** – Mx. **K** – P5. **L** – P6. **M** – P7. **N** – CF.

Plate 67. ***Proceroecia microprocera***, male. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: PDCs. **D** – FO and An1. **E** – other specimen: capitulum of FO. **F** – An1: armature of b-, d- and e- setae. An2: **G** – Prp and Exp; **H** – right Enp; **I** – left hook appendage. **J** – Lb. Md: **K** – Bsp and Exp; **L** – Enp. **M** – Mx. **N** – P5. **O** – P6. **P** – P7. **Q** – CA. **R** – CF.

Proceroecia procera (Müller, 1894)

(Pict. 34; Pls 68, 69; Figs 77, 78)

For synonymy before 1906, see Müller, 1906a.
Conchoecia procera: Müller, 1906a, p. 71, pl. XIII figs 37–47; pl. XIV figs 3–6; Deevey, 1968a, p. 45, figs 16, 17; Angel, 1971, p. 259, figs 1–3.
Paraconchoecia procera: Poulsen, 1973, p. 50, fig. 21.
Proceroecia procera: Kock, 1992, p. 82; Angel, 1999, pp. 821, 834, fig. 9.117.

Pict. 34. ***Proceroecia procera***. **A** – female; **B** – male.

Females. L = 1.10–1.21 mm (1.16 ± 0.02 mm; N = 44); H/L = 42.8 ± 1.1% (N = 27).

Plate 68**A**–**O**. Carapace (**A**–**C**): similar to that in *P. macroprocera* and *P. microprocera* (Pls 7C, 64A, 66A), but right PDC always has small point directed downward and RAG opens 17–20% L from posterior margin. FO (**D**): more than 2 times longer than An1; capitulum long, slightly bent downward, widened distally, covered with short hairs on distal ventral half; its tip always pointed. An1 (**D**): e-seta has long hairs in its distal part which decrease in size distally. An2 (**E**–**H**): similar to that in *P. microprocera* (Pl. 66F, G), but a-seta on Enp1 with tiny spines and all setae on Enp2+3 relatively longer. Lb (**I**): in dorsal projection tapered anteriorly; anterior edge rounded. Md (**J**): 2 disto-ventral setae on Enp2 about equal, as in *P. macroprocera* (Pl. 64J). Mx (**K**): similar to that in two other sibling species (Pls 64K, 66J). P5 (**L**): Cxp2 covered with long hairs; all setae on Bsp, except disto-lateral one, non-plumose. P6 (**M**): similar to that in *P. macroprocera* (Pl. 64M), but dorsal seta on Bsp longer and reaches over the half of Enp1. P7 (**N**): longer terminal seta strongly shortened, as in *P. microprocera* (Pl. 66M); another seta extremely short or missing (or not visible due to its small size). CF (**O**): similar to that in *P. macroprocera* (Pl. 64O).

Males. L = 0.99–1.08 mm (1.03 ± 0.04 mm; N = 29); H/L = 41.6 ± 1.7% (N = 11).

Plate 69**A**–**P**. Carapace (**A**–**D**): similar to that in *P. macroprocera* and *P. microprocera* (Pls 7C, 65A, 67A), but RAG opens ~ 15–17% L from posterior margin. FO (**E**, **F**): capitulum elongated, with long hairs in mid-part of ventral surface and on lateral surfaces proximally; its tip rounded. An1 (**E**, **G**): e-seta with a comb of about 17–18 paired, long, pointed spines directed proximally and decreasing in size distally; just beyond comb e-seta has pairs of tiny spines directed distally; b-seta has tiny spines opposite e-comb. An2 (**H**–**J**): inner surface of Prp bare; b-seta on Enp1 with strong spines; e-seta either missing or not visible due to its small size; right hook appendage strongly curved backwards, its tip slightly rounded; left appendage smaller and less curved. Lb (**K**), Md (**L**), Mx, P5 (**M**), P7 (**O**), CF: similar to those in female. P6 (**N**): all setae on Cxp2, Bsp and Enp1–2 far shorter than in female; dorsal seta on Bsp longer than in *P. macroprocera* and *P. microprocera* (Pls 65P, 67O); 3 terminal setae on Enp3 almost equal and with long hairs (cut off in the drawing). CA (**P**): relatively smaller than in two sibling species; with 4 muscle bands; terminal part tapered; end rounded.

Remarks. Descriptions of the Arabian Sea adult specimens of *P. procera* are based on seven females (1.11–1.21 mm) and eight males (1.05–1.08 mm).

The main differences between three sibling species, *P. macroprocera*, *P. microprocera* and *P. procera*, are the carapace length and the position of RAG (see Pl. 7C).

In addition to these, *P. microprocera* differs from other two species by: **a**) the presence of distinct spine on right PDC; **b**) relatively shorter FO in female; **c**) the presence of five anterior setae on Mx Enp1 (six setae in two other species); **d**) shorter 2nd to 4th claws on CF relative to 5th–8th.

P. macroprocera differ from other two species by: **a**) b-seta on An2 Enp1 having tiny little spines (this seta have distinct spines in other two species); **b**) the shape of Lb dorsal projection, which is almost rectangular, with straight anterior edge.

Distribution. *Proceroecia procera* is recorded from all oceans; geographical range is from 50°N to 44°S; shallow mesopelagic species, depth range is usually 50–400 m. "Records from earlier than 1971 (when Angel has described three sibling species) may include one or more of the other species" (Angel et al., 2008). In the Arabian Sea Region, *P. procera* was found mainly in the southern part of the investigated area (Fig. 77), in 9% of tows. Maximum abundances were recorded at depths 100–300 m (Fig. 78).

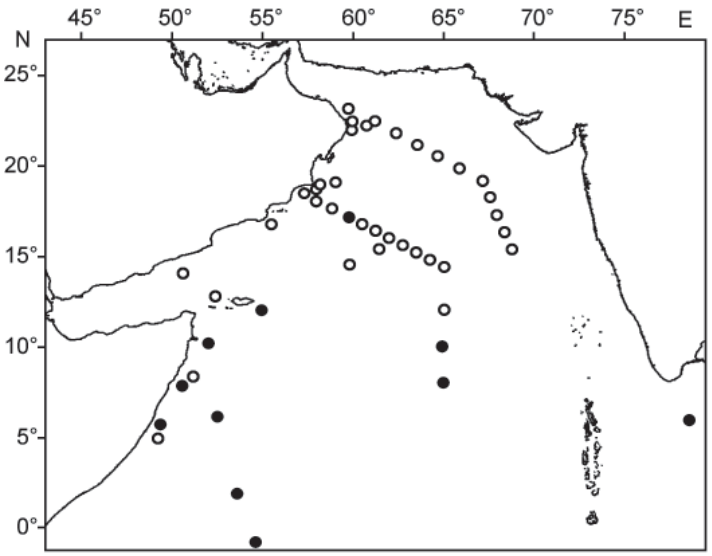


Fig. 77. Occurrence of ***Proceroecia procera*** at the stations listed in Table 1. Open circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

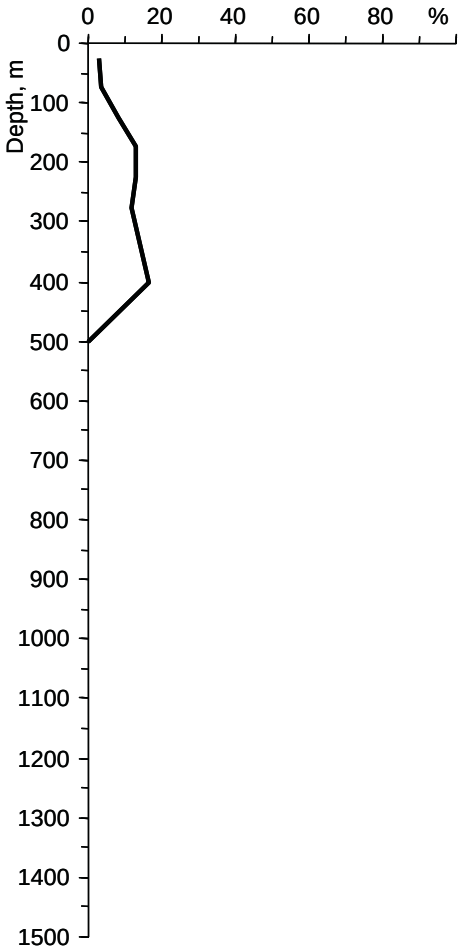


Fig. 78. Occurrence of ***Proceroecia procera*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

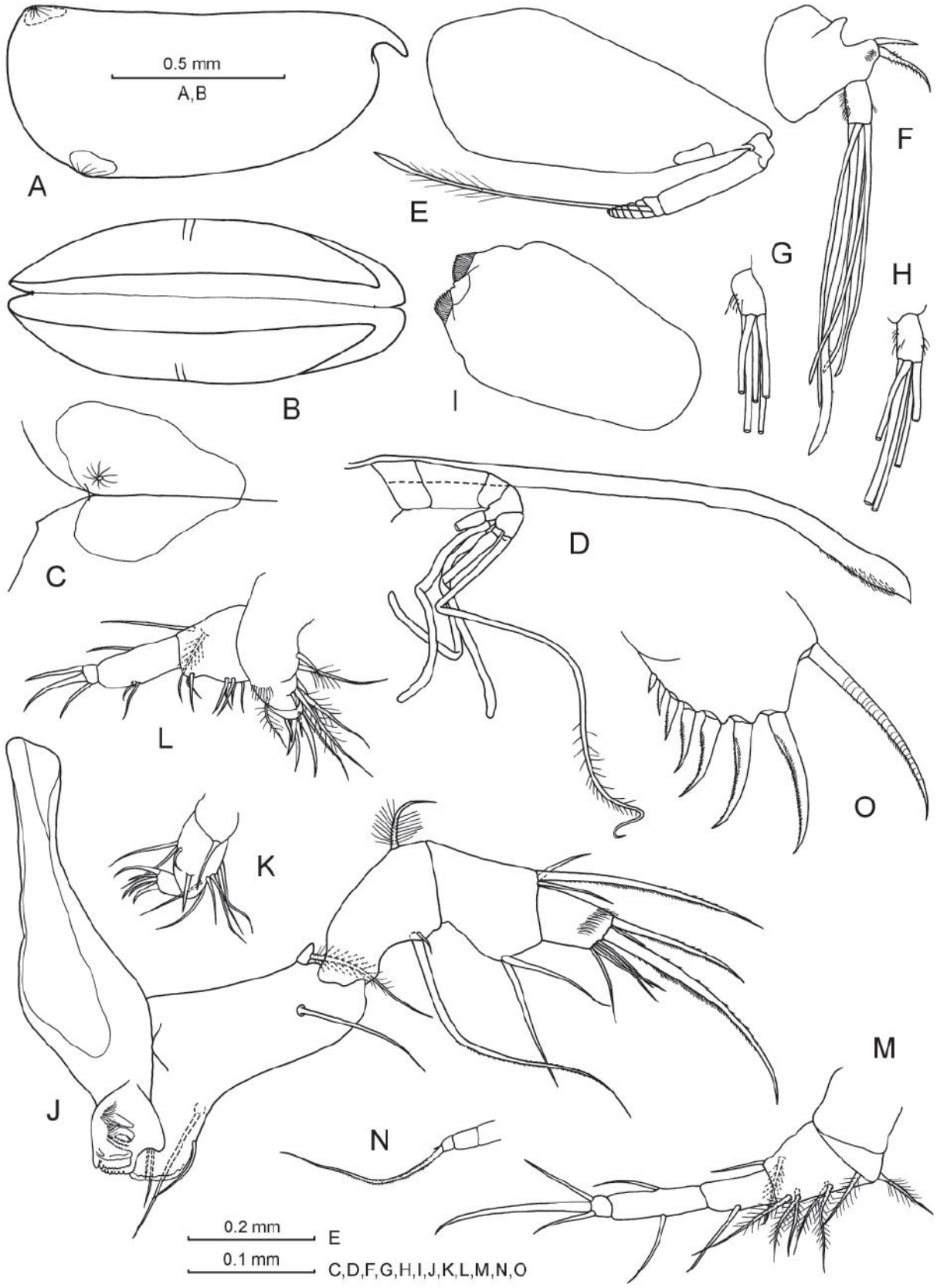


Plate 68. ***Proceroecia procera***, female. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside: PDCs. **D** – FO and An1. An2: **E** – Prp and Exp; **F** – Enp; **G**, **H** – Enp2+3 (other specimens). **I** – Lb. **J** – Md. **K** – Mx. **L** – P5. **M** – P6. **N** – P7. **O** – CF.

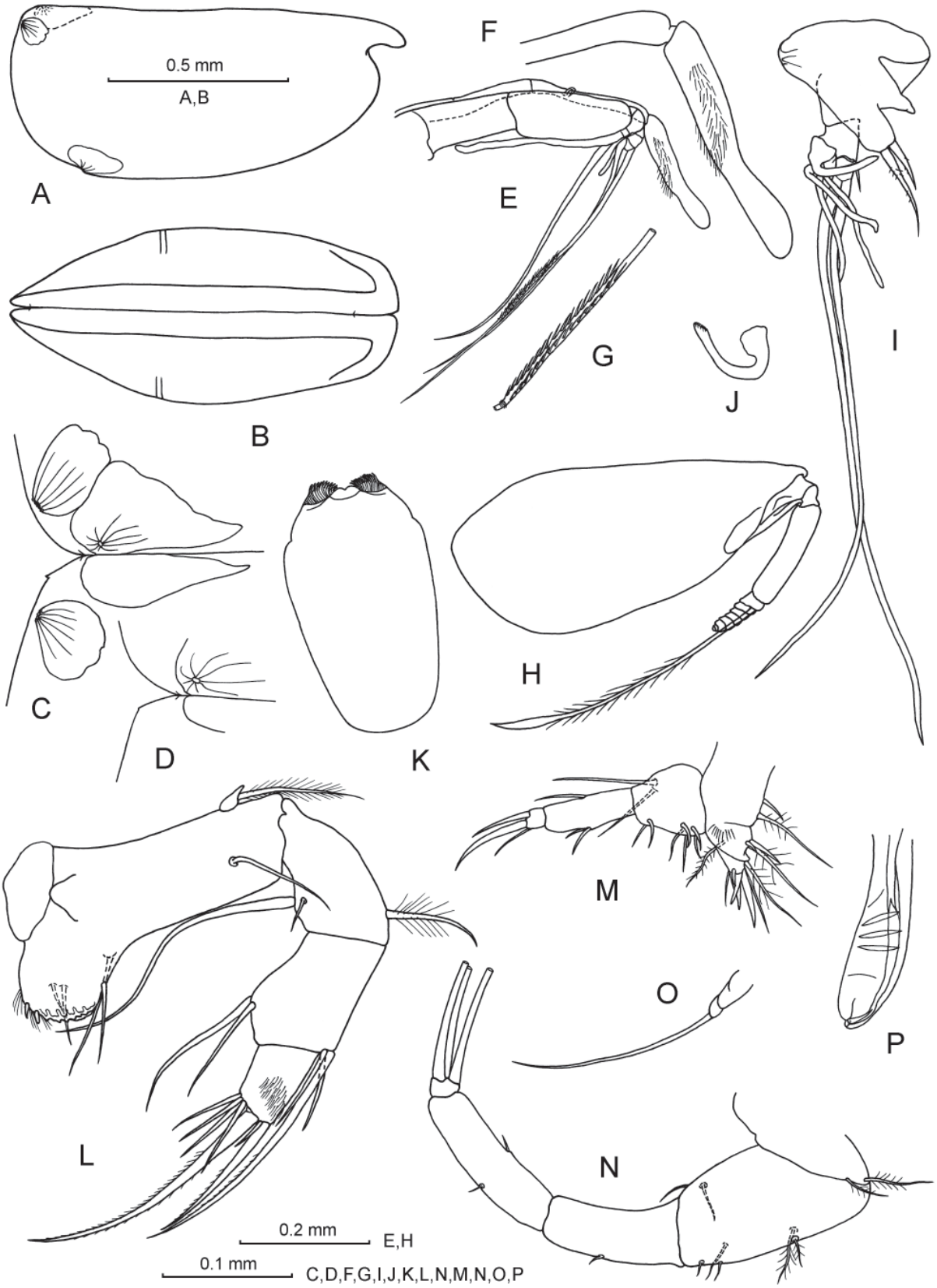


Plate 69. ***Proceroecia procera***, male. Carapace: **A** – lateral; **B** – ventral; **C**, **D** – both valves outside: PDCs (different specimens). **E** – FO and An1. **F** – capitulum of FO. **G** – An1: e-seta. An2: **H** – Prp and Exp; **I** – left Enp; **J** – right hook appendage. **K** – Lb. **L** – Md without Cxp. **M** – P5. **N** – P6. **O** – P7. **P** – CA.

Genus ***Pseudoconchoecia*** Claus, 1890

Carapace short, height ~ 60% of length; RAG and LAG are in the usual places; ventral LGGs present. The surface has a more or less pronounced striation; Bsp of Md is very short. (Poulsen, 1973).

A single species, *P. concentrica* (Müller, 1906), has been found in the analyzed material (Table 3, Appendix 2).

Pseudoconchoecia concentrica (Müller, 1906)

(Pict. 35; Pls 70, 71; Figs 79, 80)

Conchoecia concentrica Müller, 1906b, p. 10, pl. I figs 1–10.
Conchoecia concentrica: Deevey, 1968a, p. 95, figs 48–50; 1970, p. 820, figs 10, 11a, b; Poulsen, 1969a, p. 166, fig. 15.
Pseudoconchoecia concentrica: Poulsen, 1973, p. 150, fig. 75; Angel, 1999, pp. 821, 832, fig. 9.119.
Not *Conchoecia pectinata*: Leveau, 1966, Pls 1–2.

Pict. 35. ***Pseudoconchoecia concentrica***. **A** – female; **B** – male.

Females. L = 1.23–1.51 mm (1.38 ± 0.06 mm; N = 186); H/L = 59.7 ± 2.8% (N = 57).

Plate 70**A**–**D**, **F**–**Q**. Carapace (**A**–**D**): short, tapered anteriorly; PDCs somewhat extended (left more than right) and left PDC ends in point; each of shoulder vaults have rounded wing-like extension; ventral LGGs present and open on posterior margin just above RAG and opposite on left valve; surface of carapace with striation (not shown in drawings). FO (**F**): capitulum wider than stem, with strong spines; distal part of its dorsal surface with shorter and weaker spines; tip pointed. An1 (**F**): 2nd segment with long dorsal seta; shaft with tiny spines ventrally near insertion of 1st and 2nd segments; 4th segment bears a few hairs on dorsal side; e-seta bears short spines along its posterior surface below sensory setae; these latter setae have swollen bases, and as long as a third of e-seta. An2 (**G**, **H**): Prp with medial bulge covered with hairs; surface of Exp1 with small spinules proximally; Enp1 with a- and b- setae having spines; h-, i- and j- setae have rare tiny spines down their shafts. Lb (**J**): dorsal projection with hairs laterally. Md (**K**, **L**): Bsp short, with large epipodial seta; Enp1 bears 4 ventral setae and non-plumose dorsal seta. Mx (**M**): Enp1 has 8 strong spines near distal edge. P5 (**N**): surface of Cxp1–2 with long hairs; Cxp3 has 7 setae in ventral group; Bsp with 7 setae in proximal ventral group (one of them very short and 2 plumose) and 4 setae in distal group (one of them plumose). P6 (**O**): dorsal seta on Bsp relatively short; most distal ventral seta extends beyond distal edge of Enp1. P7 (**P**): longer terminal seta with tiny spines proximally. CF (**Q**): dorsal seta present.

Males. L = 1.18–1.46 mm (1.30 ± 0.05 mm; N = 139); H/L = 56.1 ± 2.1% (N = 49).

Plate 71**A**–**O**. Carapace (**A**–**E**): with a spine-like point on left PDC, right PDC rounded; shoulder vaults well developed but without wing-like extensions; LGGs as in female. FO (**F**): capitulum rather long, its distal part bent upward; its surface with spines mainly in mid-part; tip rounded and with tiny spines. An1 (**F**, **G**): shaft bare; armature of e-seta consists of more than

30 pairs of densely sitting elongated teeth; b-seta has short oval pad and a few spinules distally from pad; d-seta with spinules opposite distal part of e-comb. An2 (**H**–**K**): Prp has medial bulge covered with longer hairs than in female; a-, b-, c- and d- setae powerful, with broad bases and furnished with tiny spines; e-seta present; h-, i- and j- setae thin, about a third of g-seta; right hook appendage considerably larger than left, strongly curved, its base has 2–3 small conic processes (spines), and along its inner surface there are similar but smaller spines; both hook appendages end in 2 tiny papillae. Lb (**L**): slightly more elongated than in female. Md (**M**): differs from that in female by plumose dorsal seta on Enp1. Mx, P5, P7, CF (**O**): similar to those in female. P6 (**N**): all setae on Cxp2, Bsp and Enp1–2 far shorter than in female; dorso-lateral seta on Bsp extremely short; 3 terminal setae on Enp3 almost equal and with long hairs. CA (**O**): exceptionally large, in lateral view has oval shape and about 10 narrow muscle bands.

Juveniles. Earlier instars have delicate, transparent spine-like processes along wing-like extensions (Pl. 70**E**), which are absent or not always seen in later juveniles and adults.

Remarks. Arabian Sea male specimens of *P. concentrica* differ from those described by Deevey (1968) and Poulsen (1973) by smaller numbers of teeth (~ 30 pairs) on An1 e-seta; specimens described earlier had e-seta with 44–50 pairs of teeth.

Distribution. *Pseudoconchoecia concentrica* is a poorly known species recorded from all oceans; geographical range is from 44°S to 46°N; epipelagic and shallow mesopelagic species (Angel et al., 2008). In the Arabian Sea Region, *P. concentrica* was found generally in the northern and central parts of the investigated area (Fig. 79), in 78% of tows. Maximum abundances were recorded at depths 50–100 m (Fig. 80).

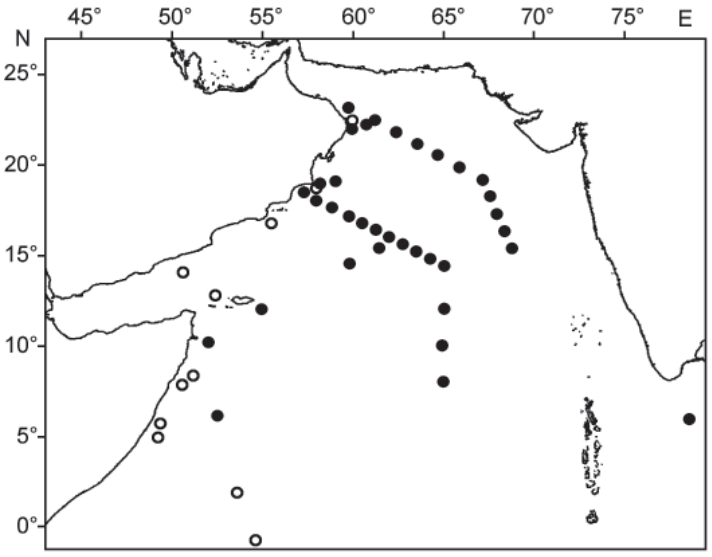


Fig. 79. Occurrence of ***Pseudoconchoecia concentrica*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

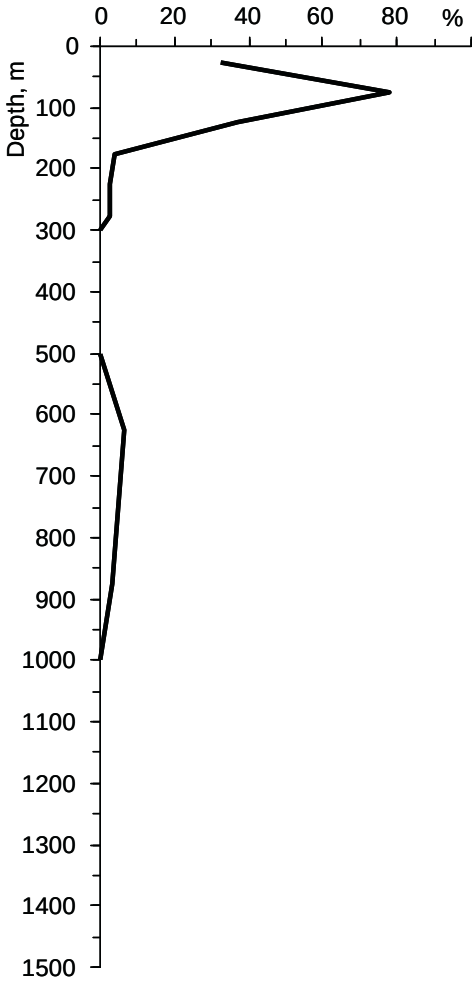


Fig. 80. Occurrence of ***Pseudoconchoecia concentrica*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

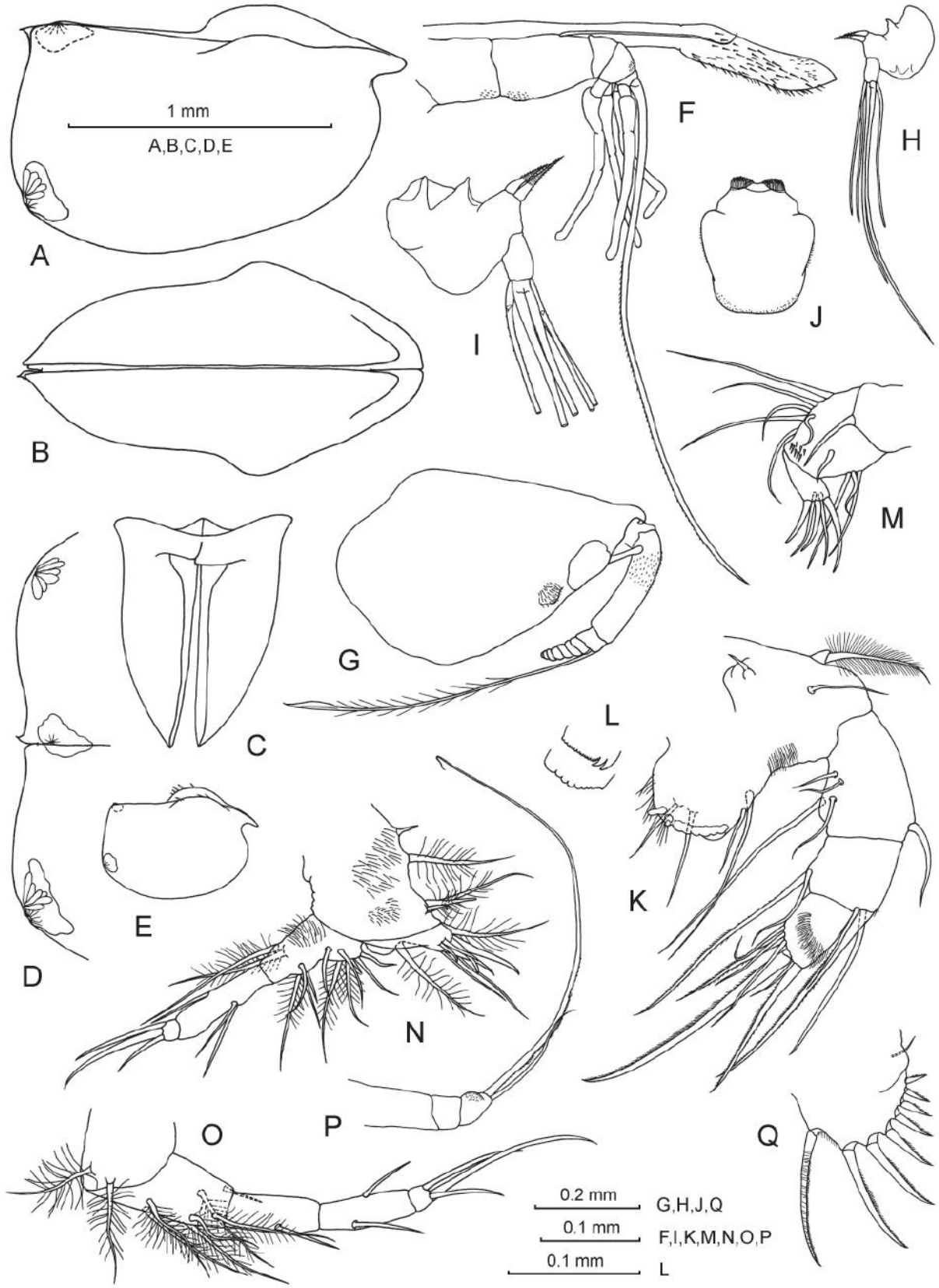


Plate 70. ***Pseudoconchoecia concentrica***, adult female (excluding **E** – lateral view of juvenile). Carapace: **A** – lateral; **B** – ventral; **C** – anterior; **D** – both valves outside: posterior margins. **F** – FO and An1. An2: **G** – Prp and Exp; **H**, **I** – Enp. **J** – Lb. Md: **K** – Bsp, Exp and Enp; **L** – coxal endite: toothed edge and distal tooth-list. **M** – Mx. **N** – P5. **O** – P6. **P** – P7. **Q** – CF.

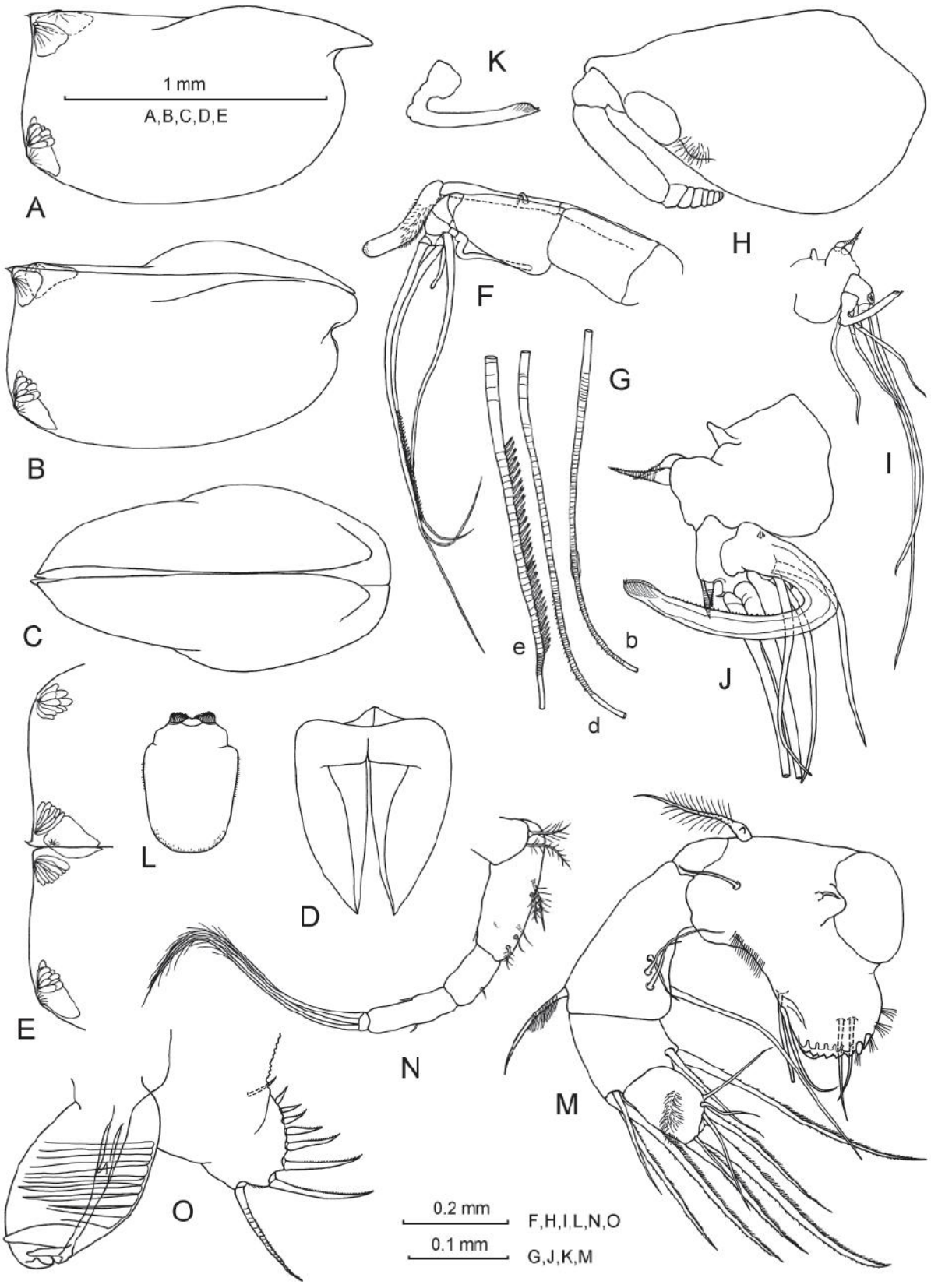


Plate 71. ***Pseudoconchoecia concentrica***, male. Carapace: **A** – lateral; **B** – dorso-lateral; **C** – ventral; **D** –anterior; **E** – both valves outside: posterior margins. **F** – FO and An1. **G** – An1: armature of b-, d- and e- setae. An2: **H** – Prp and Exp; **I**, **J** – right and left Enps; **K** – left hook appendage. **L** – Lb. **M** – Md without Cxp. **N** – P6. **O** – CA and CF.

Tribe **Metaconchoeciini** Chavtur & Angel, 2011

The main characteristics of this tribe are the following: **a**) LAG opens on the anterior third of dorsal margin or on rostrum; **b**) RAG opens more or less closely to PDC; **c**) PDCs rounded, without spine, posterior margin strongly arched; **d**) female An1 with no dorsal seta; **e**) Lb hyaline membrane deeply notched; **f**) Mx Enp1 with 4 setae on anterior side. (Chavtur & Angel, 2011).

Five genera of the tribe Metaconchoeciini have been found in the investigated material: *Clausoecia* Chavtur & Angel, 2011; *Kyrtoecia* Chavtur & Angel, 2011; *Metaconchoecia* Howe, 1955; *Muelleroecia* Chavtur & Angel, 2011; *Nasoecia* Chavtur & Angel, 2011 (Table 3, Plate 72, Appendices 1, 2).

Key to the five genera of **Metaconchoeciini**:

1 LAG opens on dorsal margin of carapace ~ 24–27% L from rostrum tip;
RAG opens on posterior margin of carapace ~ 26–27% H from dorsal margin
(Pl. 72**A**) ………………………………………………………….……………. ***Muelleroecia***

1a LAG on dorsal margin < 20% L from rostrum tip;
RAG on posterior margin < 20% H from dorsal margin …….……...…..……...….……...….. 2

2 LAG on dorsal margin posteriorly from anterior hinge of carapace;
carapace elongated, H/L usually < 50% ………………………..…..……………….………...….. 3

2a LAG on dorsal margin just near anterior hinge of carapace
or on rostrum between anterior hinge and rostrum tip;
carapace shortened, H/L usually > 50% ………….………...………………......…………. 4

3 LAG on dorsal margin ~ 10–13% L from rostrum tip;
RAG on posterior margin < 5% H from dorsal margin
(Pl. 72**B**) …..…... ***Metaconchoecia***

3a LAG on dorsal margin ~ 15–17% L from rostrum tip;
RAG at apex of angle formed by posterior margin ~ 15% H from dorsal margin
(Pl. 72**C**) ……………………………………....…………..……..…………….. ***Clausoecia***

Other features. In males: An1 e-seta with comb of paired spines distally and unpaired proximally; A2 Enp3 with relatively large and strong right hook appendage; distal part of CA with swollen anterior margin. (Pl. 74E, G, O)

4 LAG just on rostrum; RAG on posterior margin ~ 15% H from dorsal margin;
carapace valves with round bulges close to PDC (more developed in female)
(Pl. 72**D**) ……………………………………………………….......………...….. ***Nasoecia***

Other features. In both sexes: small Md Exp present; Md Enp1 with 2 ventral setae; in males: An1 e-seta with paired spines directed proximally; CA elongated, with almost straight posterior and anterior margins. (Pls 77I, 78G, L, Q).

4a LAG just near anterior hinge; RAG on posterior margin ~ 8% H from dorsal margin;
carapace valves without bulges
(Pl. 72**E**) ……………………………………………………...…………………. ***Kyrtoecia***

Other features. In both sexes: Md Exp not developed; Md Enp1 with 1 ventral setae; in males: An1 e-seta with pegs directed at right angles to seta; CA shortened, widened distally. (Pls 75H, 76E, J, O).

The members of three, at present monospecific, genera of tribe Metaconchoeciini, *Clausoecia*, *Kyrtoecia* and *Nasoecia*, are described in this book.

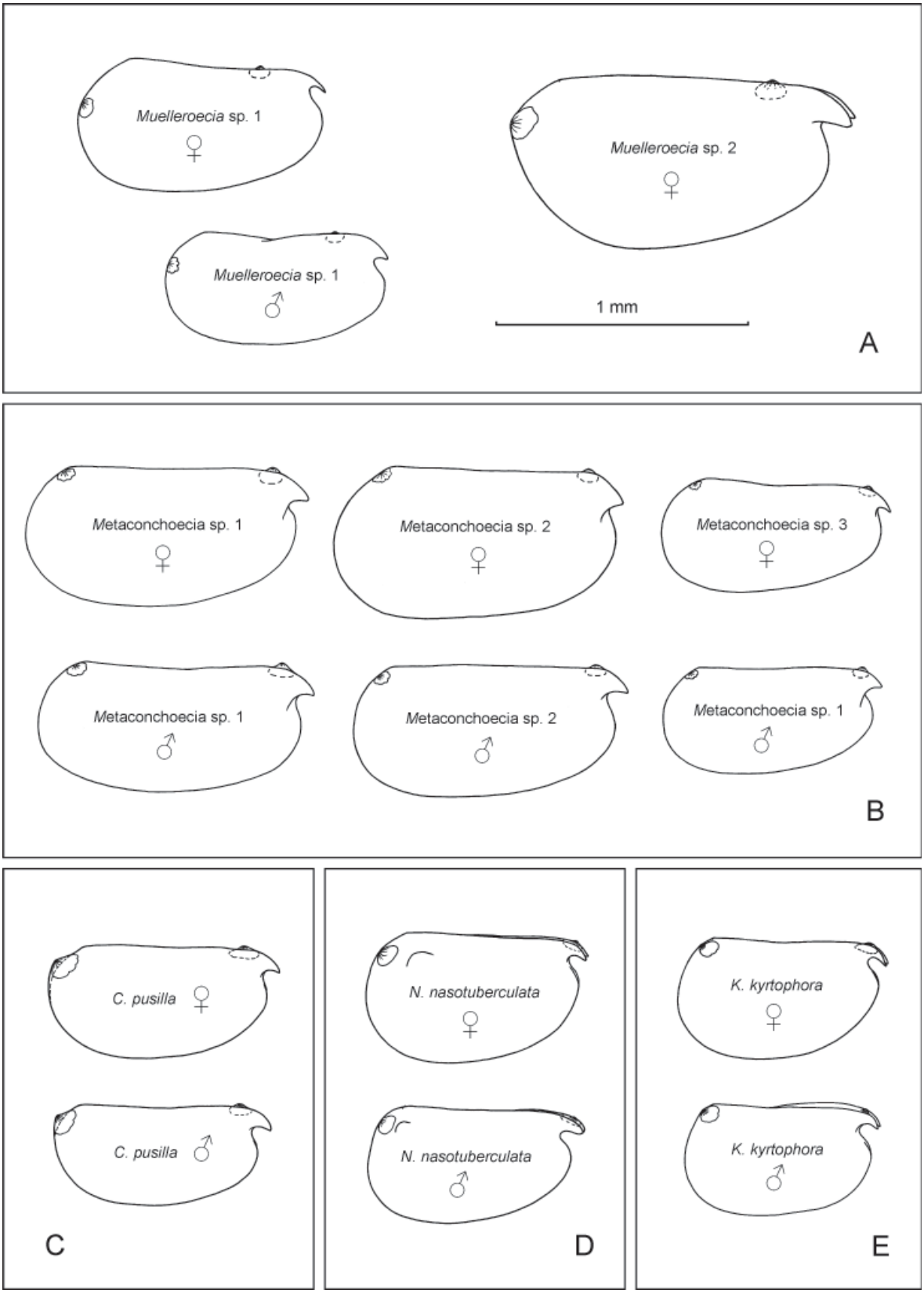


Plate 72. Carapace outlines of the members of different genera in the tribe Metaconchoeciini. **A** – *Muelleroecia*. **B** – *Metaconchoecia*. **C** – *Clausoecia*. **D** – *Nasoecia*. **E** – *Kyrtoecia*.
All drawings are represented in the same scale.

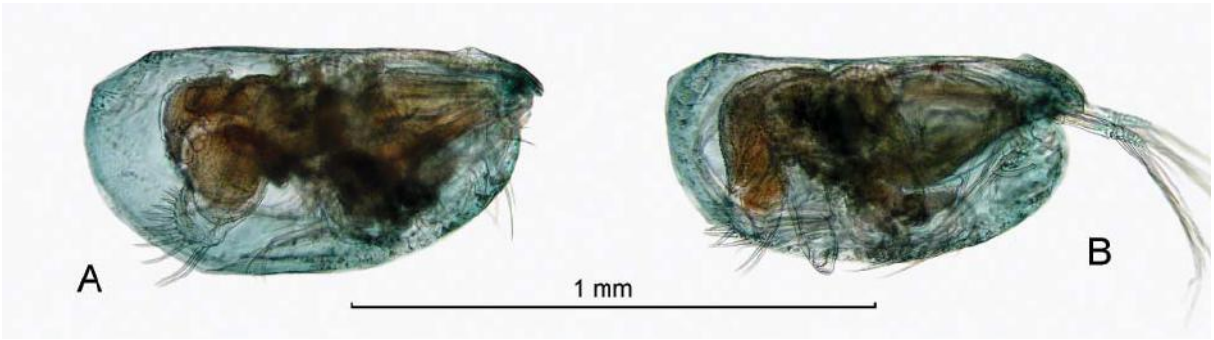
Genus ***Clausoecia*** Chavtur & Angel, 2011

Small species, L 0.71–0.94 mm. Carapace relatively elongated, H/L ~ 50%. LAG opens on dorsal margin ~ 15–17% L from rostrum tip; RAG at apex of angle formed by posterior margin ~ 15% H from dorsal margin. Male An1 has e-comb with ~ 20 spines that are paired distally and unpaired proximally. Currently, the genus is monospecific.

Clausoecia pusilla (Müller, 1906)

(Pict. 36; Pls 73, 74; Figs 81, 82)

Conchoecia pusilla var. *major* and var. *minor* Müller, 1906a, p. 80, 81, pl. XVI figs 30–39, pl. XVII figs 35–36.
Conchoecia pusilla major: Deevey, 1968a, p. 57, fig. 25.
Conchoecia pusilla: Gooday, 1981, p. 144, fig. 5A, C.
Metaconchoecia pusilla: Poulsen, 1973, p. 78; Angel, 1999, pp. 820, 831, fig. 9.71.
Clausoecia pusilla: Chavtur & Angel, 2011, p. 45.



Pict. 36. ***Clausoecia pusilla***. **A** – female; **B** – male.

Females. L = 0.75–0.94 mm (0.86 ± 0.03 mm; N = 87); H/L = 50.4 ± 1.7% (N = 10).

Plate 73**A**–**M**. Carapace (**A**–**C**): elongated; posterior and anterior ventral corners rounded; posterior margin strongly arched and formed an angle (~ 15% H from dorsal margin); RAG opens at apex of this angle; LAG opens behind rostrum, moved somewhat backwards from anterior hinge of dorsal margin. FO (**D**): straight, no differentiation between stem and capitulum; the latter widened in its anterior part, with slightly pointed tip, covered with short hairs, which are more numerous on ventral surface. An1 (**D**): sensory setae (a–d) longer than half e-seta; e-seta rather short (~ 1.5 times longer than shaft), with short spines on its posterior side distally. An2 (**E**, **F**): medial bulge on Prp without hairs; g-seta on Enp2 only somewhat longer than f-, h-, i- and j- setae. Lb (**G**): in dorsal projection short and broad, anterior edge almost straight; hyaline membrane with deep notch. Md (**H**): Bsp without epipodial seta and with long lateral seta on inner side; Enp1 has plumose dorsal seta and only 1 ventral seta. Mx (**I**): seta on Bsp missing; Enp1 with 4 setae on anterior side, 3 on posterior, 1 laterally and 4–5 small spines near distal edge. P5 (**J**): Cxp3 with 7 setae in ventral group; Bsp bears 5 setae in proximal ventral group, 2 in distal, 1 long dorsal seta and 1 dorso-lateral (all these setae non-plumose); dorsal terminal seta on Enp2 is longer than central and ventral setae. P6 (**K**): Cxp2 with 1 plumose seta and 1 non-plumose; Bsp with 5 ventral and 1 dorso-lateral setae (all plumose); dorsal seta missing; dorso-lateral seta and most distal ventral seta are long, extending over half Enp2. P7 (**L**): both terminal setae with no spinules. CF (**M**): broad, with dorsal seta.

Males. L = 0.71–0.87 mm (0.80 ± 0.03 mm; N = 69); H/L = 49.8 ± 2.0% (N = 6).

Plate 74**A**–**P**. Carapace (**A**–**C**): in lateral view similar to that of female; in ventral view with far broader rostrum; MGGs absent. FO (**D**): capitulum elongated, with widened anterior

part and round tip, proximal 2/3 of its ventral surface covered with rather long hairs. An1 (**D**, **E**): a-seta long and equal to total length of 1st and 2nd segments; e-seta with comb having 4–5 paired spines and 10–11 unpaired; b-seta has a few fine spines opposite distal part of e-comb; b- and d- setae slightly shorter than e-seta. An2 (**F**–**H**): inner surface of Prp with medial bulge covered with tiny spinules; Enp2 with short c-, d- and e- setae; right hook appendage very large and strong; both hook appendages strongly curved and with pointed tips. Lb (**I**): dorsal projection more elongated than in female. Md (**J**): as in female, besides a few short spines on anterior surface of Enp2. Mx (**K**), P5 (**L**), P7 (**N**), CF (**P**): similar to those in female. P6 (**M**): setation of Cxp, Bsp and Enp1–2 as in female but all setae shorter; 3 terminal setae on Enp3 almost equal and with long hairs. CA (**O**): has 4 muscle bands and strongly swollen distal part of its anterior margin; posterior edge almost straight; end rounded.

Remarks. Müller (1906a) described two subspecies of *C. pusilla*: "*major*" (females 0.90–0.98 mm and males 0.85–0.95 mm) and "*minor*" (females 0.70–0.85 mm and males 0.70–0.85 mm). In addition to size, these subspecies differ in the armature of An1 e-seta: about 8 paired and 10 unpaired spines on e-seta of larger subspecies, 4 paired and 8 unpaired spines in smaller one. *C. pusilla* from our materials have the number of spines on e-seta (4–5 paired and 10–11 unpaired; see Pl. 74E) closer to Müller's *C. pusilla minor*.

Distribution. *Clausoecia pusilla* is recorded from all oceans; latitudinal range is 46°S to 60°N, but it is absent from the North and Central Pacific oceans; predominantly a deep mesopelagic species with a range of 500–1000 m (Angel et al., 2008). In the investigated area (Fig. 81), *C. pusilla* was found in 19% of tows. Maximum abundances were recorded at depths 500–1000 m (Fig. 82).

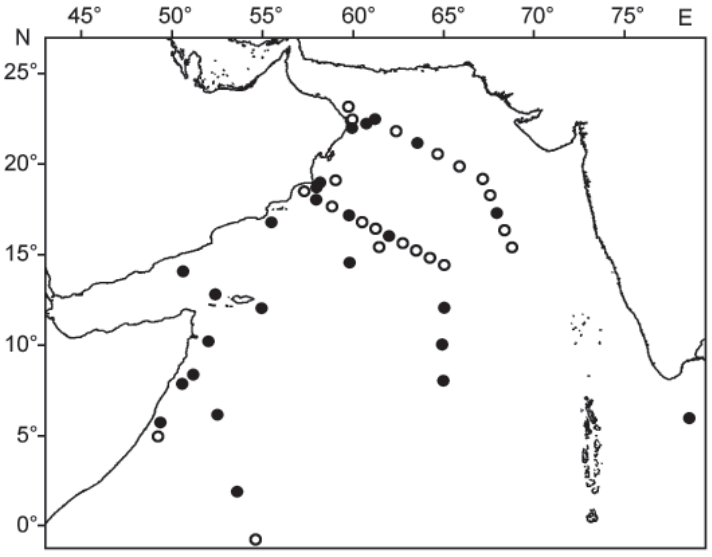


Fig. 81. Occurrence of ***Clausoecia pusilla*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

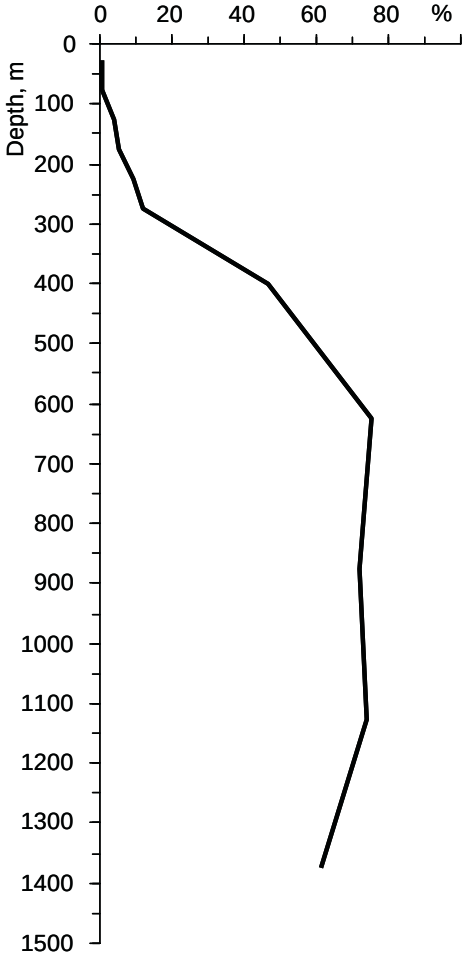


Fig. 82. Occurrence of ***Clausoecia pusilla*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

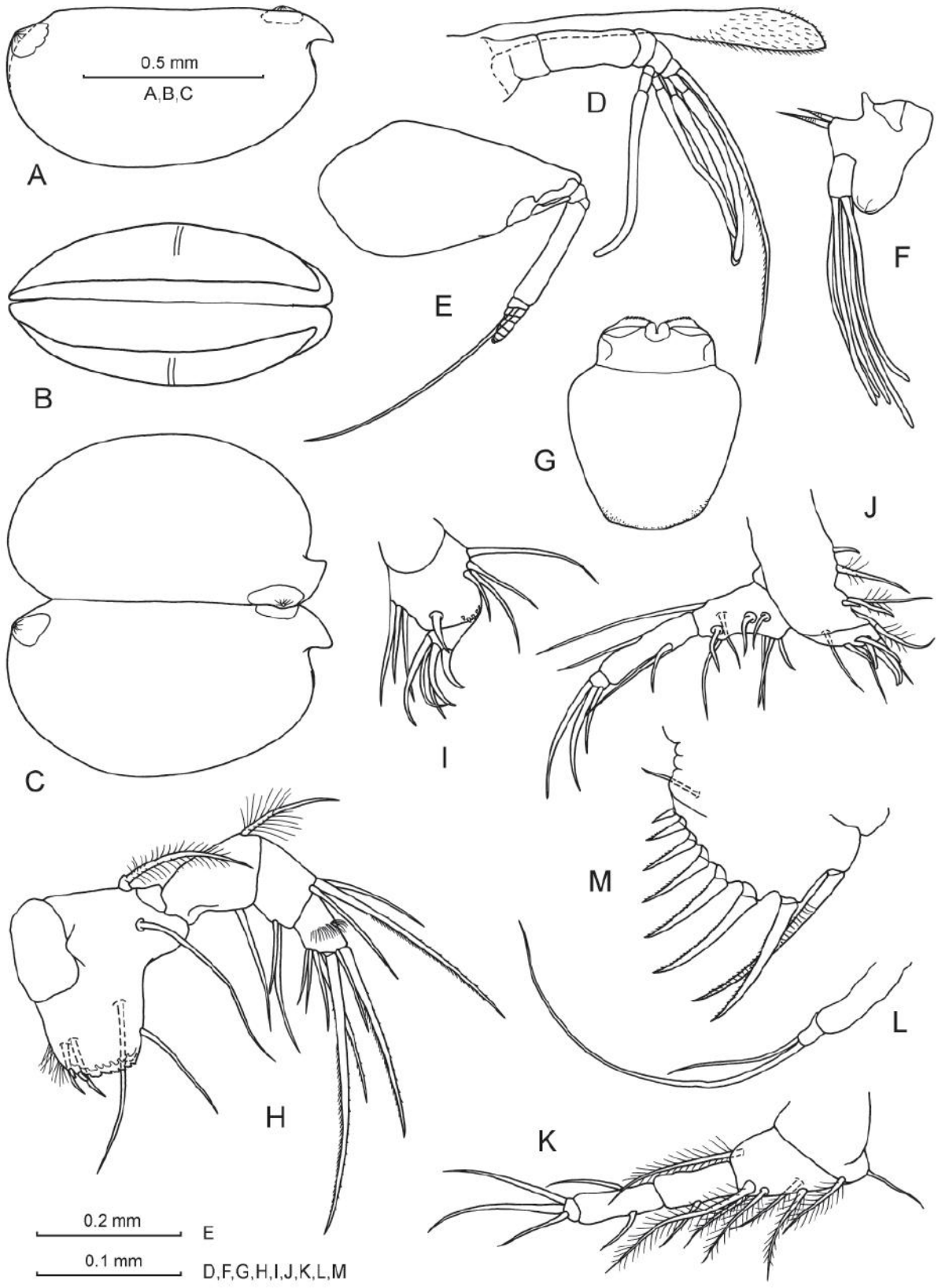


Plate 73. ***Clausoecia pusilla***, female. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside. **D** – FO and An1. An2: **E** – Prp and Exp; **F** – Enp. **G** – Lb. **H** – Md without Cxp. **I** – Mx. **J** – P5. **K** – P6. **L** – P7. **M** – CF.

Plate 74. ***Clausoecia pusilla***, male. Carapace: **A** – lateral; **B** – both valves outside; **C** – ventral. **D** – FO and An1. **E** – other specimen: armature of e-seta. An2: **F** – Prp and Exp; **G** – right Enp; **H** – left hook appendage. **I** – Lb. **J** – Md without Cxp. **K** – Mx. **L** – P5. **M** – P6. **N** – P7. **O** – CA. **P** – CF.

Genus ***Kyrtoecia*** Chavtur & Angel, 2011

Small species, L 0.74–0.85 mm. Carapace shortened, H/L > 50%. LAG opens on dorsal margin just near anterior hinge, RAG on posterior margin ~ 8% H from dorsal margin. An1 e-seta with 18-20 pegs placed in two rows at right angles to seta. These pegs paired distally and alternated proximally. Currently, the genus is monospecific.

Kyrtoecia kyrtophora (Müller, 1906)

(Pict. 37; Pls 75, 76; Figs 83, 84)

Conchoecia kyrtophora Müller, 1906a, p. 82, pl. XVII figs 1, 3–10.
Conchoecia kyrtophora: Deevey, 1974, p. 364, fig. 5g; Angel, 1981, p. 53, figs 4–6; Cooday, 1981, p. 144, fig. 4B, E.
"*Metaconchoecia*" *kyrtophora*: Martens, 1979, p. 352.
Metaconchoecia kyrtophora: Angel, 1999, pp. 820, 831, fig. 9.66.
Kyrtoecia kyrtophora: Chavtur & Angel, 2011, p. 50.

Pict. 37. ***Kyrtoecia kyrtophora***. **A** – female; **B** – male.

Females. L = 0.78–0.85 mm (0.81 ± 0.02 mm; N = 23); H/L = 55.9 ± 2.8% (N = 9).

Plate 75**A**–**L**. Carapace (**A**–**C**): relatively short; posterior margin swollen, all corners rounded; LAG opens just near anterior hinge of valves; RAG opens on posterior margins of right valve ~ 8% H from dorsal margin. FO (**D**): almost straight; no clear differentiation between stem and capitulum; capitulum widened distally, with fine hairs on all surfaces except dorsal one; its tip rounded. An1 (**D**): sensory setae (a–d) longer than half e-seta; e-seta rather short (less than 1.5 times longer than shaft), with short spines on posterior side distally. An2 (**E**, **F**): Prp with medial bulge covered with hairs; a- and b- setae on Enp1 bare; c-, d- and e- setae missing; remaining setae about equal. Lb (**G**): in dorsal projection rather short and broad, strongly narrowed anteriorly; hyaline membrane deeply notched. Md (**H**): Bsp with long disto-lateral seta on inner side, epipodial appendage without seta; Exp not developed; on its place there is only rather short, plumose seta; Enp1 has non-plumose dorsal seta and a single ventral one. Mx (**I**): Bsp without seta; Enp1 with 4 setae on anterior side, 3 on posterior, 1 laterally and a few tiny spines near distal edge. P5 (**J**): Cxp3 with 7 setae in ventral group; Bsp bears 5 setae in proximal ventral group, 2 in distal ventral group, 1 dorsal seta and 1 dorso-lateral. P6 (**K**): Cxp2 with 2 non-plumose setae; Bsp with 5 ventral setae (2 of them plumose, most distal seta extends over distal edge of Enp2) and long dorso-lateral non-plumose seta; dorsal seta on Bsp missing. P7 (**L**): both terminal setae without spines. CF (as in male in Pl. 76 O): unpaired dorsal seta absent.

Males. L = 0.74–0.83 mm (0.77 ± 0.02 mm; N = 27); H/L = 56.6 ± 2.7% (N = 10).

Plate 76**A**–**O**. Carapace (**A**–**C**): less tapered anteriorly than in female; in ventral view with a clear constriction behind shoulder vaults; MGGs missing. FO (**D**): capitulum long, swollen distally, with rather long hairs in middle part of ventral surface. An1 (**D**, **E**):

a-seta only slightly thickened proximally, long, extends to base of 1st segment; c-seta about equal total length of 3rd, 4th and 5th segments; e-seta with comb having 18–20 pegs placed in two rows at right angles to axis of seta; b- and d- setae shorter than e-seta and has a few fine spines opposite distal part of e-comb. An2 (**F**–**H**): inner surface of Prp bare; c- and d- setae short; e-seta extremely minute; remaining setae slightly thickened proximally; both hook appendages form acute angles near their bases and terminate in 2 tiny papillae; right hook appendage larger than left. Lb (**I**), and also Mx (**K**), P5 (**L**), P7 (**N**), CF (**O**): similar to those in female. Md (**J**): Enp1 with plumose dorsal seta. P6 (**M**): Cxp2 with 2 non-plumose setae; all setae on Bsp and Enp1–2 far shorter than in female; 3 terminal setae on Enp3 almost equal and with long hairs. CA (**O**): shortened, its distal part widened, end rounded; has 3 muscle bands.

Distribution. *Kyrtoecia kyrtophora* is recorded from all oceans; its geographical range is from 32°N in the Atlantic Ocean to 65°S to the south of Australia; shallow mesopelagic species, most abundant at depths 50–400 m; before Angel's (1981) descriptions of this species and similar *N. nasotuberculata* there was confusion between these species (Angel et al., 2008). In the Arabian Sea Region, *K. kyrtophora* was found mainly in the southern and central parts of the investigated area (Fig. 83), in 14% of tows. Maximum abundances were recorded at depths 150–300 m (Fig. 84).

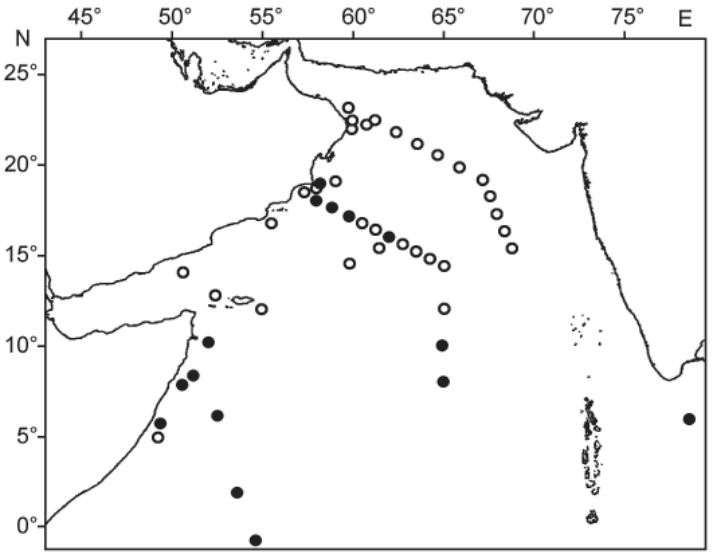


Fig. 83. Occurrence of ***Kyrtoecia kyrtophora*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

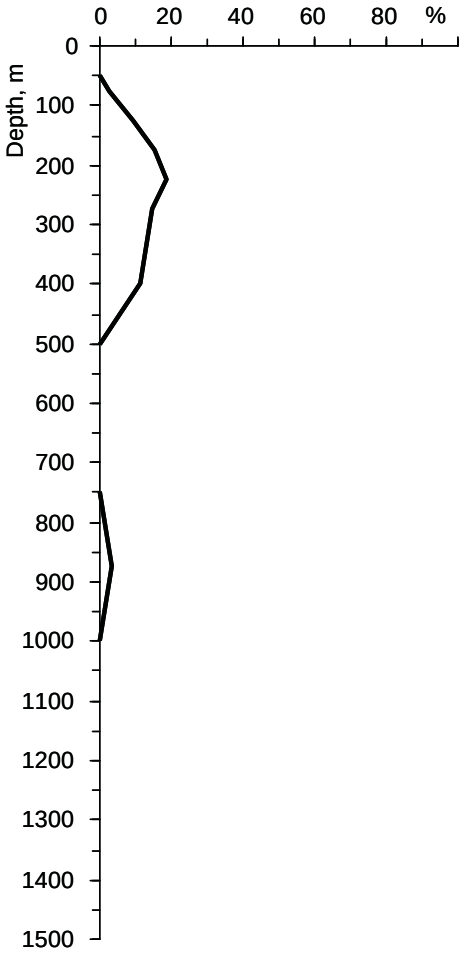


Fig. 84. Occurrence of ***Kyrtoecia kyrtophora*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

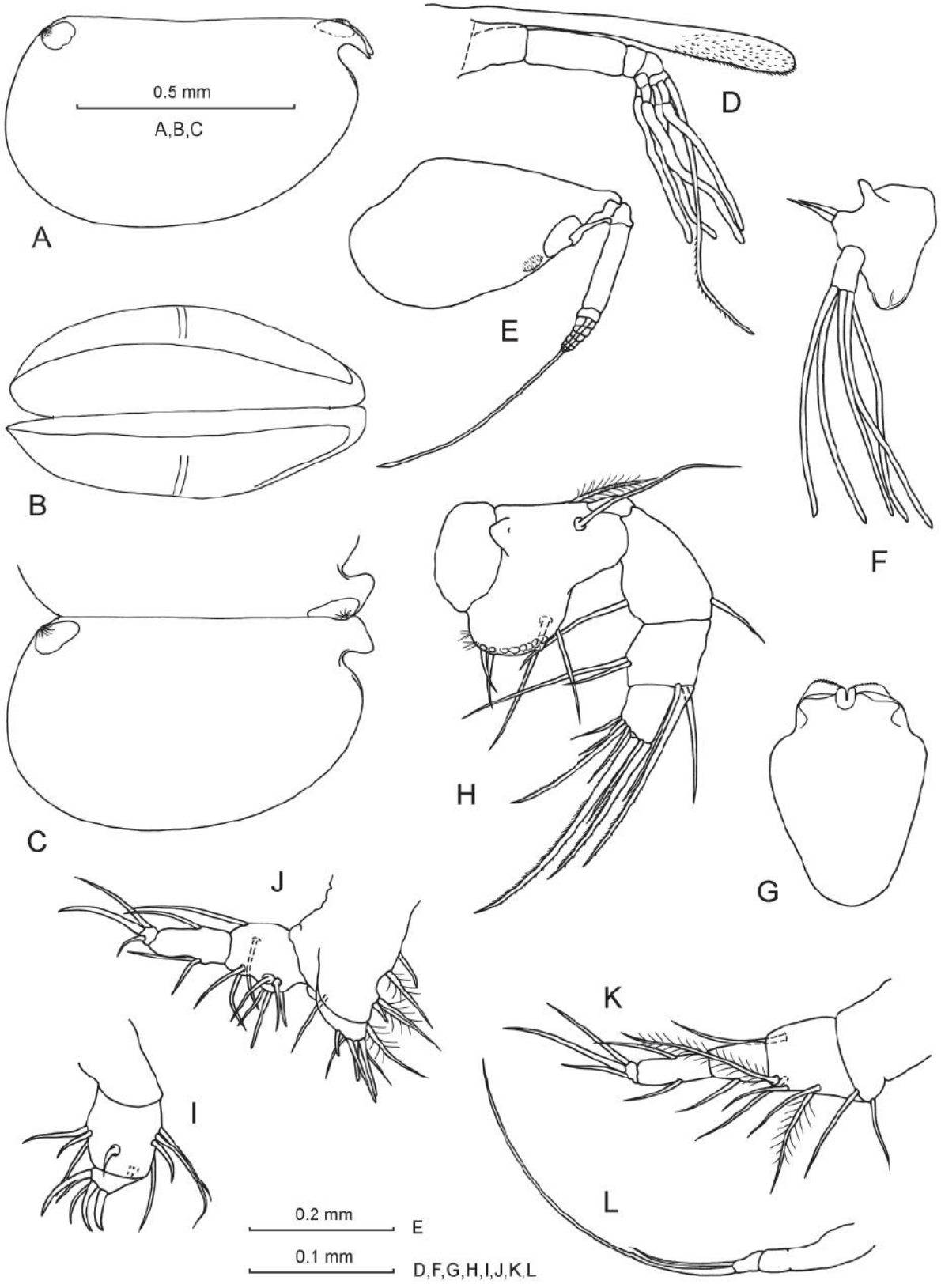


Plate 75. ***Kyrtoecia kyrtophora***, female. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside. **D** – FO and An1. An2: **E** – Prp and Exp; **F** – Enp. **G** – Lb. **H** – Md without Cxp. **I** – Mx. **J** – P5. **K** – P6. **L** – P7.

Plate 76. ***Kyrtoecia kyrtophora***, male. Carapace: **A** – lateral; **B** – ventral; **C** – both valves outside. **D** – FO and An1. **E** – An1: armature of b-, d- and e- setae. An2: **F** – Prp and Exp; **G** – right Enp; **H** – left hook appendage. **I** – Lb. **J** – Md without Cxp. **K** – Mx. **L** – P5. **M** – P6. **N** – P7. **O** – CA and CF.

Genus *Nasoecia* Chavtur & Angel, 2011

Small species, L 0.75–0.90 mm. Carapace shortened, H/L > 50%. LAG opens just on rostrum, RAG on posterior margin ~ 15% H from dorsal margin. Carapace valves with symmetrically placed, round bulges close to PDC. Male An1 e-seta with comb of 13 pairs of spines directed proximally. Currently, the genus is monospecific.

Nasoecia nasotuberculata (Müller, 1906)

(Pict. 38; Pls 77, 78; Figs 85, 86)

Conchoecia nasotuberculata Müller, 1906a, p. 83, pl. XVIII figs 25–30, pl. XVII fig. 2 (female's carapace represented as *kyrtophora*).
Conchoecia nasotuberculata: Deevey, 1970, p. 810, figs 5, 6; 1974, p. 364, fig. 5a; Angel, 1981, p. 47; figs 1–3; Gooday, 1981, p.144, fig. 4A, D.
Metaconchoecia nasotuberculata: Poulsen, 1973, p. 74, fig. 37 (male); Angel, 1999, pp. 820, 831, fig. 9.69.
Nasoecia nasotuberculata: Chavtur & Angel, 2011, p. 48.

Pict. 38. ***Nasoecia nasotuberculata***. **A** – female; **B** – male.

Females. L = 0.80–0.90 mm (0.84 ± 0.03 mm; N = 26); H/L = 55.5 ± 2.0% (N = 14).

Plate 77**A**–**M**. Carapace (**A**–**D**): relatively short, with rounded corners; has round bulges close to PDCs symmetrically on both valves which protrude in ventral and latero-ventral view; LAG opens just on rostrum, between its tip and anterior hinge of valves, closer to the latter; RAG opens on posterior margin of right valve ~ 15% of H from dorsal margin. FO (**E**): almost straight; capitulum broader than stem and covered with short hairs on ventral surface and posteriorly on dorsal; its tip rounded. An1 (**E**): sensory setae (a–d) shorter than half e-seta; e-seta ~ 2 times longer than shaft, with short spines on posterior side below sensorly setae. An2 (**F**, **G**): Prp with medial bulge covered with hairs; a- and b- setae on Enp1 with fine spinules; 5 setae on Enp2+3 about equal. Lb (**H**): in dorsal projection rather short; anterior part narrowed, with rounded edge; hyaline membrane with deep notch. Md (**I**): Bsp with long lateral seta on inner side, and epipodial appendage without seta; Exp present; Enp1 has plumose dorsal seta and 2 ventral setae. Mx (**J**): Bsp without setae; Enp1 with 4 setae on anterior side, 3 on posterior, 1 laterally and a few tiny spines near distal edge. P5 (**K**): Cxp3 with 7 setae in ventral group; Bsp bears 5 setae in proximal ventral group, 2 in distal ventral group, 1 dorsal seta and 1 plumose dorso-lateral seta. P6 (**L**): Cxp2 with 1 plumose seta and 1 non-plumose; Bsp with most distal ventral seta extending slightly beyond distal edge of Enp1 and a dorso-lateral non-plumose seta, which is reaching to half of Enp1; both setae far shorter than those in *K. kyrtophora* (Pl. 75K); dorsal seta missing. CF (**M**): unpaired dorsal seta absent.

Males. L = 0.75–0.85 mm (0.83 ± 0.03 mm; N = 14); H/L = 52.8 ± 3.4% (N = 8).

Plate 78**A**–**R**. Carapace (**A**–**D**): slightly more elongated than in female; symmetrical lateral bulges present but less than in female and not visible in ventral view. FO (**E**): capitulum rather

long, thickened, covered with rather long hairs on ventral surface and shorter hairs on dorsal one proximally. An1 (**F**, **G**): a-seta noticeably thickened proximally, with the curving, slightly longer than 2nd segment; c-seta shorter than total length of 3rd, 4th and 5th segments; e-seta has comb of 13 paired spines directed proximally and rarely placed hairs distally; b- and d- setae with a few fine spines opposite distal part of comb; both these setae slightly shorter than e-seta. An2 (**H**–**J**): Prp has medial bulge covered with hairs; a- and b- setae on Enp1 with tiny marginal spinules; e-seta on Enp2 present; f-seta only slightly shorter than g-seta; h-, i- and j-setae become thicker proximally; left hook appendages rather gently curved; right appendage more curved than left, has almost right angle near its base; both appendages with round tips. Lb (**K**), Mx (**M**), P5 (**N**), CF (**R**): similar to those in female. Md (**L**): as in female except more elongated Bsp and long hairs on anterior surface of Enp2. P6 (**O**): Cxp2 with 2 non-plumose setae; almost all setae on Bsp and Enp1–2 strongly reduced, dorsal and dorso-lateral setae missing; 3 terminal setae on Enp3 almost equal and with long hairs. P7 (**P**): both terminal setae without spines. CA (**Q**): elongated, with almost straight posterior and anterior edges and rounded end; has 4 muscle bands.

Distribution. *Nasoecia nasotuberculata* is recorded from all oceans, but absent in the north and central Pacific Ocean. Geographical range is from 54°S to 32°N, "although not all records may be correct, because there was confusion between this species and similar *K. kyrtophora* until Angel's (1981) descriptions of both species" (Angel et al., 2008); predominantly shallow mesopelagic species, most abundant at 200–300 m (Angel, 1981). In the investigated area, *N. nasotuberculata* was found mainly from the upwelling zones along the shores of Somalia and Oman (Fig. 85), in 9% of tows. Maximum abundances were recorded at depths 200–300 m (Fig. 86).

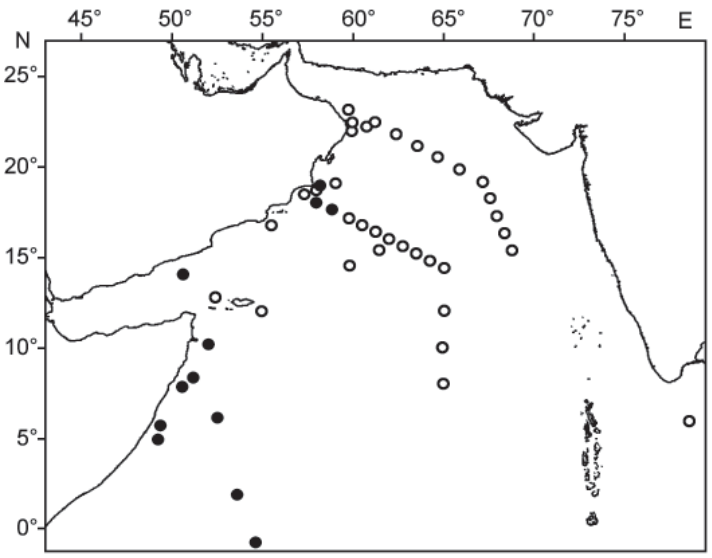


Fig. 85. Occurrence of ***Nasoecia nasotuberculata*** at the stations listed in Table 1. Circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

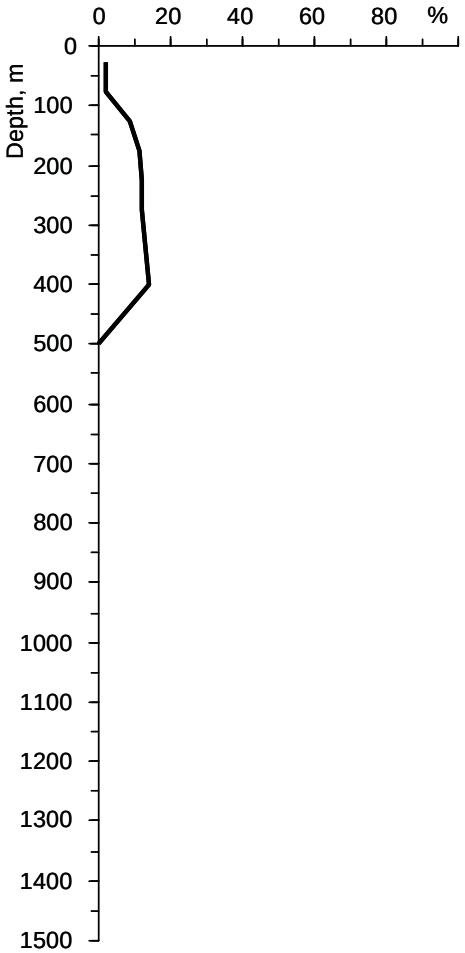


Fig. 86. Occurrence of ***Nasoecia nasotuberculata*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

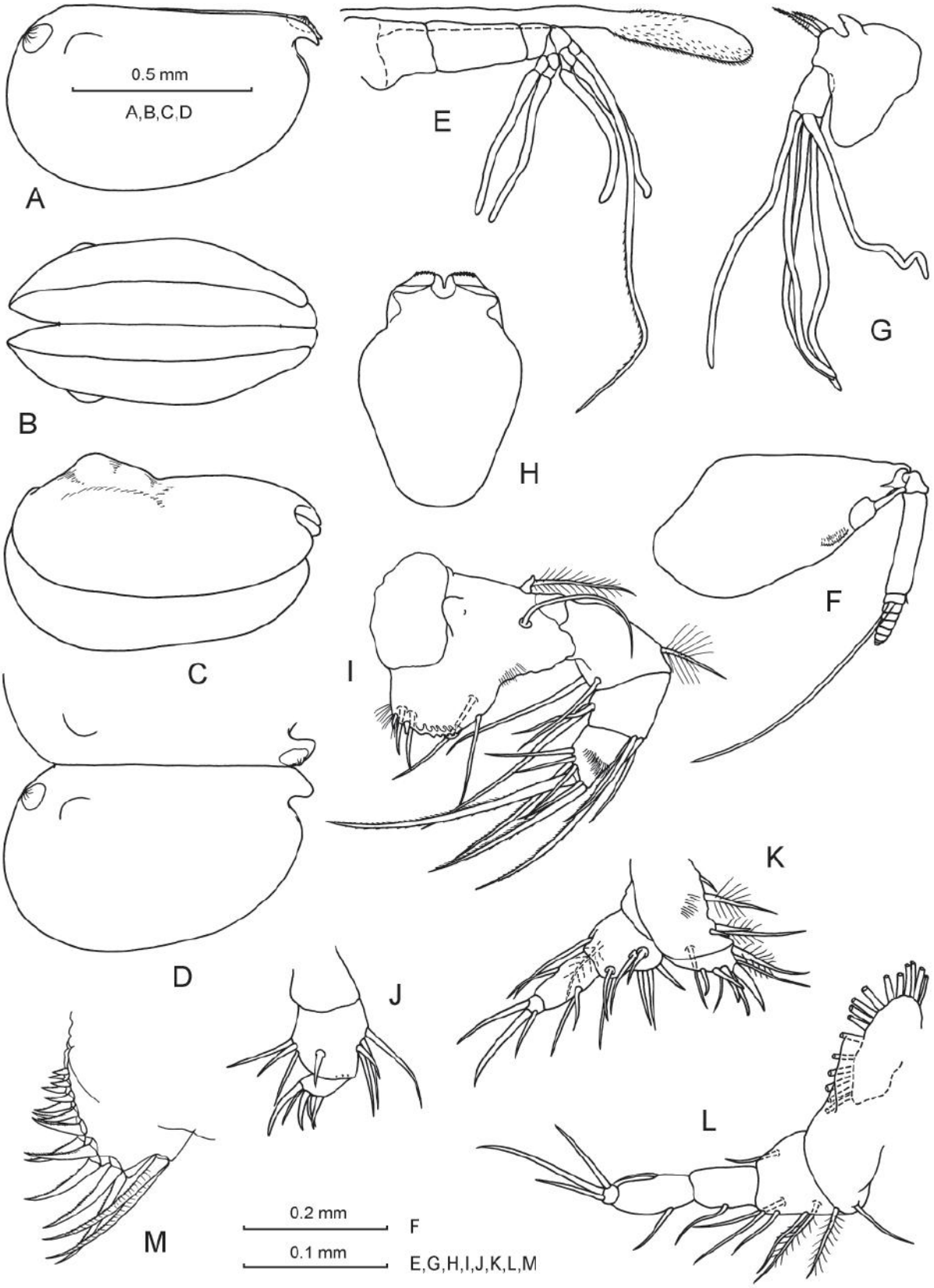


Plate 77. ***Nasoecia nasotuberculata***, female. Carapace: **A** – lateral; **B** – ventral; **C** – latero-ventral; **D** – both valves outside. **E** – FO and An1. An2: **F** – Prp and Exp; **G** – Enp. **H** – Lb. **I** – Md without Cxp. **J** – Mx. **K** – P5. **L** – P6. **M** – CF.

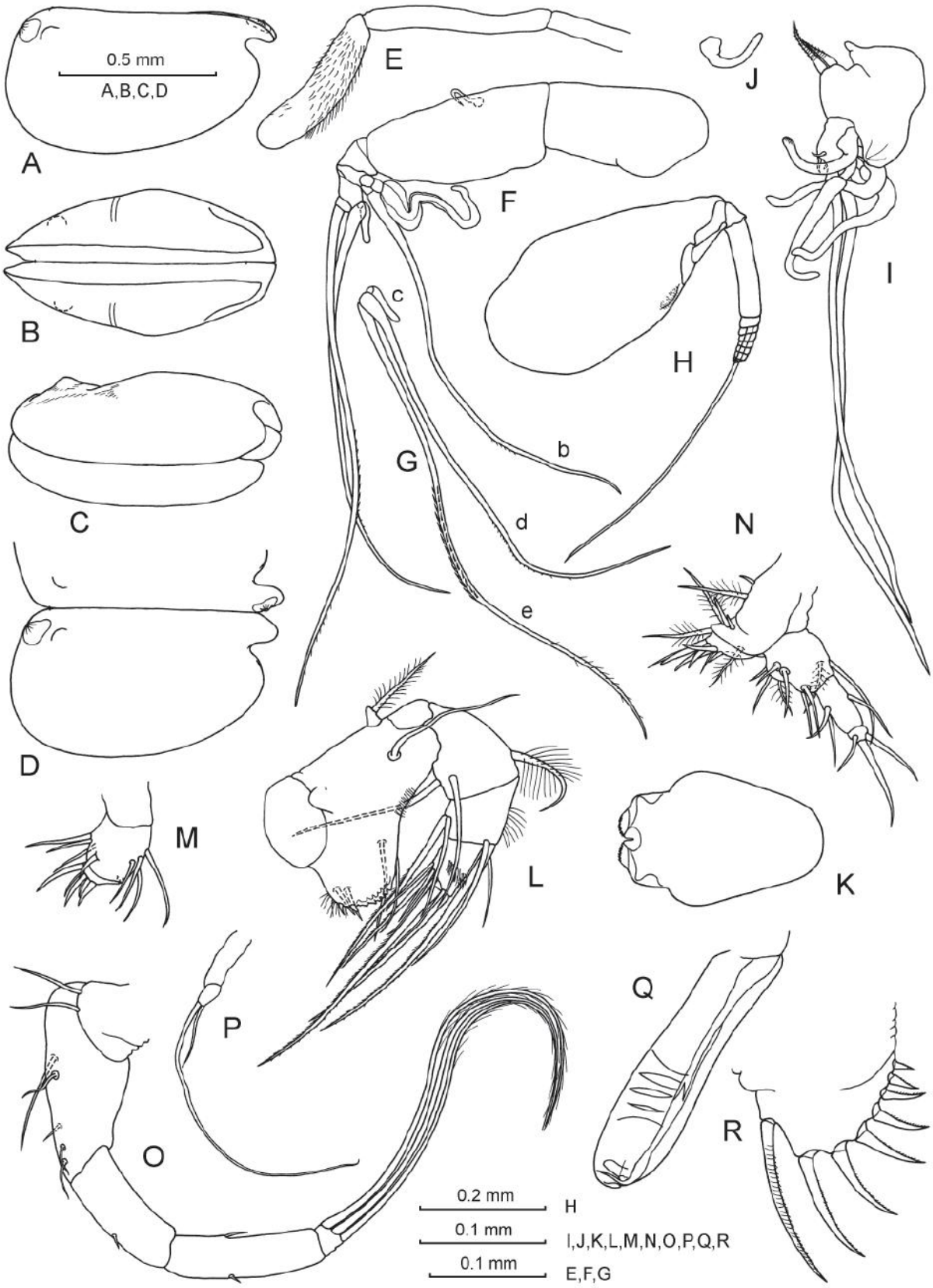


Plate 78. ***Nasoecia nasotuberculata***, male. Carapace: **A** – lateral; **B** – ventral; **C** – latero-ventral; **D** – both valves outside. **E** – FO. **F** – An1. **G** – An1: c-, d- and e- setae. An2: **H** – Prp and Exp; **I** – right Enp; **J** – left hook appendage. **K** – Lb. **L** – Md without Cxp. **M** – Mx. **N** – P5. **O** – P6. **P** – P7. **Q** – CA. **R** – CF.

Subfamily **Euconchoeciinae** Poulsen, 1969

At the present time, the two genera, *Bathyconchoecia* Deevey, 1968 and *Euconchoecia* Müller, 1891 belong to this subfamily.

Key to the genera of **Euconchoeciinae**:

1 Terminal segments of An1 with more than 100 sensory and other setae;
CF with 8 claws (see Deevey, 1968b) ..……...…….…..... ***Bathyconchoecia***

1a Terminal segments of An1 with 20–30 sensory and other setae;
CF with 7 claws (as in Pls 79E, N, 80E, P) ……...…….…….…..... ***Euconchoecia***

Only two juvenile specimens belonging to the genus *Bathyconchoecia* were found in the investigated material (Table 3, Appendix 1). The members of *Euconchoecia* are described below.

Genus ***Euconchoecia*** Müller, 1891

Carapace is transparent, tapered anteriorly and posteriorly; RAG and LAG open symmetrically on the posterior margins near PDCs; the terminal segments of An1 with 20–30 sensory and other setae. Also, "adult females of *Euconchoecia* are unique among other halocyprids, because they brood their embryos within the carapace" (Angel et al., 2008).

Two or possibly three species of *Euconchoecia* have been found in the analyzed material: *E.* cf. *aculeata* (Scott, 1894), its elongate form *E.* aff. *aculeata elongata* Müller, 1906, and *E.* cf. *chierchiae* Müller, 1891[1] (Table 3, Appendices 1, 2). All these are described below.

Key to the species of ***Euconchoecia*** (adult females and males):

1 PDCs not extended, usually both with small spines;
FO shorter than An1; seta at 6th segment of An1 with long hairs on anterior side;
Md Bsp with disto-lateral seta; Mx with 5 anterior and 4 posterior setae;
P5 Bsp with 2 setae in distal ventral group and always with 2 dorso-lateral setae;
P6 Bsp with 5 ventral setae; P6 Enp2 with 2 ventral setae
(Fig. 87**E, F**; Pls 83A, C, D, F, L–O, 84A, C, E, L–O) ……..…..... ***E.*** cf. ***chierchiae***

1a PDCs extended, both with longer spines;
FO longer than An1; seta at 6th segment of An1 without long hairs;
Md Bsp without disto-lateral seta; Mx with 3 anterior and 3 posterior setae;
P5 Bsp with 1 seta in distal ventral group and usually with 1 dorso-lateral seta;
P6 Bsp with 3–4 ventral setae; P6 Enp2 with 1 ventral seta
(Fig. 87**A–D**; Pls 79–82) …..... ***E.*** cf. ***aculeata*** + ***E.*** aff. ***a. elongata***

[1] During the assembly of this book, a paper was published (Graves, 2011) in which the type specimens of *E. chierchiae* and *E. aculeata* from the Atlantic Ocean were redescribed and the two size forms of *Euconchoecia* from the Gulf of Oman were described as separate species (*E. hormuzensis* and *E. omanensis*). The *Euconchoecia* species in our materials differ from the redescribed *E. aculeata* and *E. chierchiae* (see below: Remarks, pp. 199 and 207). They also differ from the new species described by Graves from the Gulf of Oman (see Remarks, p. 202). Therefore the *Euconchoecia* species from our materials need redescription, most probably as three separate species. Because of uncertainty about the systematic position of these species, they are presented in this book as *E.* cf. *aculeata*, *E.* aff. *aculeata elongata* and *E.* cf. *chierchiae*. The two firsts are the size forms of one species herein, in accordance with Müller (1906a) who described the elongate form.

Key to the size forms of ***Euconchoecia*** cf. ***aculeata***:

Adult females:

1 Usually L < 1.1 mm; mean H/L 41%;
Md Enp1 more often with 3 (sometimes 2) ventral setae;
P6 Bsp with 3 ventral setae; 2 longest terminal setae on
P6 Enp3 not longer than total length of Enp1 to Enp3
(Fig. 87**A**; Pl. 79I, L) ……..…..... ***E.*** cf. ***aculeata***

1a Usually L > 1.1 mm; mean H/L 34%;
Md Enp1 usually with 2 ventral setae, sometimes with 3 setae;
P6 Bsp with 4 (sometimes 3) ventral setae; 2 longest terminal setae on
P6 Enp3 longer than total length of Enp1 to Enp3
(Fig. 87**C**; Pl. 81J, M) ……..……. ***E.*** aff. ***aculeata elongata***

Adult males:

1 Usually L < 1.0 mm; mean H/L 43%;
Md Enp1 with 3 ventral setae;
P6 Bsp usually with 3 ventral setae
(Fig. 87**B**; Pl. 80J, M, N) …….……...…….....…..... ***E.*** cf. ***aculeata***

1a Usually L > 1.0 mm; mean H/L 40%;
Md Enp1 usually with 3 ventral setae, sometimes with 2 setae;
P6 Bsp with 3–4 ventral setae
(Fig. 87**D**; Pl. 82J, K, N) ……...……..…...… ***E.*** aff. ***aculeata elongata***

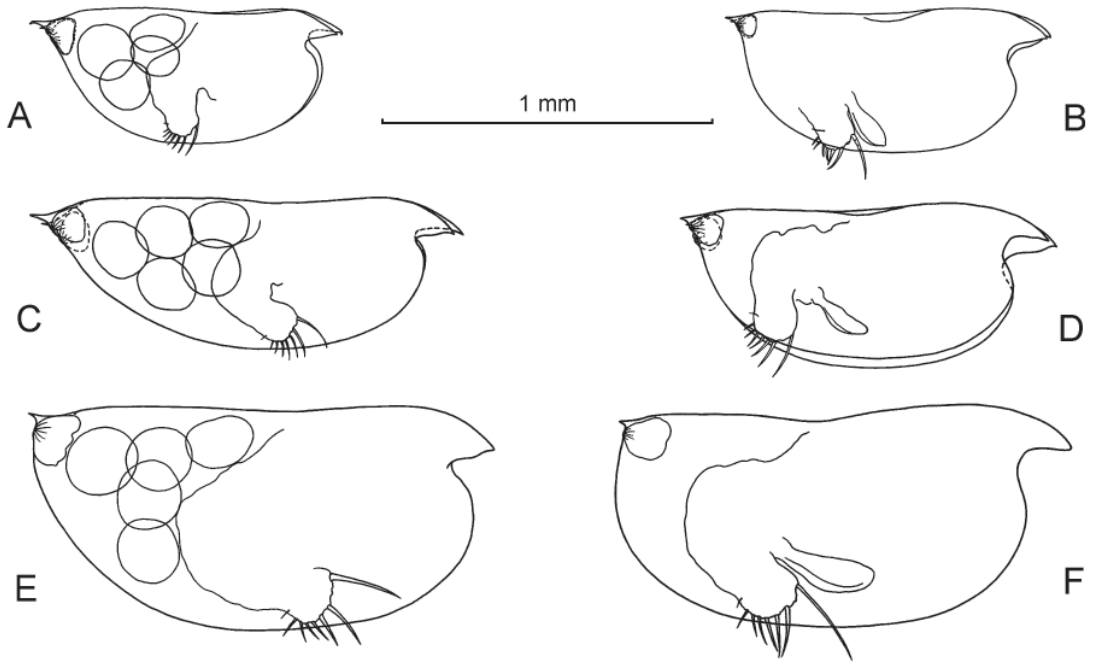
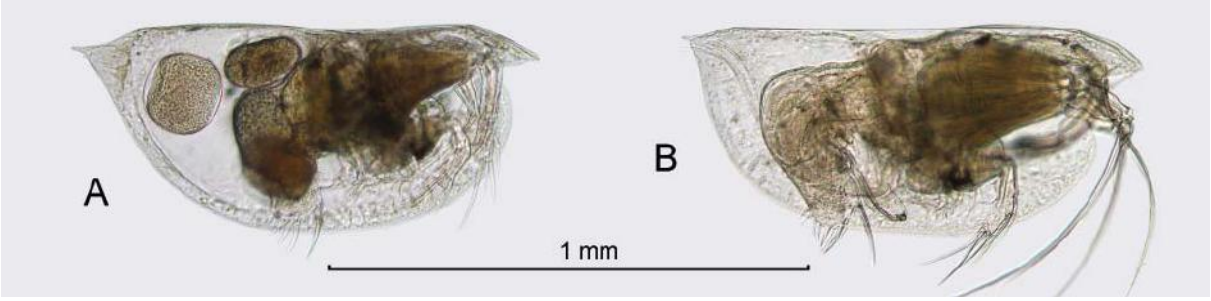


Fig. 87. Carapace outlines of the members of genus ***Euconchoecia*** from the Arabian Sea: *E.* cf. *aculeata* (**A**, **B**), *E.* aff. *aculeata elongata* (**C**, **D**) and *E.* cf. *chierchiae* (**E**, **F**), viewed in the same scale.
A, C, E – females; B, D, F – males.

Euconchoecia cf. ***aculeata*** (Scott, 1894)

(Pict. 39; Pls 79, 80; Figs 88, 89)

For synonymy before 1906, see Müller, 1906a.
Euconchoecia aculeata: Müller, 1906a, p. 129, pl. XXXII figs 18–20, 22, 23, 25, 26; Poulsen, 1969b, p. 41, fig. 15; George & Nair, 1980, pp. 32, 33.



Pict. 39. ***Euconchoecia*** cf. ***aculeata***. **A** – female; **B** – male.

Females. L = 0.85–1.08 mm (0.97 ± 0.05 mm; N = 359); H/L = 40.6 ± 2.4% (N = 24).

Plate 79**A**–**N**. Carapace (**A**–**D**): elongated; tapered anteriorly and posteriorly; PDCs extended, both with spines (left shorter than right); rostrum pointed (left longer than right); LAG and RAG open symmetrically on the posterior margins near PDCs. FO (**E**, **F**): very thin, undifferentiated on stem and capitulum, extending beyond the end of An1; its tip either rounded or with tiny papilla. An1 (**E**): 7-segmented (see Poulsen, 1969b: pp. 32, 38, figs 10, 13); 1st to 4th segments without setae; 5th bears more than 20 equal sensory setae; 6th with 1 short seta, 7th with 3 setae of varying size. An2 (**G**): Prp bare; Enp1 elongated, with bare a- and b- setae disto-dorsally; c-, d- and e- setae missing; Enp2+3 with longest g- and shorter f- setae (both setae have tiny spines on anterior side); only 1 seta of 3 (h-, i- or j- seta) present. Lb (**H**): dorsal projection strongly narrowed anteriorly; hyaline membrane almost straight. Md (**I**): Bsp with very long, plumose epipodial seta and with no disto-lateral seta; Exp not developed, in its place there is a strong, plumose seta; Enp1 has 1 short, non-plumose dorsal seta and 3 ventral setae (sometimes 2 setae); Enp2 bears 2 setae on dorsal side and 1 seta ventrally (3 dorsal and 2 ventral setae in subfamiles Archiconchoeciinae and Conchoeciinae). Mx (**J**): Bsp with single seta; Enp1 has 3 setae on anterior side and 3 setae on posterior, and a few long hairs mid-anteriorly; lateral seta on Enp1 missing; Enp2 with 6 terminal setae and a few long hairs ventrally. P5 (**K**): Cxp3 has 5 setae in ventral group (one of them is a little away from others); Bsp has 3 setae in proximal ventral group and 1 in distal one, relatively long plumose dorso-lateral and non-plumose dorsal setae, and a few long hairs proximo-ventrally; sometimes there are 2 plumose dorso-lateral setae on Bsp, as in *E.* cf. *chierchiae* (Pl. 83N). P6 (**L**): Cxp2 has 2 setae; Bsp with 3 ventral setae, 1 dorso-lateral and 1 dorsal (vestige of Exp) which does not reach distal edge of Enp1; 2 longest terminal setae on Enp3 about equal and not longer than total length of Enp1 to Enp3. P7 (**M**): both terminal setae without spines. CF (**N**): with 7 claws; 1st to 4th claws with bent tips; unpaired dorsal seta present; on each of furcal plates between 1st and following claws there is an oval process, which is like a trace of a claw basis. Probably this is a vestige of the claw.

Males. L = 0.85–0.99 mm (0.95 ± 0.05 mm; N = 289); H/L = 42.7 ± 1.8% (N = 20).

Plate 80**A**–**P**. Carapace (**A**–**D**): laterally similar to that in female but with shorter posterior dorsal spines; ventrally with broader rostrum and more developed shoulder vaults. FO (**E**): as in female. An1 (**E**): 7-segmented as in female; 7th segment bears 4 setae of varying size; longest seta about 2 times longer than An1, has tiny spines distally on anterior side. An2 (**F**–**H**): inner surface of Prp bare; Enp1 elongated, with 3 groups of short hairs on dorsal side; Enp2 has a conical process dorsally; g-seta very long, extending well beyond posterior margin of carapace, f-seta about half of

g-seta; Enp3 elongated, with 3 setae of varying size (h-, i- and j- setae); hook appendage developed only on right Enp. Lb (**I**), Mx (**K**), P7 (**O**), CF (**P**): similar to those in female. Md (**J**): Enp1 has 1 very short dorsal seta and always 3 ventral setae, also a few long hairs near bases of ventral setae. P5 (**L**): Cxp1–2 with long hairs on their surfaces. P6 (**M**, **N**): Bsp with 3 ventral, 1 dorso-lateral and 1 dorsal (vestige of Exp) setae and a few long hairs proximo-ventrally; Enp1 usually with 1 ventral setae, sometimes with 2 (**N**); Enp3 with 3 long terminal setae having long hairs distally (hairs not shown in drawing). CA (**P**): large, strongly narrowed in mid-part; end rounded.

Remarks. According to Müller (1906a) there is an elongate form of *E. aculeata* that differs from the main species by having a longer carapace.

Size ranges of *E.* cf. *aculeata* and *E.* aff. *aculeata elongata* from the Arabian Sea Region were obtained by means of a diagram of size distribution of all adult males and females that were measured in our materials; certainly, the real size ranges of these species are overlapping (especially in males). Descriptions of the Arabian Sea adult specimens of *E.* cf. *aculeata* are based on seven females (0.94–0.99 mm) and six males (0.96–0.99 mm).

The males and females of *E.* cf. *aculeata* in our materials differ from the type specimens redescribed by Graves (2011: figs 7–10) mainly by longer FO and smaller number of setae on Mx, P5 and P6. For comparison, see Graves (2011: figs 7C, 8B–D, 9C, 10B, C).

Distribution. E*uconchoecia aculeata* is recorded mainly from the Indian Ocean and Western Pacific with single records from the tropical Atlantic and Eastern Pacific; this species is most abundant in the surface waters (Müller, 1906a; Poulsen, 1969b; George et al., 1975; George & Nair, 1980; Angel et al., 2008). In the investigated area, *E.* cf. *aculeata* was found generally in the central and northern parts of the region; it was rare in the upwelling areas along the shores of Somalia and Oman (Fig. 88). Maximum abundances were recorded at depths 0–100 m (Fig. 89).

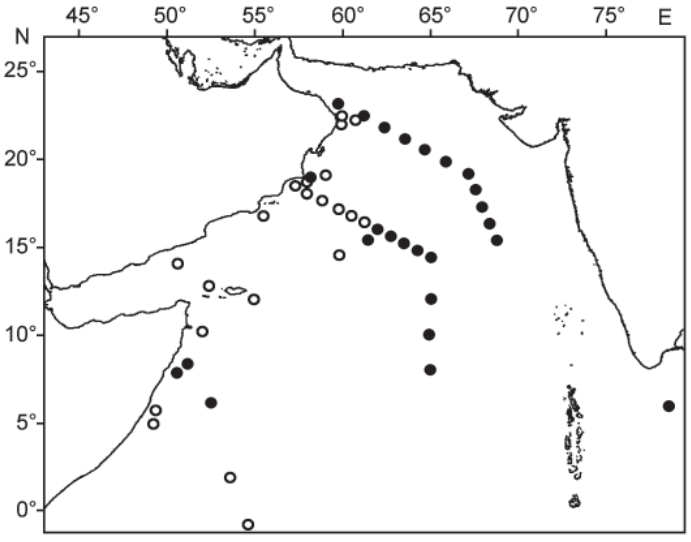


Fig. 88. Occurrence of ***Euconchoecia*** cf. ***aculeata*** at the stations listed in Table 1. Open circles represent stations sampled, closed circles represent stations where females and males of the species were found.

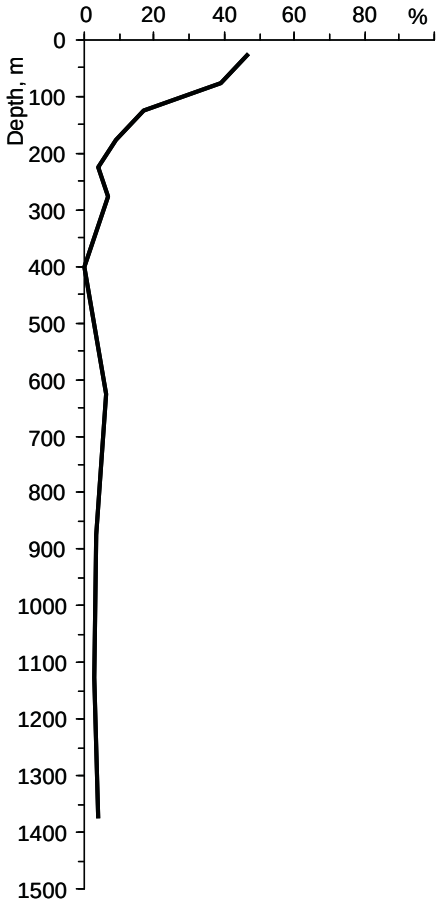


Fig. 89. Occurrence of ***Euconchoecia*** cf. ***aculeata*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

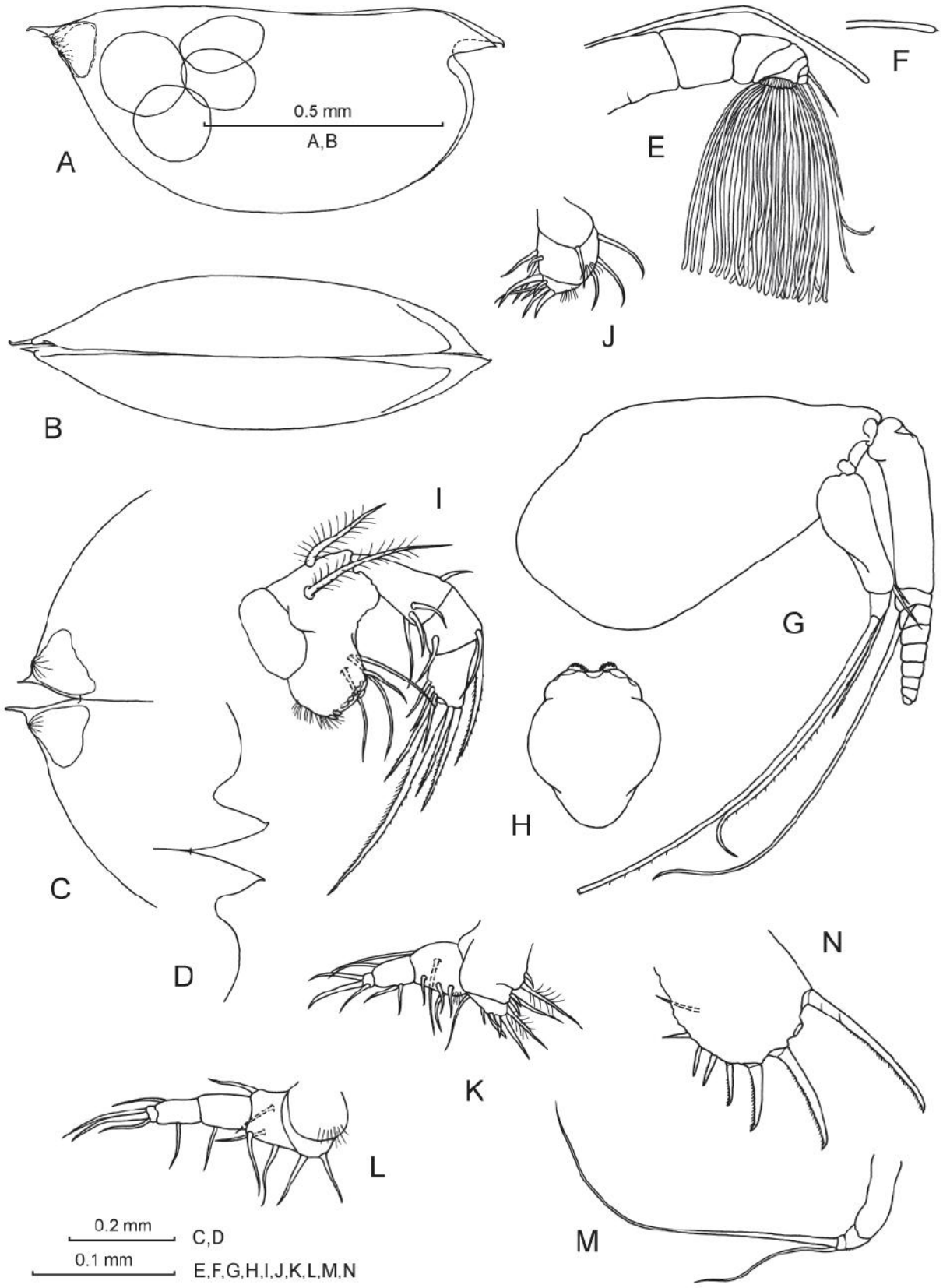


Plate 79. ***Euconchoecia*** cf. ***aculeata***, female. Carapace: **A** – lateral; **B** – ventral; **C**, **D** – both valves outside: PDCs and rostrum. **E** – FO and An1. **F** – other specimen: capitulum of FO. **G** – An2. **H** – Lb. **I** – Md without Cxp. **J** – Mx. **K** – P5. **L** – P6. **M** – P7. **N** – CF.

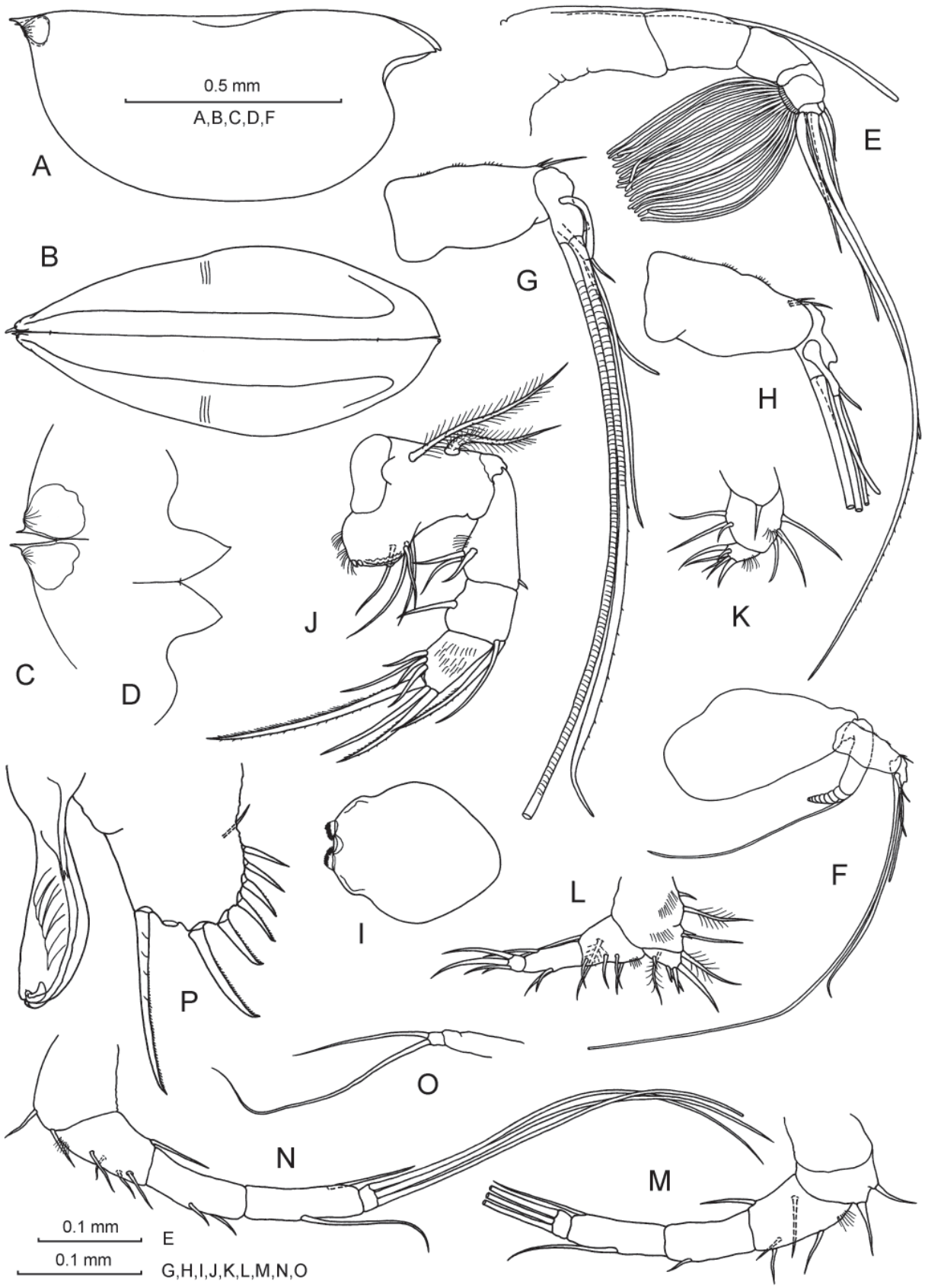
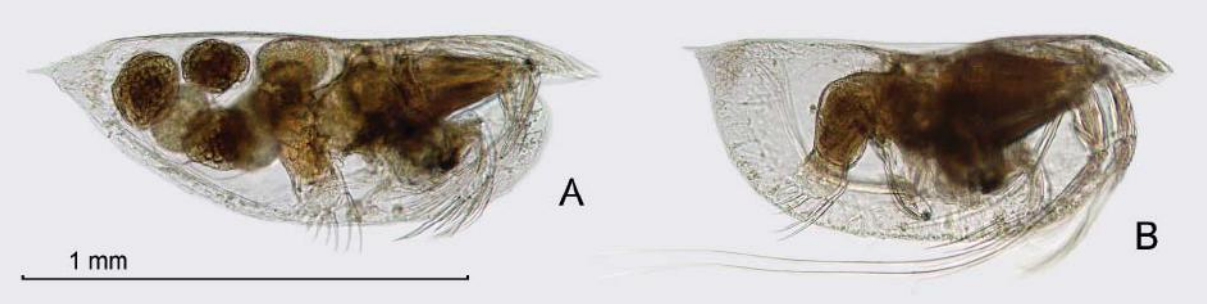


Plate 80. ***Euconchoecia*** cf. ***aculeata***, male. Carapace: **A** – lateral; **B** – ventral; **C**, **D** – both valves outside: PDCs and rostrum. **E** – FO and An1. An2: **F** – Prp, Exp and Enp; **G**, **H** – right and left Enps. **I** – Lb. **J** – Md without Cxp. **K** – Mx. **L** – P5. **M** – P6. **N** – other specimen: P6. **O** – P7. **P** – CA and CF.

Euconchoecia aff. ***aculeata elongata*** Müller, 1906

(Pict. 40; Pls 81, 82; Figs 90, 91)

Euconchoecia aculeata var. *elongata* Müller, 1906a, p. 129, pl. XXXII fig. 2.
Euconchoecia aculeata var. *elongata*: Poulsen, 1969b, p. 42.
Euconchoecia aculeata: George & Nair, 1980, pp. 32, 33.



Pict. 40. ***Euconchoecia*** aff. ***aculeata elongata***. **A** – female; **B** – male.

Females. L = 1.11–1.60 mm (1.28 ± 0.10 mm; N = 917); H/L = 33.9 ± 1.6% (N = 49).

Plate 81**A**–**O**. Carapace (**A**–**D**): posterior part far more elongated than in female of *E.* cf. *aculeata* (Fig. 87A, C); H of both forms about equal. FO (**E**, **F**): thin, undifferentiated, extending beyond the end of An1; its tip either rounded or pointed. An1 (**E**), An2 (**G**, **H**), Lb (**I**), Mx (**K**), P7 (**N**): similar to those in *E.* cf. *aculeata* (Pl. 79E, G, H, J, M). Md (**J**): Enp1 usually has 2 ventral setae; inner of them ~ 2 times shorter than the other; sometimes there are 3 setae on both Md (right and left), or 2 setae on one of Md and 3 on other. P5 (**L**): more haired than in *E.* cf. *aculeata* (Pl. 79K). P6 (**M**): Bsp with 4 (sometimes 3 as in *E.* cf. *aculeata*) ventral setae, dorsal seta reaches over distal edge of Enp1; 2 longest terminal setae on Enp3 about equal and longer than total length of Enp1 to Enp3. CF (**O**): as in *E.* cf. *aculeata* (Pl. 79N); sometimes either both furcal plates or one of them have 6 claws instead of 7.

Males. L = 1.02–1.30 mm (1.09 ± 0.05 mm; N = 525); H/L = 39.9 ± 1.7% (N = 24).

Plate 82**A**–**Q**. Carapace (**A**–**D**): a little more elongated than in male of *E.* cf. *aculeata* (Fig. 87B, D). FO (**E**): as in female. An1 (**E**), An2 (**F**–**H**), Lb (**I**), Mx (**L**), P7 (**O**), CA (**P**), CF (**Q**): similar to those in *E.* cf. *aculeata* (Pl. 80E–I, K, O, P). Md (**J**, **K**): dorsal seta on Enp1 shorter than in female; Enp1 usually with 3 ventral setae, sometimes with 2 (**K**). P5 (**M**): similar to that in female. P6 (**N**): Bsp with 3–4 ventral setae; Enp3 with 3 long terminal setae having long hairs distally (cut off in drawing).

Remarks. Descriptions of the Arabian Sea adult specimens of *E.* aff. *aculeata elongata* are based on 10 females (1.27–1.32 mm) and six males (1.09–1.18 mm).

The adult specimens of *E.* aff. *aculeata elongata* differ from those of *E.* cf. *aculeata* mainly by more elongated carapaces (in females to a greater extent than in males); see Fig. 87A–D and also Key to the size forms of *Euconchoecia* cf. *aculeata*, p. 197.

E. cf. *aculeata* and *E.* aff. *aculeata elongata* differ from the new species *E. hormuzensis* and *E. omanensis* described by Graves (2011: figs 11–20) from the Gulf of Oman. Both new species have more setae on Mx Enp1 (5 anterior and 4 posterior setae), on P5 Bsp (5 ventral setae and 2 dorso-lateral) and on P6 (4–5 ventral setae on Bsp, always 2 ventral setae on Enp1) than are found on *E.* cf. *aculeata* and *E.* aff. *aculeata elongata* from our materials (see Pls 79J, K, L, 80K, L–N, 81K, L, M, 82L, M, N). The male and female of *E. hormuzensis* have also shorter FO (Graves, 2011: figs 16C, 18C) than those of *E.* cf. *aculeata* and *E.* aff. *aculeata elongata* (Pls 79E, 80E, 81E, 82E).

As it has been said above, Arabian Sea specimens of *E.* cf. *aculeata* and *E.* aff. *aculeata elongata* have CF with 7 claws as result of the probable reduction of the 2nd claw. Skogsberg (1920) and then Poulsen (1969b) also have noted 7 claws on CF and the presence "between the first and second claw a rounded process seems always to be developed" in a closely related species *E. chierchiae* (Skogsberg, 1920: p. 750, fig. CLI 30) and in *E. aculeata* (Poulsen, 1969b: p. 42). At the same time, Tseng (1976) observed 8 claws on CF of adult specimens of *E. elongata* from Apra Harbor, Guam (13.5º N, 144.5º E), and the 2nd claw in his fig. 4 is weaker than 1st and 3rd.

E. cf. *aculeata* and *E.* aff. *aculeata elongata* are highly polymorphic (especially the last one), and this is natural for abundant neritic species occurring in surface waters. The facts that: **a**) the adult females of *Euconchoecia* brood their embryos within the carapace; **b**) the males of both forms are similar to each other more than females; and **c**) the absence of *E.* cf. *aculeata* in the upwelling area (Fig. 88), while *E.* aff. *aculeata elongata* is most abundant in this area (Fig. 90), possibly testify that the elongated posterior part of carapace (it is the brood cavity) is the result of *E.* aff. *aculeata elongata* inhabiting the upwelling regions. The larger brood cavity allows more offspring to be produced per female when environmental conditions (upwelling) are favorable. Both forms need careful study based on a large number of individuals because of their high variability.

Distribution. *Euconchoecia aculeata elongata* has been recorded in the tropical and near-tropical zone of Indian and Pacific oceans (Müller, 1906a; Poulsen, 1969b; Tseng, 1976). At first the females were recorded by Müller (1906a) from a station in the Indian Ocean (13°S, 40°E). In the investigated area, *E.* aff. *aculeata elongata* was found generally in the upwelling zone along the coast of Oman and in the central part of region; it is absent in the south-western part (Fig. 90). Maximum abundances were recorded at depths 0–100 m (Fig. 91).

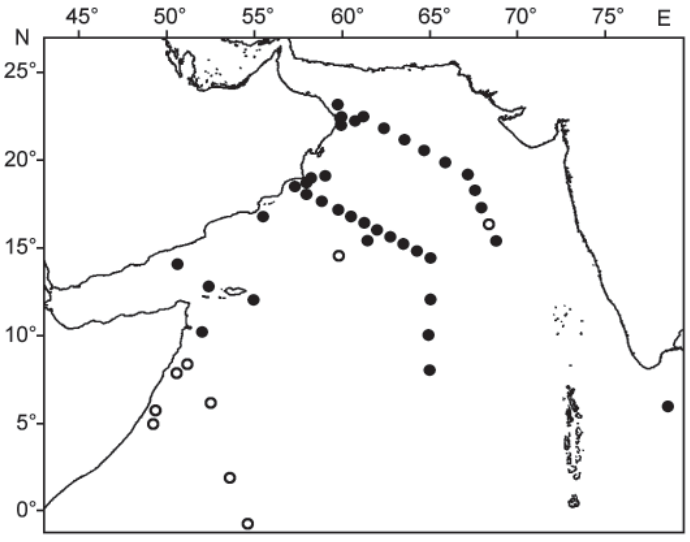


Fig. 90. Occurrence of ***Euconchoecia*** aff. ***aculeata elongata*** at the stations listed in Table 1. Open circles represent stations sampled, closed circles represent stations where females and males of the species were found.

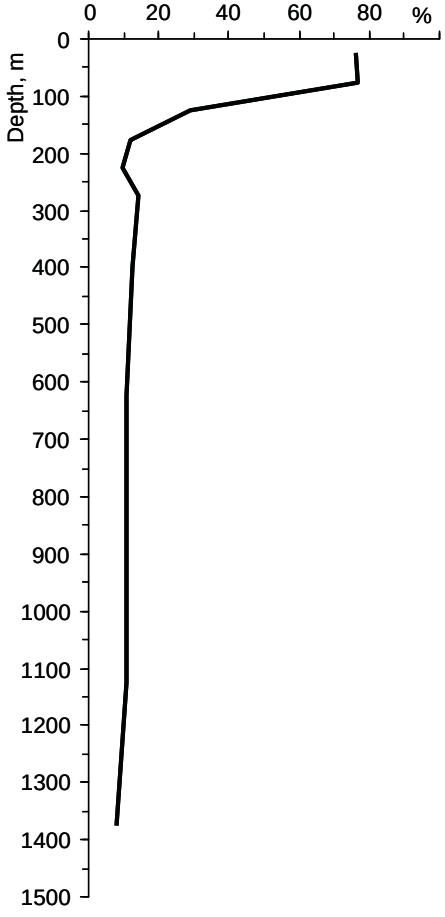


Fig. 91. Occurrence of ***Euconchoecia*** aff. ***aculeata elongata*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

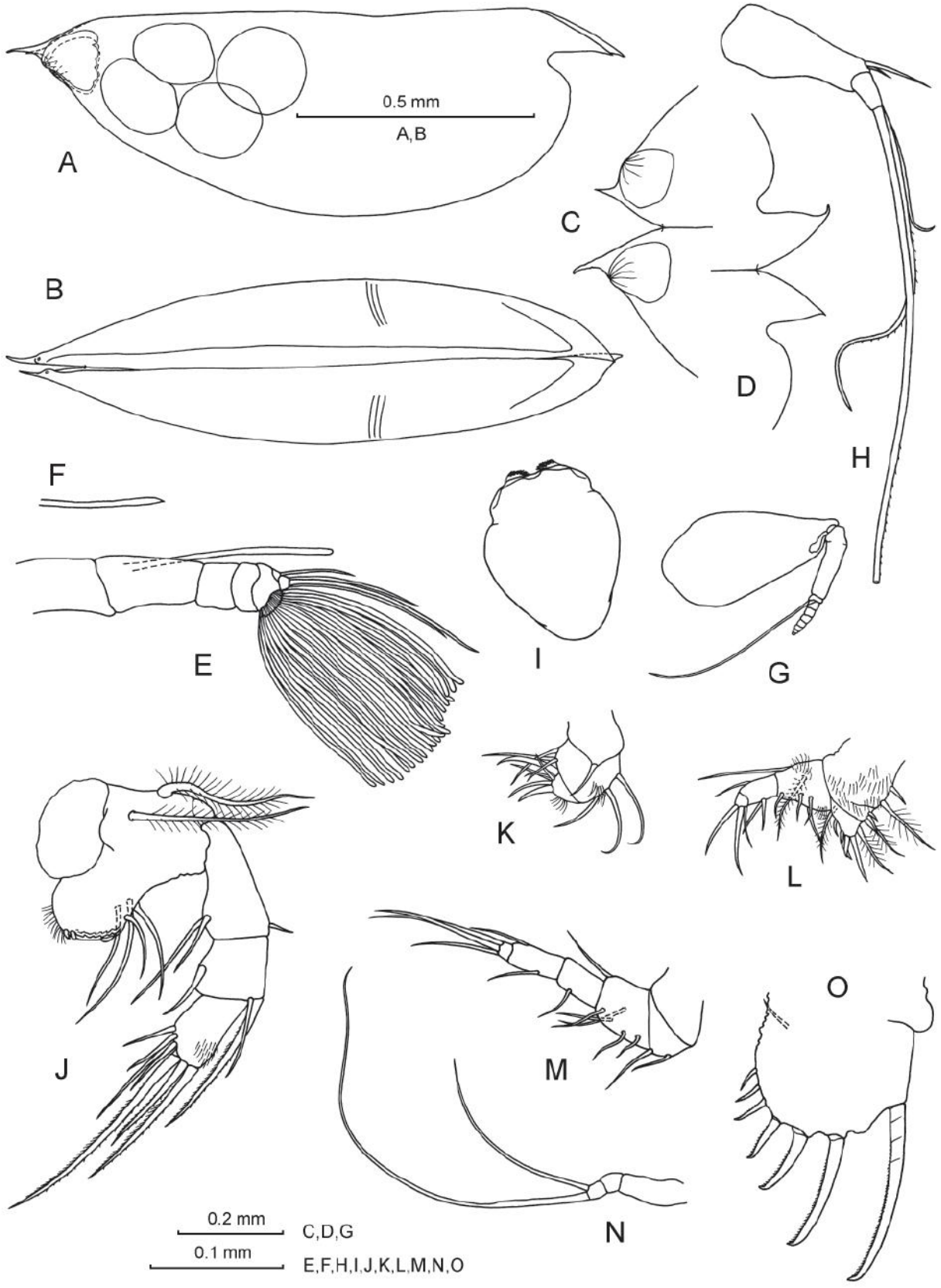


Plate 81. ***Euconchoecia*** aff. ***aculeata elongata***, female. Carapace: **A** – lateral; **B** – ventral; **C**, **D** – both valves outside: PDCs and rostrum. **E** – FO and An1. **F** – other specimen: capitulum of FO. An1: **G** – Prp and Exp, **H** – Enp. **I** – Lb. **J** – Md without Cxp. **K** – Mx. **L** – P5. **M** – P6. **N** – P7. **O** – CF.

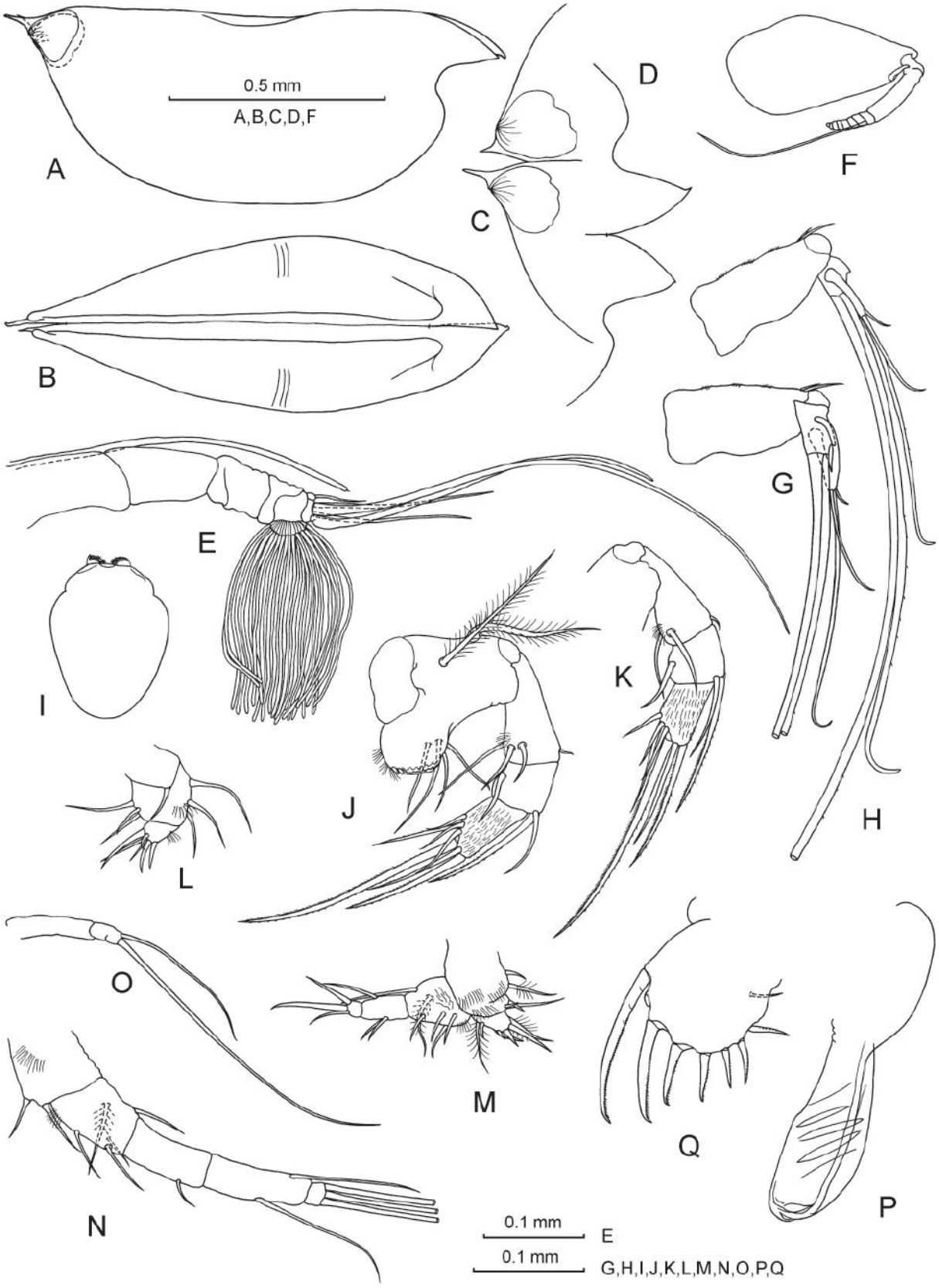
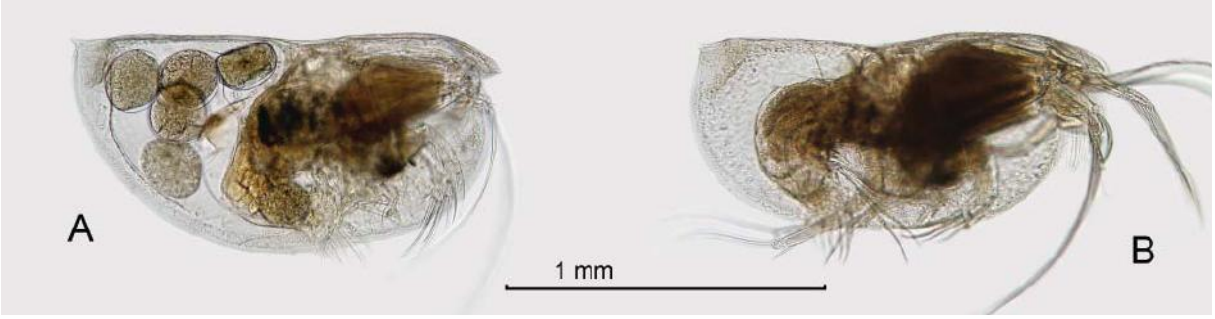


Plate 82. ***Euconchoecia*** aff. ***aculeata elongata***, male. Carapace: **A** – lateral; **B** – ventral; **C**, **D** – both valves outside: PDCs and rostrum. **E** – FO and An1. An2: **F** – Prp and Exp; **G**, **H** – right and left Enps. **I** – Lb. Md: **J** – Bsp, Exp and Enp; **K** – other specimen: Enp. **L** – Mx. **M** – P5. **N** – P6. **O** – P7. **P** – CA. **Q** – CF.

Euconchoecia cf. ***chierchiae*** Müller, 1891

(Pict. 41; Pls 83, 84; Figs 92, 93)

For synonymy before 1906, see Müller, 1906a.
Euconchoecia chierchiae: Müller, 1906a, p. 128, pl. XXXII figs 8–17, 24; Poulsen, 1969b, p. 38, figs 12, 13; George & Nair, 1980, pp. 38, 40.



Pict. 41. ***Euconchoecia*** cf. ***chierchiae***. **A** – female; **B** – male.

Females. L = 1.23–1.51 mm (1.35 ± 0.08 mm; N = 21); H/L = 47.6 ± 0.4% (N = 3).

Plate 83**A**–**Q**. Carapace (**A**–**E**): elongated, tapered anteriorly and posteriorly; PDCs not extended, usually both with short spines (left spine shorter than right, sometimes absent); rostrum shoter than in *E.* cf. *aculeata* (see Fig 87E, F; Pl. 79A, B, D); LAG and RAG open symmetrically on the posterior margins near PDCs. FO (**F**): very thin, undifferentiated on stem and capitulum, extending slightly beyond distal edge of 2nd segment of An1. An1 (**F**): 7-segmented; 1st to 4th segments without setae; 5th bears ~ 22 equal sensory setae; 6th with 1 short seta having thin, rather long hairs on its anterior side; 7th with 3 setae of varying size. An2 (**G**, **H**): Prp bare; Enp1 elongated, with bare a- and b- setae disto-dorsally; c-, d- and e- setae missing; Enp2+3 with long g- and far shorter f- setae; shortest h-, i- or j- seta longer than Enp1. Lb (**I**, **J**): dorsal projection narrowed anteriorly; hyaline membrane almost straight. Md (**K**, **L**): Bsp with very long, plumose epipodial seta and rather thin, shorter disto-lateral seta; Exp not developed, in its place there is a strong, plumose seta; Enp1 has 1 very short, non-plumose dorsal seta and 3 ventral setae; Enp2 bears 2 setae on dorsal side and 1 seta ventrally. Mx (**M**): Bsp with single seta not reaching distal edge of Enp1; Enp1 has 5 setae on anterior side, 4 on posterior and 2 groups of long hairs on inner side of segment mid-anteriorly and proximo-posteriorly; lateral seta on Enp1 missing; Enp2 with 6 terminal setae and a few long hairs ventrally. P5 (**N**): Cxp3 has 6 setae in ventral group (one of them is a little away from others); Bsp has 3 setae in proximal ventral group and 2 in distal one, 2 plumose dorso-lateral setae and non-plumose dorsal seta, and a few long hairs proximo-ventrally. P6 (**O**): Cxp2 has 2 plumose setae; Bsp with 5 ventral setae, 1 dorso-lateral and 1 dorsal which does not reach distal edge of Enp1; all setae on Bsp plumose except of dorsal one. P7 (**P**): longest of 2 terminal setae with tiny spines proximally. CF (**Q**): with 7 claws, unpaired dorsal seta and an oval process between 1st and following claws; 1st to 4th claws with less bent tips than in *E.* cf. *aculeata* (Pl. 79N).

Males. L = 1.23–1.35 mm (1.30 ± 0.04 mm; N = 8); H/L = 47.9 ± 1.4% (N = 4).

Plate 84**A**–**Q**. Carapace (**A**–**D**): posterior and dorsal margins form almost right angle; in ventral view, with broader rostrum, more developed shoulder vaults and shorter posterior dorsal spines than in female. FO (**E**, **F**): short, only slightly extending over distal edge of 2nd segment of An1; its tip either rounded or pointed (**F**). An1 (**E**): 7-segmented as in female; 1st segment with a distinct rounded process near its distal edge ventrally; 7th segment bears 4 setae of varying size. An2 (**G**–**J**): inner surface of Prp bare; Exp2–7 with long plumose swimming setae; Exp8 with 2 far shorter setae (**H**); Enp1 elongated, its dorsal side bare; Enp2 has a rounded process disto-dorsally; g-seta very long, extending well beyond the posterior margin of carapace; f-seta about half of g-seta; Enp3 elongated, with 3 setae of varying size (h-, i- and j- setae); hook appendage developed only

on right Enp (**I**). Lb (**K**), Md (**L**), Mx (**M**), P5 (**N**): similar to those in female. P6 (**O**): all setae on Bsp as in female but shorter; Enp1 with 2 ventral setae; Enp2 with 2 ventral and 1 dorsal setae; 3 long terminal setae on Enp3 about equal and with long hairs distally. P7 (**P**): relatively smaller than in female. CA (**Q**): large, strongly narrowed in mid-part; distal part widened; end rounded. CF (**Q**): 1st claw visibly longer than others.

Remarks. Descriptions of the Arabian Sea adult specimens of *E.* cf. *chierchiae* are based on three females (1.35–1.47 mm) and three males (1.32–1.35 mm).

The adult specimens of *E.* cf. *chierchiae* clearly differ from those of *E.* cf. *aculeata* and *E.* aff. *aculeata elongata* (see Key to the species of *Euconchoecia,* p. 196).

E. cf. *chierchiae* from our materials is in the best agreement with *E. chierchiae* shown by Müller (1906a) in pl. XXXII fig. 8–17, 24.

Arabian Sea specimens of *E.* cf. *chierchiae* differ from those of *E. chierchiae* redescribed by Graves (2011) from the Atlantic Ocean by the following: **a**) shorter FO reaching slightly over distal edge of 2nd segment of An1; **b**) the presence of thin disto-lateral seta on Md Bsp; **c**) two groups of long hairs on inner side of Mx Enp mid-anteriorly and proximo-posteriorly; **d**) two ventral setae on male P6 Enp2. In addition, the shortest seta of female An1 has long hairs on its anterior side. (Pls 83F, L, M, 84E, L, M, O). For comparison, see Graves (2011: figs 1C, 2A, C, 3C, 4C, E, 5B).

Distribution. *Euconchoecia chierchiae* is recorded in the surface waters of tropical and sub-tropical regions of all oceans; it was not found in the Eastern Pacific (Müller, 1906a; Skogsberg, 1920; Poulsen, 1969b; George & Nair, 1980; Angel et al., 2008). In our materials, *E.* cf. *chierchiae* was found generally in the south-western part of the region with single records north of 15°N (Fig. 92). Maximum abundances were recorded at depths 0–100 m (Fig. 93).

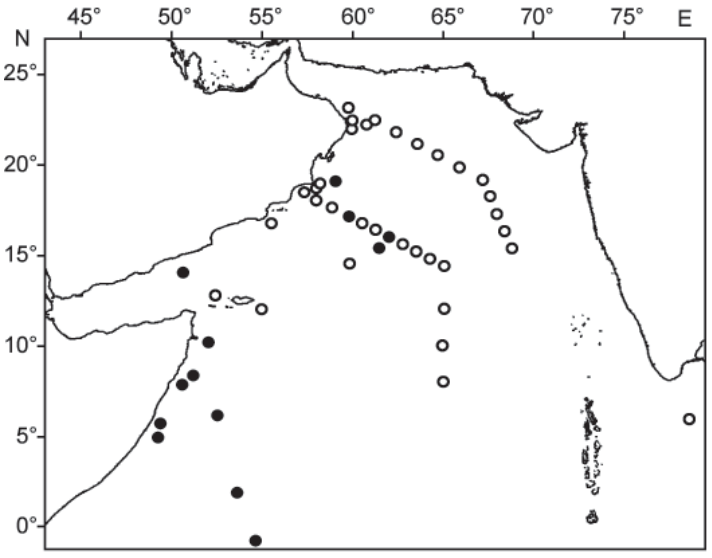


Fig. 92. Occurrence of ***Euconchoecia*** cf. ***chierchiae*** at the stations listed in Table 1. Open circles represent stations sampled, closed circles represent stations where adults and juveniles of the species were found.

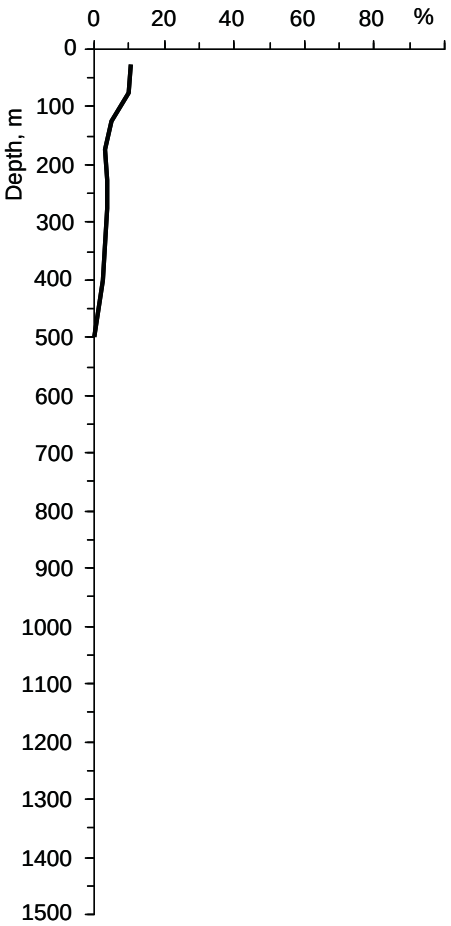


Fig. 93. Occurrence of ***Euconchoecia*** cf. ***chierchiae*** at different depths. X-axis represents the number of records of the species as a percentage of the total number of tows (Table 2) in the corresponding layers.

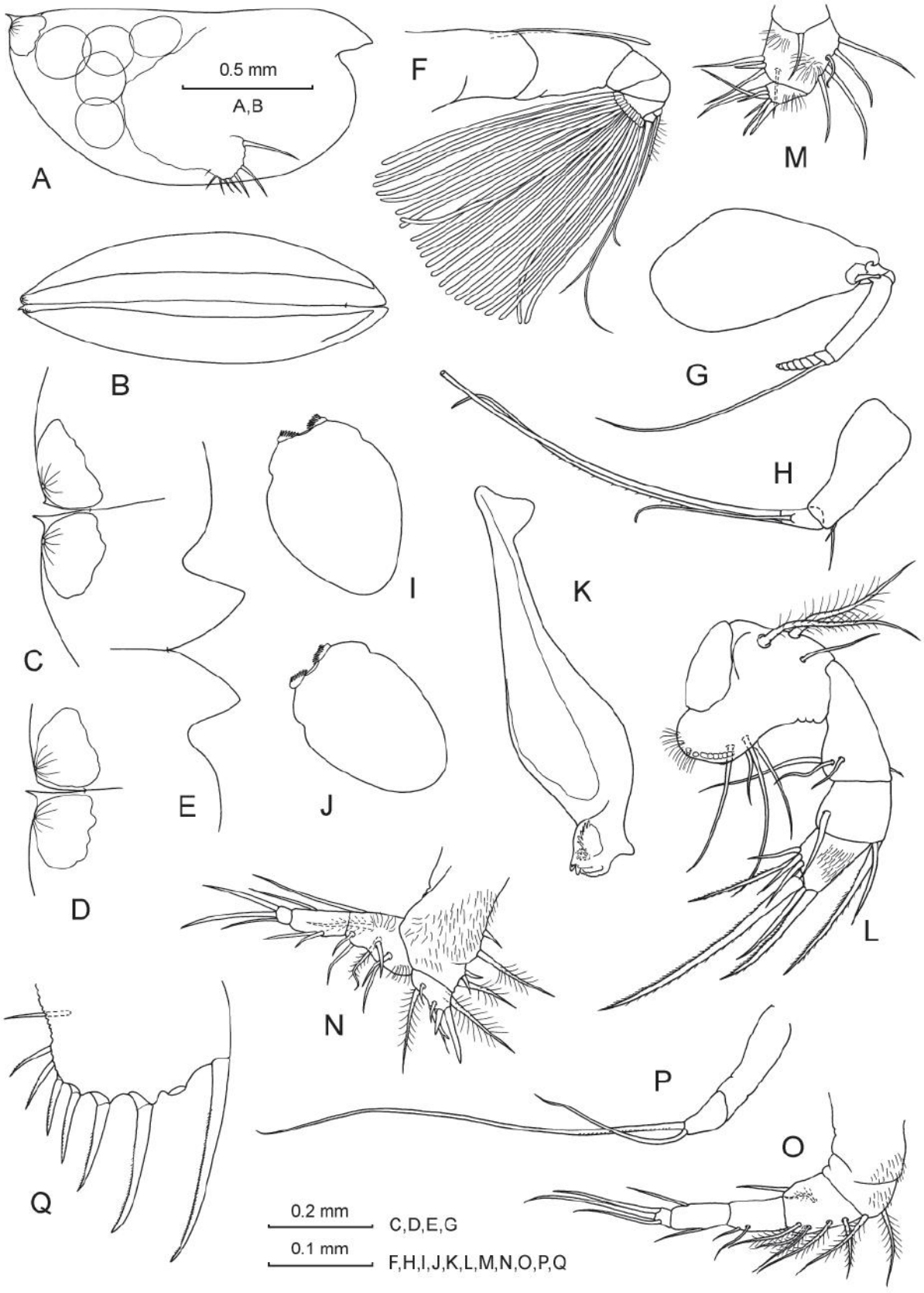


Plate 83. ***Euconchoecia*** cf. ***chierchiae***, female. Carapace: **A** – lateral; **B** – ventral; both valves outside: **C** – PDCs; **D** – PDCs of other specimen; **E** – rostrum. **F** – FO and An1. An2: **G** – Prp and Exp; **H** – Enp. **I** – Lb. **J** – Lb of other specimen. Md: **K** – Cxp; **L** – Bsp, Exp and Enp. **M** – Mx. **N** – P5. **O** – P6. **P** – P7. **Q** – CF.

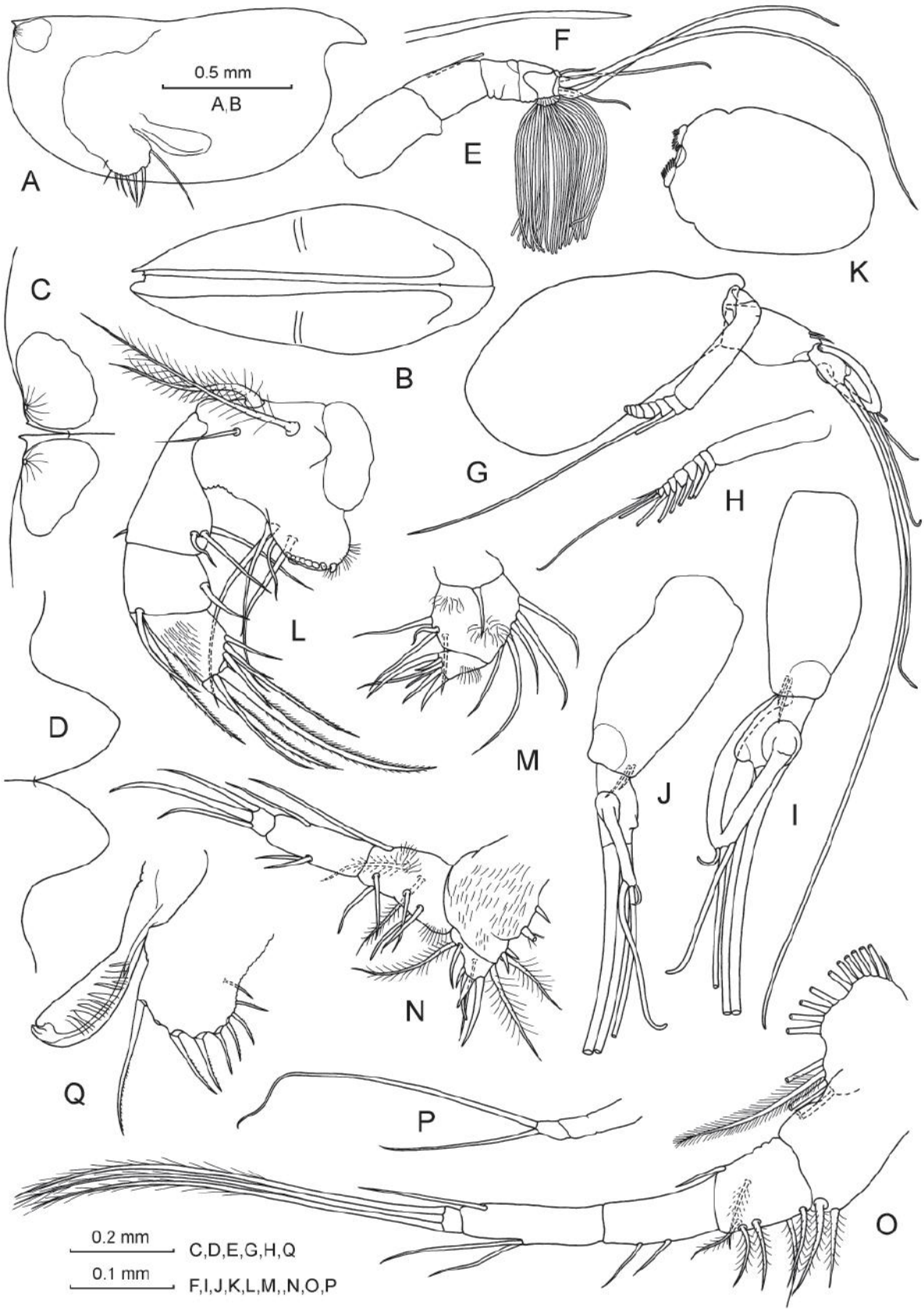


Plate 84. ***Euconchoecia*** cf. ***chierchiae***, male. Carapace: **A** – lateral; **B** – ventral; **C**, **D** – both valves outside: PDCs and rostrum. **E** – FO and An1. **F** – other specimen: FO (higher magnification). An2: **G** – Prp, Exp and Enp; **H** – Exp: setae; **I**, **J** – right and left Enps. **K** – Lb. **L** – Md without Cxp. **M** – Mx. **N** – P5. **O** – P6. **P** – P7. **Q** – CA and CF.

Subfamily **Halocypridinae** Claus, 1890

Carapace "always very short, its height being at least two-thirds of the length. The rostrum short, sometimes scarcely developed at all. Of the two unsymmetrical glands the left one opens out just in front of the postero-dorsal corner of the shell, the right one at about the boundary between the ventral and posterior margins of the shell; sometimes, however, the latter gland is somewhat displaced dorsally." In addition, FO and An1 show no or rather slight dimorphism and An2 Enp1 has not processus mamillaris. (Skogsberg, 1920: p. 581–583).

The members of three genera were found in the analyzed material: *Fellia* Poulsen, 1969; *Halocypria* Claus, 1874; *Halocypris* Dana, 1853 (Table 3, Appendix 1). For descriptions of the genera, and also their members listed in Table 3, see Angel (1982), Chavtur & Stovbun (2008a, b), Deevey (1968a, 1982), Deevey & Brooks (1980), Poulsen (1969b), Scogsberg (1920).

Key to the genera of **Halocypridinae**:

1 Rostrum not indistinct (Fig. 94A, C, E, G) ...…...…...… ***Halocypris***

1a Rostrum distinct (Fig. 95A, C, E) ..……...……...……..… 2

2 RAG displaced dorsally on posterior margin;
shoulder vaults not developed (Fig. 95A–D) ……..……..… ***Halocypria***

2a RAG in usual place near PVC;
shoulder vaults developed (Fig. 95E, F) …...……...…….……... ***Fellia***

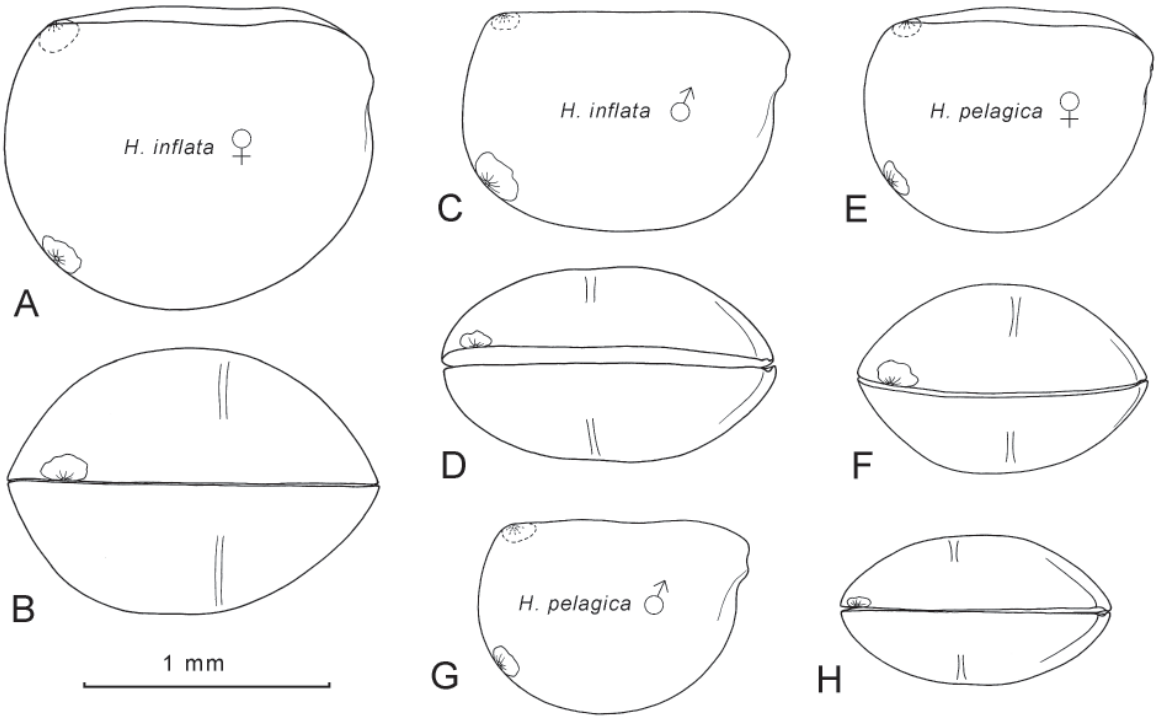


Fig. 94. Genus ***Halocypris***: carapace outlines of *H. inflata*, female (**A**, **B**), male (**C**, **D**); and *H. pelagica*, female (**E**, **F**), male (**G**, **H**).
A, C, E, G – lateral view; B, D, F, H – ventral.
All drawings in the Figs 94, 95 are represented in the same scale.

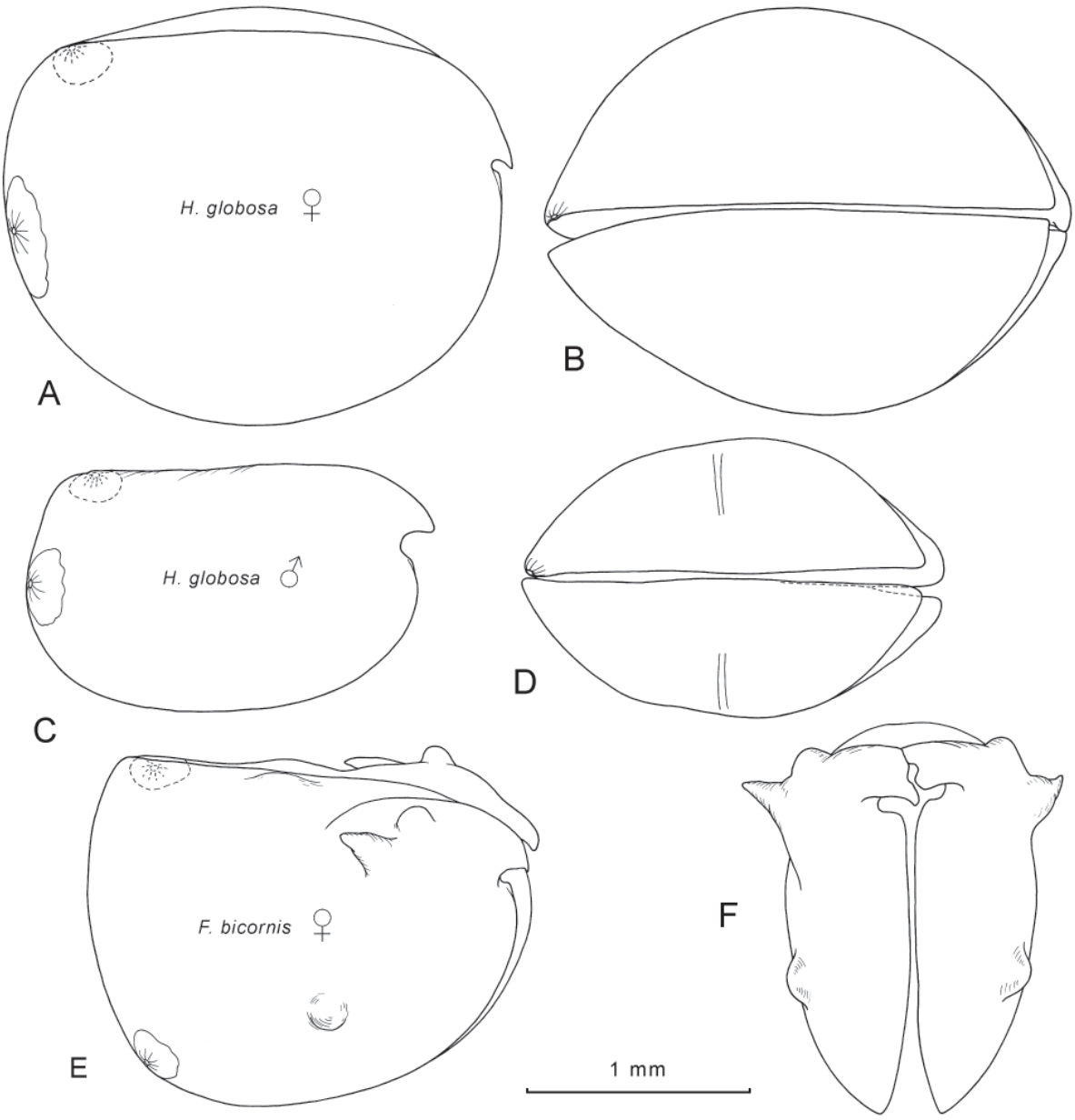


Fig. 95. Genera ***Halocypria*** and ***Fellia***: carapace outlines of *H. globosa*, female (**A**, **B**), male (**C**, **D**); and *F. bicornis*, female (**E**, **F**).
A, C, E – lateral; ~~B~~ B F – anterior; D, ~~F~~ B F – ventral.

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APPENDICES

Appendix 1

Occurrence and depth ranges of halocyprid species found at the stations in the investigated area but not described in the present book. See Fig. 1 and Table 1 for abbreviations.

Species	**Cruises:** stations	Depth range (m)
Archiconchoecetta bispicula	**Tyro B2:** SB4, SB2, NWS; **TN039:** TN2; **MB9503:** M3, M4, M7	100–500
Archiconchoecinna cuneata	**MB9506:** M43	300–500
Archiconchoecissa cucullata	**TN039:** TN2, TN6, S13, S15; **MB9503:** M3, M4, M6, M7, M13, M28; **MB9506:** M45, S7	100–150(1juv.), 500–2000
Conchoecissa symmetrica	**TN039:** N4, N9	1000–1500
Macroconchoecia caudata	**Tyro B2:** SB4, SB3; **TN039:** TN2; **MB9503:** M3, M4	150–1000
Mollicia acanthophora	**TN045:** S2; **MB9503**: M7, M13, M28	750–2000
Mollicia mollis	**TN039:** TN2, N9, S15	500–1500
Orthoconchoecia bispinosa	**Tyro B2:** SB4, SB3, SB2, US1; **MB9503:** M3, M4	0–500
Orthoconchoecia secernenda *	**Tyro B2:** SB3, SB2; **MB9506:** M48	150–500
Paraconchoecia cophopyga	**MB9503:** M13	1500–2000
Paraconchoecia mamillata	**TN039:** TN2, N2, N4, N9, S13; **MB9503:** M7, M13, M31; **MB9506:** M45	50–200, 500–1000
Paraconchoecia spinifera	**Tyro B2:** SB4, SB3, SB2, US1; **MB9503:** M3, M4, M6, M7	0–1000
Proceroecia brachyaskos, deep f.	**MB9503:** M3, M4	1300–1800
Metaconchoecia spp. 1+2	at all stations except N1, N5, N8, S1, S6, (SB2, SB3, SB4, US1, SI, NWS)**	0–1500
Metaconchoecia sp. 3	at all stations except (SB2, SB3, SB4, US1, SI, NWS)*	0–200, 200–1000 (4 ind.)
Muelleroecia macromma	**TN039:** S15	400–500
Muelleroecia sp. 1	**Tyro B2:** US1; **TN045:** S2, S3, S4; **MB9503:** M7, M28, M30; **MB9506:** M43, M45, M48, S7	100–1500
Muelleroecia sp. 2	**TN039:** TN2, N2, N9, S13; **MB9503:** M13	750–1500
Bathyconchoecia sp.	**MB9506:** M37	150–200
Fellia bicornis	**Tyro B2:** SB3; **TN039:** S15	150–500
Fellia cornuta	**TN039:** TN6	1000–1500
Halocypris inflata *	**Tyro B2:** SB4, SB3, SB2, US1, SI; **TN039:** TN6, S11, S13; **TN043:** S4, S15; **MB9503:** M3, M4, M6, M7, M13, M14, **MB9506:** M14; **TN050:** S4; **TN054:** A, S2, S3, S4	0–500
Halocypris pelagica *	**Tyro B2:** SB4, SB3, SB2, US1; **TN039:** TN6; **MB9503:** M4	0–150
Halocypris inflata+ pelagica	**Tyro B2:** SB4, SB3, SB2, US1, SI; **TN039:** TN2, TN6, S11, S13, S15; **TN043:** S4, S11, S15; **TN045:** S2, S3, S15; **MB9503:** M3, M4, M6, M7, M13, M14; **MB9506:** M14, M45, M48; **TN050:** S4, S15; **TN054:** S2, S4, S15	0–2000
Halocypria globosa	**Tyro B2:** SB4, SB3, SB2, US1	0–500

* only adult specimens (herein and in Appendix 2 I–VI);

** species composition of *Metaconchoecia* at the stations SB2, SB3, SB4, US1, SI, NWS (cruise Tyro B2) was not analyzed.

Appendix 2

Occurrence (+) of halocyprid species found at the stations of eight oceanographic expeditions and described in the present book. See Fig. 1 and Table 1 for abbreviations.

I. Cruises Tyro B2, TN039

Species	Tyro B2						TN039									
	SB4	SB3	SB2	US1	SI	NWS	N2	N4	N7	N9	N11	S11	S13	S15	TN2	TN6
A. (*A.*) *striata*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
A. alata	+	+	+	+	+	+	+						+		+	
A. leptothrix															+	+
C. acuminata		+	+												+	+
C. giesbrechti	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+
C. lophura		+	+	+	+	+								+	+	+
C. macrocheira		+	+													
C. magna	+	+	+	+	+	+							+		+	+
C. daphnoides	+	+	+	+											+	+
C. imbricata	+	+	+	+		+								+	+	
C. plinthina							+			+			+			
D. discophora	+	+	+	+	+	+	+	+		+		+	+	+	+	+
D. aff. *elegans*	+	+	+	+											+	
D. tamensis	+	+	+	+	+	+	+	+	+	+		+	+		+	+
L. loricata	+	+	+		+										+	+
M. curta s.l.	+	+	+	+	+	+		+				+	+	+	+	+
M. stigmatica										+			+	+	+	
O. atlantica	+	+	+	+	+	+		+					+	+	+	+
O. striola s.s.	+	+	+	+	+	+								+	+	+
P. allotherium *	+	+	+	+												+
P. echinata	+	+	+	+												
P. inermis																+
P. oblonga, f. A *	+	+	+	+											+	
P. oblonga, f. B *	+	+	+													
P. dichotoma													+		+	+
P. prosadene	+	+	+	+	+	+							+	+	+	+
P. parthenoda	+	+	+	+	+	+									+	+
P. porrecta	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
P. spinirostris	+	+	+	+	+											
P. brachyaskos													+	+	+	+
P. decipiens	+	+	+	+	+	+	+	+				+	+	+	+	+
P. macroprocera	+	+	+	+	+	+							+	+	+	+
P. microprocera	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
P. procera	+	+	+	+	+									+	+	+
P. concentrica			+		+		+	+	+	+	+	+	+	+	+	+
C. pusilla		+	+	+	+	+	+	+		+			+	+	+	+
K. kyrtophora	+	+	+	+											+	+
N. nasotuberculata	+	+	+	+												
E. cf. *aculeata* *			+	+				+	+	+	+	+		+	+	+
E. aff. *a. elongata* *					+	+	+	+	+	+	+	+	+	+	+	+
E. cf. *aculeata* and *E.* aff. *a. elongata*			+	+	+	+	+	+	+	+	+	+	+	+	+	+
E. cf. *chierchiae*	+	+	+	+												

II. Cruise TN043

Species	TN043																		
	N2	N4	N6	N7	N9	N11	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S13	S15
A. (*A.*) *striata*	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+
A. alata								+	+	+		+	+				+		
A. leptothrix																			
C. acuminata																			
C. giesbrechti	+	+			+	+		+	+	+	+	+	+	+	+	+	+	+	+
C. lophura									+	+									+
C. macrocheira																			
C. magna									+	+		+				+			+
C. daphnoides																			
C. imbricata																			
C. plinthina																			
D. discophora								+	+	+		+					+	+	+
D. aff. *elegans*																			
D. tamensis	+	+		+	+			+	+	+	+		+				+		
L. loricata																			
M. curta s.l.										+									
M. stigmatica																			
O. atlantica								+	+	+						+	+	+	+
O. striola s.s.									+										
P. allotherium *																			
P. echinata																			
P. inermis																			
P. oblonga, f. A *																			
P. oblonga, f. B *																			
P. dichotoma																			
P. prosadene									+	+						+	+	+	+
P. parthenoda										+			+						
P. porrecta	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+
P. spinirostris																			
P. brachyaskos																			
P. decipiens				+	+			+	+	+	+	+	+	+	+	+	+		+
P. macroprocera									+	+							+	+	+
P. microprocera	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
P. procera										+									
P. concentrica	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+		+
C. pusilla																			
K. kyrtophora									+				+						
N. nasotuberculata																			
E. cf. *aculeata* *	+	+	+	+	+								+	+	+	+	+	+	
E. aff. *a. elongata* *	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+
E. cf. *aculeata* and *E.* aff. *a. elongata*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
E. cf. *chierchiae*																			

III. Cruise TN045

Species	TN045																	
	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	S2	S3	S4	S7	S9	S11	S13	S15
A. (*A.*) *striata*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
A. alata											+	+						
A. leptothrix																		
C. acuminata																		
C. giesbrechti	+	+	+		+	+	+	+	+					+	+	+	+	+
C. lophura											+	+	+					+
C. macrocheira																		
C. magna											+	+	+					+
C. daphnoides																		
C. imbricata											+							
C. plinthina																		
D. discophora											+	+	+				+	+
D. aff. *elegans*											+							
D. tamensis	+	+	+	+	+	+					+	+	+	+				+
L. loricata																		
M. curta s.l.											+		+					+
M. stigmatica																		
O. atlantica											+	+	+					+
O. striola s.s.											+							
P. allotherium *																		
P. echinata																		
P. inermis																		
P. oblonga, f. A *																		
P. oblonga, f. B *																		
P. dichotoma																		
P. prosadene											+	+					+	+
P. parthenoda																		
P. porrecta	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
P. spinirostris																		
P. brachyaskos											+							
P. decipiens			+			+	+				+	+	+	+		+		+
P. macroprocera											+	+					+	+
P. microprocera	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
P. procera																		
P. concentrica	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+		
C. pusilla											+		+					
K. kyrtophora											+							+
N. nasotuberculata											+	+						
E. cf. *aculeata* *		+	+	+	+	+	+	+	+	+				+		+	+	
E. aff. *a. elonga*ta *	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+		
E. cf. a*culeata* and *E.* aff. *a. elongata*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
E. cf. *chierchiae*																		

IV. Cruises MB9503, MB9506

Species	MB9503									MB9506					
	M3	M4	M6	M7	M13	M14	M28	M30	M31	M14	M37	M43	M45	M48	S7
A. (*A.*) *striata*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
A. alata	+	+	+	+			+	+				+	+	+	+
A. leptothrix															
C. acuminata	+	+		+											
C. giesbrechti		+	+	+	+	+	+	+	+	+	+	+	+	+	+
C. lophura	+	+	+	+									+	+	
C. macrocheira	+	+	+	+											
C. magna	+	+	+	+	+		+					+	+	+	+
C. daphnoides	+	+		+											
C. imbricata		+	+	+											
C. plinthina					+										
D. discophora	+	+	+	+	+		+	+			+	+	+	+	+
D. aff. *elegans*	+	+		+											
D. tamensis	+	+	+	+	+		+	+	+	+	+	+	+	+	+
L. loricata			+	+											
M. curta s.l.	+	+	+	+			+					+	+	+	+
M. stigmatica				+											
O. atlantica	+	+		+	+	+	+	+		+		+	+	+	+
O. striola s.s.	+	+	+	+									+	+	
P. allotherium *	+	+	+	+											
P. echinata	+	+		+										+	
P. inermis				+											
P. oblonga, f. A *	+	+		+											
P. oblonga, f. B *	+	+		+											
P. dichotoma		+		+											
P. prosadene		+		+		+	+					+			+
P. parthenoda	+	+		+			+			+		+	+	+	
P. porrecta	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
P. spinirostris	+	+	+	+	+								+	+	
P. brachyaskos		+	+	+	+		+						+		
P. decipiens	+	+	+	+	+	+	+	+	+	+		+	+	+	+
P. macroprocera		+		+			+							+	
P. microprocera	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
P. procera		+		+											
P. concentrica				+	+	+	+	+	+	+	+				+
C. pusilla		+	+	+	+		+	+	+			+	+	+	+
K. kyrtophora		+	+	+			+								
N. nasotuberculata	+	+	+	+			+							+	
E. cf. *aculeata* *			+			+	+			+	+				
E. aff. *a. elongata* *				+		+	+	+	+	+	+	+	+	+	+
E. cf. *aculeata* and *E.* aff. *a. elongata*	+		+	+	+	+	+	+	+	+	+	+	+	+	+
E. cf. *chierchiae*	+	+	+	+						+				+	

V. Cruise TN050

Species	TN050																
	N2	N3	N4	N5	N6	N7	N11	A	S1	S2	S3	S4	S7	S9	S11	S13	S15
A. (*A.*) *striata*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
A. alata								+		+	+	+					
A. leptothrix																	
C. acuminata																	
C. giesbrechti	+	+	+			+	+	+		+	+	+	+	+	+	+	+
C. lophura																	+
C. macrocheira																	
C. magna		+						+		+	+	+		+			
C. daphnoides																	
C. imbricata																	
C. plinthina																	
D. discophora								+				+					+
D. aff. *elegans*																	
D. tamensis	+	+	+			+	+	+	+	+	+	+	+	+	+		+
L. loricata																	
M. curta s.l.								+		+	+	+					
M. stigmatica																	
O. atlantica								+		+	+	+					+
O. striola s.s.												+					
P. allotherium *																	
P. echinata																	
P. inermis																	
P. oblonga, f. A *																	
P. oblonga, f. B *																	
P. dichotoma																	
P. prosadene								+		+	+					+	+
P. parthenoda								+		+		+					
P. porrecta	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
P. spinirostris										+							
P. brachyaskos																	
P. decipiens		+						+	+	+	+	+	+	+	+	+	+
P. macroprocera																	+
P. microprocera	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
P. procera																	
P. concentrica	+	+	+	+	+	+	+	+		+		+	+	+	+		+
C. pusilla																	
K. kyrtophora																	
N. nasotuberculata																	
E. cf. *aculeata* *		+		+	+	+	+							+	+	+	+
E. aff. *a. elonga*ta *	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
E. cf. a*culeata* and *E.* aff. *a. elongata*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
E. cf. *chierchiae*								+				+	+				

VI. Cruise TN054

Species	TN054																
	N1	N2	N4	N6	N7	N9	N11	A	S1	S2	S3	S4	S7	S9	S11	S13	S15
A. (*A.*) *striata*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
A. alata		+								+	+	+					
A. leptothrix																	
C. acuminata																	
C. giesbrechti		+			+	+	+	+		+	+	+	+	+	+	+	+
C. lophura										+							+
C. macrocheira																	
C. magna								+		+	+	+					
C. daphnoides																	
C. imbricata																	
C. plinthina																	
D. discophora										+					+		+
D. aff. *elegans*																	
D. tamensis	+	+	+	+		+		+	+	+	+	+	+				+
L. loricata																	
M. curta s.l.										+		+					
M. stigmatica																	
O. atlantica										+	+	+		+		+	+
O. striola s.s.										+		+					
P. allotherium *																	
P. echinata																	
P. inermis																	
P. oblonga, f. A *																	
P. oblonga, f. B *																	
P. dichotoma																	
P. prosadene								+		+	+						+
P. parthenoda										+	+	+					
P. porrecta	+	+	+	+	+	+		+	+	+	+	+	+		+		
P. spinirostris										+		+					
P. brachyaskos																	
P. decipiens		+			+			+	+	+	+	+	+	+			
P. macroprocera										+							+
P. microprocera	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
P. procera												+					
P. concentrica		+	+		+	+			+	+	+	+	+		+		
C. pusilla																	
K. kyrtophora										+		+					+
N. nasotuberculata																	
E. cf. *aculeata* *		+		+	+	+	+						+	+	+		
E. aff. *a. elongata* *	+	+	+	+	+		+	+	+	+	+	+	+		+		
E. cf. *aculeata* and *E.* aff. *a. elongata*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+
E. cf. *chierchiae*																	