

Fig. 43. *Sergia plumea*, male, "Dana" St. 3909-2, Cp length 17.1 mm. - A, lateral view of Cp. - B, scaphocerite. - C, Up.

branchial lobe on somite XII not hidden under anterior lobe; LI undivided, not overlapping other lobes and processes; LT entire; LC divided, with distal lobule strongly curved laterally at 1/2 length and overlapping other lobes and processes; proximal lobule directed proximally; LAc absent; LA evenly curved medially, reaching 0.4-0.6 PV length, no photophores found.

Description: Integument usually semi-membranous; Cp 2.1 times as long as high and 0.48 times as long as abdomen (Fig. 43A). Abdomen with somite VI 1.6 times as long as high and 1.1 times as long as telson; telson 3.5 times as long as wide.

Ocular papilla 0.3 times as long as wide; cornea usually poorly pigmented, light brown, 1.0 times as long as wide, 0.7 times as long and 1.6 times as wide as eyestalk. A I peduncle 0.6 times as long as Cp, with segments 2 and 3 0.67 and 0.63 times as long as segment 1, respectively; segment 3 of male outer A I flagellum in male with tubercle overlapping segment 4 of flagellum; segment 4 bearing 5 serrated bristles and several setae on dorsal surface (Fig. 44C). A II peduncle 0.4 times as long as scaphocerite; latter 3.2 times as long as wide (Fig. 43B), 0.83 times as long as A I peduncle.

Md palp 0.32 times as long as Cp, with proximal segment 2.3 times as long as distal one. Mx I with palp 2.3 times as long as wide and 0.06 times as long as Cp; endopod 1.7 times as long as wide and 1.7 times as long as palp; endite 1.5 times as long as wide and 1.0 times as long as palp. Mx II with exopod 3.0 times as long as wide and 0.37 times as long as Cp; palp 3.8 times as long as wide and 0.12 times as long as Cp; endopod 2.0 times as long as wide and 0.9 times as long as palp; endites subequal, 1.6 times as long as wide and 0.4 times as long as palp.

Mxp I with exopod 2.7 times as long as wide and 0.16 times as long as Cp; endopod 1.3 times as long as exopod, segments 2 and 3 1.4 and 1.3 times as long as segment 1, respectively. Mxp II 0.9 times as long as Cp, with merus 1.1, carpus 1.0, propodus 1.1, and dactyl 0.5 times as long as ischium. Mxp III 1.5 times as long as Cp, with merus 1.1, carpus 1.2, propodus and dactyl 1.1 times as long as ischium; propodus and dactyl divided into 4 and 7 subsegments, respectively.

P I 1.0 times as long as Cp, with merus 2.6, carpus 1.5, and propodus 2.8 times as long as ischium; propodus divided into 9 subsegments. P II 1.5 times as long as Cp, with merus 3.4, carpus 2.2, propodus 2.8, and dactyl 0.1 times as long as ischium; propodus incompletely divided into 12 subsegments. P III 1.7 times as long as Cp, with merus 2.6, carpus 2.3, propodus 2.8, and dactyl 0.2 times as long as ischium; propodus divided into 11 subsegments. P IV 1.2 times as long as Cp, with merus 1.3, carpus 0.8, and propodus 0.9 times as long as ischium. P V 0.6 times as long as Cp, with merus 1.0, carpus and propodus 0.6 times as long as ischium.

Somite VIII with arthrobranch 0.19 times as long as Cp and 4.4 times as long as epipod. Somite IX with anterior pleurobranch 0.26 times as long as Cp and 6.8 times as long as posterior pleurobranch. Somite X with anterior pleurobranch 0.29 times as long as Cp and 5.9 times as long as posterior pleurobranch. Somite XI with anterior pleurobranch 0.31 times as long as Cp and 7.3 times as long as

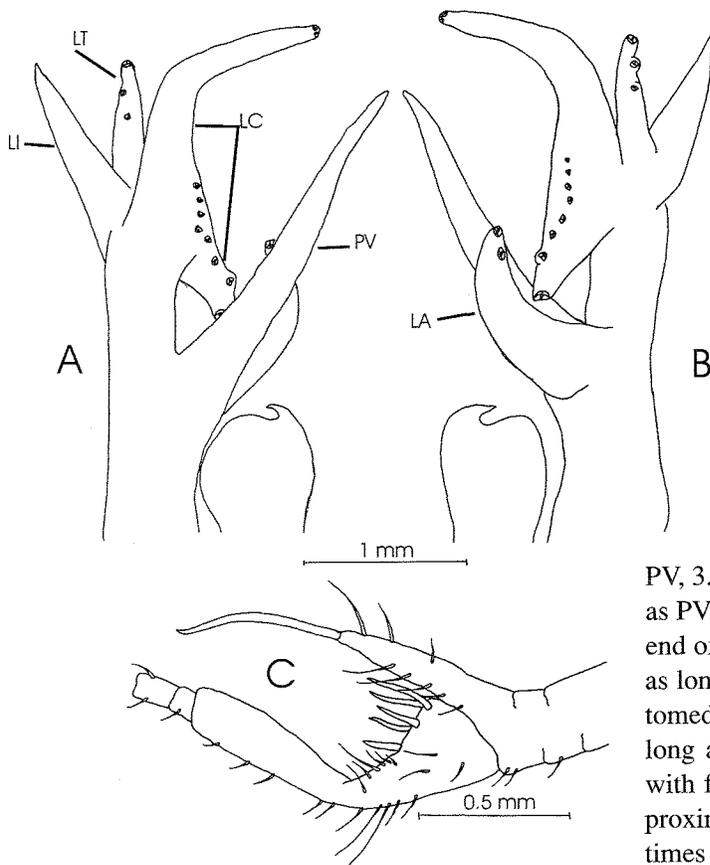


Fig. 44. *Sergia plumea*, male, "Dana" St. 3909-2, Cp length 17.1 mm. - A, caudal view of petasma. - B, oral view of petasma. - C, male outer A I flagellum.

posterior pleurobranch. Somite XII with anterior pleurobranch 0.31 times as long as Cp and 1.9 times as long as posterior pleurobranch, posterior lobe not hidden under anterior lobe. Somite XIII with anterior pleurobranch 0.31 times as long as Cp and 1.0 times as long as posterior pleurobranch.

PI I with basipod 0.32 times as long as Cp and exopod 2.4 times as long as basipod. PI II with basipod 0.31 times as long as Cp; exopod 2.7 and endopod 1.5 times as long as basipod, respectively. PI III with basipod 0.28 times as long as Cp; exopod 3.0 and endopod 1.7 times as long as basipod, respectively. PI IV with basipod 0.28 times as long as Cp; exopod 2.6 and endopod 1.3 times as long as basipod, respectively. PI V with basipod 0.25 times as long as Cp; exopod 2.2 and endopod 1.3 times as long as basipod, respectively.

Up with exopod 4.4 times as long as wide, 6.9 times as long as basipod and 0.6 times as long as Cp; endopod 3.6 times as long as wide and 0.7 times as long as exopod (Fig. 43C).

Petasma (Fig. 44A-B). PV long and narrow, 4.5 times as long as wide, tip slightly curved and directed laterally. LI well developed, not reaching end of

PV, 3.0 times as long as wide and 0.4 times as long as PV. LT slender, reaching end of LI, not reaching end of LC, 3.3 times as long as wide and 0.4 times as long as PV, armed with few small hooks on distomedial margin. LC with distal lobule 3.4 times as long as wide and 0.7 times as long as PV, armed with few small apical hooks, tip directed laterally; proximal lobule 1.3 times as long as wide and 0.3 times as long as PV, armed with row of small hooks along entire dorsolateral margin and single medium-sized apical hook. LA short, 2.1 times as long as wide and 0.5 times as long as PV, armed with few hooks near apex.

Photophores. No photophores were found in the "Dana" specimens.

Remarks: Since the original description by Illig (1927), *S. plumea* has not been recorded and has no junior synonyms. Even in the "Dana" collection, this extremely rare species is represented by only about 20 specimens. Although varying in minor features of the petasma, they correspond to the Illig's description and undoubtedly belong to the same species. Most specimens have a semi-membranous integument and a poorly pigmented cornea, while a few have the integument firm and the cornea well pigmented. Due to the dominance of the former group, it is difficult to believe that these variations are associated with moulting. They thus remain a puzzle.

Sergia plumea is close to *S. bisulcata* (see differences and affinities in remarks to *S. bisulcata*). It differs from all other species of the species group in having (1) P III propodus with 11 subsegments and (2) the distal lobule of LC strongly curved at about

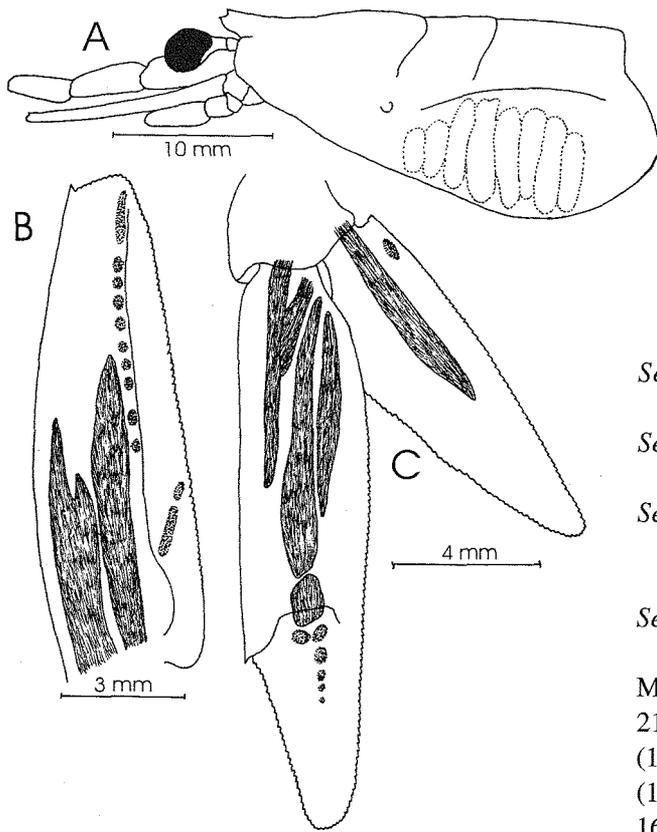


Fig. 45. *Sergia potens*, male, "Dana" St. 3975-6, Cp length 25.9 mm. – A, lateral view of Cp; bc scaphocerite. – C, Up.

1/2 length. Other affinities and differences between *S. plumea* and all other known species of the species group are shown in Table 5.

Geographical distribution (Fig. 38): North Indian Ocean only: Throughout northern part, in Arabian Sea (type locality, Illig 1927), off Sri Lanka ("Dana"), Bay of Bengal, north of Sumatra ("Dana" and "Galathea").

Thus, the distribution of *S. plumea* is very limited. It is sympatric with *S. maxima* and *S. bisulcata* and allopatric to all other species of the species group.

Vertical range: An interzonal species, migrating daily between the meso-/upper bathypelagic and upper mesopelagic zones. "Dana" specimens were taken within the depth range 200-1500 m. All specimens occur at 200-300 m at night and 800-1500 m during the day.

Sergia potens (Burkenroad, 1940)

Figs. 38, 45-46

Sergestes bisulcatus. – Stebbing 1905: 87, pl. 24 A;

1910: 381. [Not Wood-Mason in Wood-Mason & Alcock 1891a.]

Sergestes potens Burkenroad, 1940: 48. – Richardson & Yaldwyn 1958: 26.

Sergestes phorcus. – Barnard 1950: 641, fig. 120. [Not Faxon 1893.]

Sergestes (*Sergia*) *potens*. – Yaldwyn 1957: 15, figs. 11-18. – Kensley 1971: 253, fig. 19; 1977: 18. – Vereshchaka 1990b: 138.

Sergia potens. – Vereshchaka 1995a: 1651.

Material examined: "Dana" stations: 3640-6 (1f 21¹/₂); 3975-1 (2f 16¹/₂-19¹/₂ & 4j 7¹/₂-8¹/₂); 3975-6 (1m 26); 3978-1 (4f 9-23 & 5m 9¹/₂-21¹/₂); 3978-7 (1f 11 & 2m 12-14); 3978-8 (1f 9¹/₂ & 1m 21¹/₂ & 16j 6¹/₂-8).

"Galathea" stations: 607 (1f 26¹/₂); 634 (1m 30).

Type locality: South Atlantic, 35°42'S, 18°37'E.

Type material: Holotype of *Sergestes potens* ("Dana" St. 3975-7, was in ZMUC, now lost; see Introduction).

Diagnosis: Integument firm; rostrum acute, usually bidentate; cornea considerably wider than eye-stalk; segment 3 of outer A I flagellum in male with well developed tubercle overlapping segment 4 of flagellum, without terminal setae overlapping tubercle, segment 4 of flagellum bearing 5-6 serrated bristles on dorsal surface; posterior branchial lobe on somite XII not hidden under anterior lobe, LI; undivided, not overlapping other lobes and processes; LT divided; LC divided, with distal lobule straight, overlapping other lobes and processes and with proximal lobule directed laterally; LAc present; LA evenly curved medially, reaching 0.9-1.1 of PV length. Photophores in 2 rows on scaphocerite medial to inner strip of muscle (8-12 organs in longitudinal row and 2-6 organs in oblique row) and 2-7 in triangular figure distal to apical muscle strip on Up exopod.

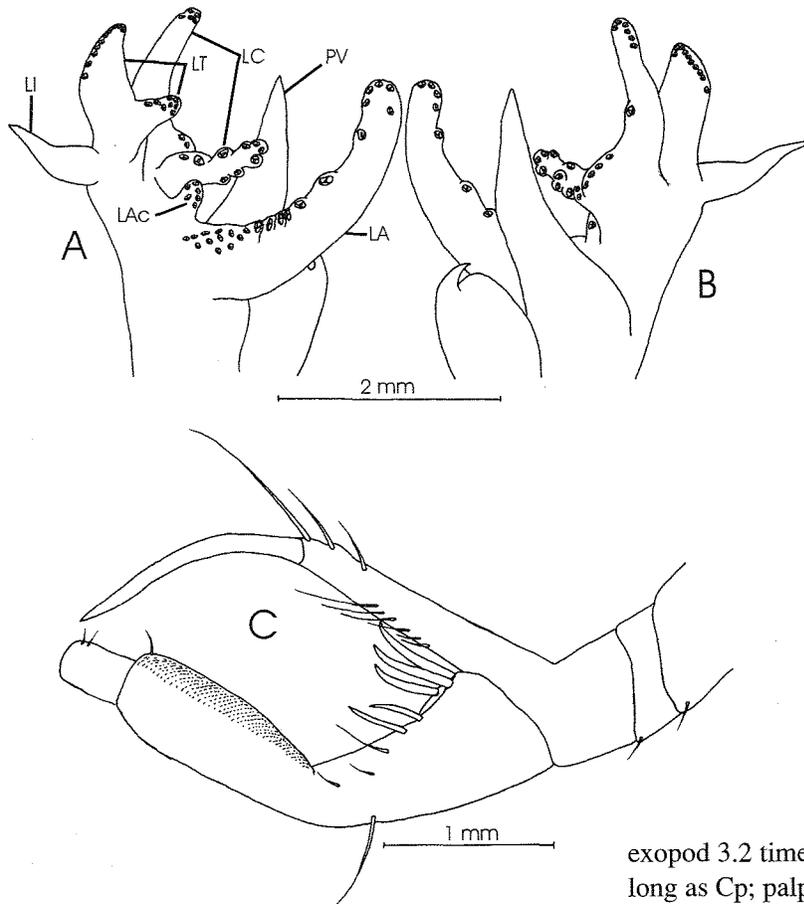


Fig. 46. *Sergia potens*, male, "Dana" St. 3975-6, Cp length 25.9 mm. - A, oral view of petasma. - B, caudal view of petasma. - C, male outer A I flagellum.

Description: Cp 1.9 times as long as high and 0.42 times as long as abdomen (Fig. 45A). Abdomen with somite VI 1.6 times as long as high and 1.2 times as long as telson; telson 2.9 times as long as wide.

Ocular papilla inconspicuous, 0.3 times as long as wide; cornea well pigmented, dark brown, 1.0 times as long as wide, 0.9 times as long and 2.2 times as wide as eyestalk. A I peduncle 0.7 times as long as Cp, with segments 2 and 3 0.63 and 0.53 times as long as segment 1, respectively; segment 3 of outer A I flagellum in male with tubercle reaching end of segment 5 of flagellum, segment 4 bearing 5-6 serrated bristles and few setae on dorsal surface (Fig. 46C). A II peduncle 0.5 times as long as scaphocerite; latter 3.4 times as long as wide (Fig. 45B), 0.83 times as long as A I peduncle.

Md palp 0.33 times as long as Cp, with proximal segment 2.1 times as long as distal one. Mx I with palp 2.5 times as long as wide and 0.07 times as long as Cp; endopod 1.8 times as long as wide and 1.5 times as long as palp; endite 1.7 times as long as wide and 0.9 times as long as palp. Mx II with

exopod 3.2 times as long as wide and 0.33 times as long as Cp; palp 2.9 times as long as wide and 0.11 times as long as Cp; endopod 1.9 times as long as wide and 1.0 times as long as palp; endites subequal, 1.6 times as long as wide and 0.5 times as long as palp.

Mxp I with exopod 3.2 times as long as wide and 0.20 times as long as Cp; endopod 1.0 times as long as exopod, segments 2 and 3 1.0 times as long as segment 1. Mxp II 0.8 times as long as Cp, with merus 1.0, carpus 0.8, propodus 0.9, and dactyl 0.5 times as long as ischium. Mxp III 1.3 times as long as Cp, with merus and propodus 0.9, and dactyl 0.8 times as long as ischium; propodus and dactyl divided into 3 and 7 subsegments, respectively.

P I 1.0 times as long as Cp, with merus 2.9, carpus 1.7, and propodus 3.3 times as long as ischium; propodus incompletely divided into 10 subsegments. P II 1.4 times as long as Cp, with merus 2.8, carpus 2.2, propodus 3.0, and dactyl 0.2 times as long as ischium; propodus divided into 12 subsegments. P III 1.7 times as long as Cp, with merus 2.9, carpus 2.4, propodus 2.7, and dactyl 0.2 times as long as ischium; propodus incompletely divided into 13-14 subsegments. P IV 1.1 times as long as Cp, with merus 1.5, carpus 1.0, and propodus 1.2 times as long as ischium. P V 0.6 times as long as

Cp, with merus 1.2, carpus 1.0 and propodus 0.8 times as long as ischium.

Somite VIII with arthrobranch 0.13 times as long as Cp and 2.0 times as long as epipod. Somite IX with anterior pleurobranch 0.23 times as long as Cp and 4.7 times as long as posterior pleurobranch. Somite X with anterior pleurobranch 0.26 times as long as Cp and 3.4 times as long as posterior pleurobranch. Somite XI with anterior pleurobranch 0.29 times as long as Cp and 4.4 times as long as posterior pleurobranch. Somite XII with anterior pleurobranch 0.32 times as long as Cp and 1.2 times as long as posterior pleurobranch, posterior lobe not hidden under anterior lobe. Somite XIII with anterior pleurobranch 0.29 times as long as Cp and 1.2 times as long as posterior pleurobranch.

Pl I with basipod 0.30 times as long as Cp and exopod 2.3 times as long as basipod. Pl II with basipod 0.30 times as long as Cp; exopod 2.5 and endopod 1.3 times as long as basipod, respectively. Pl III with basipod 0.30 times as long as Cp; exopod 2.4 and endopod 1.3 times as long as basipod, respectively. Pl IV with basipod 0.29 times as long as Cp; exopod 2.0 and endopod 1.1 times as long as basipod, respectively. Pl V with basipod 0.26 times as long as Cp; exopod 1.7 and endopod 1.0 times as long as basipod, respectively.

Up with exopod 4.7 times as long as wide, 5.5 times as long as basipod and 0.7 times as long as Cp; endopod 3.3 times as long as wide and 0.7 times as long as exopod (Fig. 45C).

Petasma (Fig. 46A-B). PV short, 2.7 times as long as wide, tip straight. LI well-developed, directed medially, not reaching ends of LT and LC, 2.9 times as long as wide and 0.4 times as long as PV. LT with distal lobule overlapping PV, 1.6 times as long as wide and 0.3 times as long as PV, armed with several small hooks on distomedial margin; proximal lobule 1.2 times as long as wide and 0.2 times as long as PV, armed with several small distal hooks. LC divided into 2 lobules: distal and proximal; distal lobule overlapping other lobes and processes, 2.1 times as long as wide and 0.6 times as long as PV, armed with several small hooks on distomedial side and few larger proximal hooks, straight, tip directed distally; proximal lobule 3.4 times as long as wide and 0.4 times as long as PV, covered with several medium-sized hooks, directed laterally. LAc small, 1.5 times as long as wide and 0.1 times as long as PV, covered with small hooks. LA strong, 3.8 times as long as wide and 1.0 times

as long as PV, armed with numerous hooks along medial side and near apex.

Photophores. Scaphocerite: photophores arranged in 2 rows medial to inner strip of muscle, (1) longitudinal row of 8-12 organs (sometimes fused) from 0.3-0.4 to 0.9-1.0 blade length and (2) oblique row of 2-6 organs (often fused) from 0.2 to 0.3 blade length. Up exopod: 2-7 photophores in triangular figure distal to apical muscle strip. Up endopod: 1 photophore in proximomedial corner.

Remarks: All "Dana" specimens agree with Burkenroad's (1940) description and are similar, almost identical to the description by Stebbing (1905, 1910, both as *Sergestes bisulcatus*). "Dana" specimens vary morphologically in the form of the rostrum (which may sometimes be more elongate and even unidentate), the position of the photophores (organs in the oblique row on the scaphocerite range from completely separate to almost entirely fused; 1-3 additional proximal photophores may rarely be present on the Up exopod, near the inner margin), minor proportions of the branchiae and appendages, and in the fine structure of the petasma (proportions of the proximal lobules of LT and LC, the latter always overlapping other lobes and processes; the configuration of LA, which is always completely straight and nearly reaching the end of PV).

Affinities and differences between *Sergestes potens* and all other known species of the species group are shown in Table 5.

Geographical distribution (Fig. 38): Atlantic, Indian, and Pacific Oceans.

Southeast Atlantic - Southwest Indian Ocean: Off South Africa ("Dana"; Stebbing 1905, Calman 1925, Barnard 1950, Kensley 1971). Southeast Indian Ocean (Wasmer 1992 [1993]).

Pacific: Off New Zealand ("Dana" and "Galathea"), Cook Strait, in the stomachs of grouper and ling, east of New Zealand (Wilson 1978); over Nazca and Sala-y-Gomez Ridges (Vereshchaka 1990b).

The presence of comparatively large numbers of *S. potens* in two areas is more likely a result of the scanty sampling of the southern Indian Ocean and the rarity of the species than of its actual absence here. *S. potens* is parapatric to *S. grandis*, *S. bisulcata*, *S. phorca*, and *S. filicta*, which live north of 10-15°S in the Atlantic, Indian and Pacific Oceans,

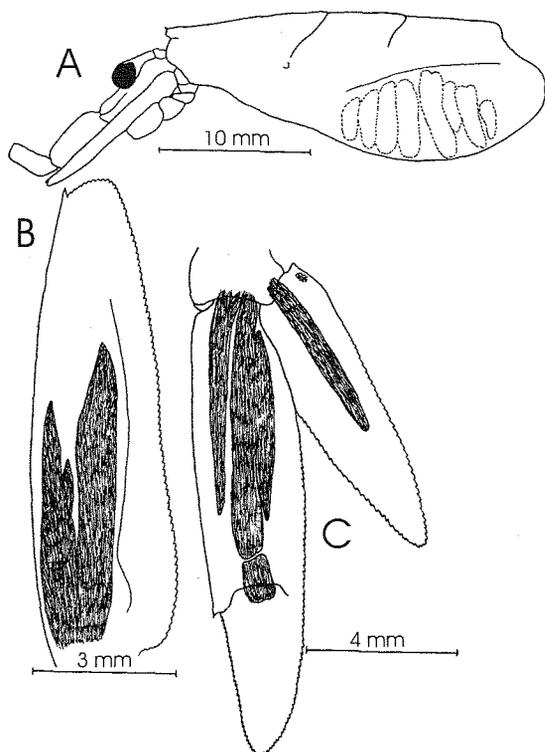


Fig. 47. *Sergia wolffi*, holotype, male, "Dana" St. 1217-1, Cp length 20.0 mm. – A, lateral view of Cp. – B, scaphocerite. – C, Up.

while *S. potens* occurs south of 10-15°S in the same oceans. *S. potens* is sympatric with *S. maxima* and *S. burukovskii* and allopatric to *S. wolffi* and *S. plumea*.

Vertical range: An interzonal species, migrating daily between the upper bathypelagic and upper mesopelagic zones. "Dana" specimens were taken within the depth range of 200-1300 m. Most specimens live at 200-300 m at night and 1000-2000 m during the day.

Sergia wolffi Vereshchaka, 1994

Figs. 30, 47-48

Sergia wolffi Vereshchaka, 1994a: 88, figs. 7, 19-21, 26.

Material examined: "Dana" stations: 1156-5 (1f 19); 1156-8 (1m 14½); 1185-11 (1f 20); 1196-1 (1f 21); 1214-4 (1f 21 & 1m 14); 1215-1 (1m 19); 1217-1 (1f 21 & 1m 20); 1223-1 (2m 12-13½); 1225-2 (1m 12½); 1228-1 (1f 15); 1230-2 (1m 13½); 1239-15 (1f 19½); 1241-6 (1f 21); 1242-11

(1f 20); 1242-14 (1f 12); 1243-1 (1m 15); 1243-2 (1m 12); 1257-1 (2f 13-21); 1261-1 (1f 19); 1286-1 (1f 17½ & 1m 19); 1320-1 (1f 13); 1332-1 (1f 16 & 1m 18); 1332-7 (1f 15); 1356-1 (1m 19); 1358-6 (1f 19); 1363-1 (1f 19½).

Holotype (male, ZMUC CRU 1612 "Dana" St. 1217-1) + 1 paratype (female, ZMUC CRU 1613, "Dana" St. 1217-1).

Type locality: Caribbean Sea, 18°50'N, 79°07'W.

Type material: Holotype + 1 paratype (ZMUC, see above, examined).

Diagnosis: Integument firm, rostrum usually acute; cornea considerably wider than eyestalk; segment 3 of outer A I flagellum in male with well developed tubercle overlapping segment 4 of flagellum, without terminal setae overlapping tubercle; segment 4 of flagellum bearing 5-6 serrated bristles on dorsal surface; posterior branchial lobe on somite XII not hidden under anterior lobe; LI undivided, not overlapping other lobes and processes; LT entire; LC divided, with distal lobule curved and overlapping other lobes and processes and proximal lobule directed distolaterally; LAc absent; LA strongly curved medially at ¾ length, reaching 0.7-0.9 PV. 1 photophore in proximomedial corner of Up endopod.

Description: Cp 2.2 times as long as high and 0.42 times as long as abdomen (Fig. 47A). Abdomen with somite VI 1.6 times as long as high and 1.2 times as long as telson; telson 2.7 times as long as wide.

Ocular papilla 0.3 times as long as wide, cornea well-pigmented, dark brown, 1.0 times as long as wide, 0.6 times as long and 1.5 times as wide as eyestalk. A I peduncle 0.6 times as long as Cp, with segments 2 and 3 0.77 and 0.67 times as long as segment 1, respectively, segment 3 of outer A I flagellum in male with tubercle overlapping segment 4 of flagellum; segment 4 bearing 5-6 serrated bristles and several setae on dorsal surface (Fig. 48C). A II peduncle 0.4 times as long as scaphocerite; latter 3.5 times as long as wide (Fig. 47B), 0.83 times as long as A I peduncle.

Md palp 0.38 times as long as Cp, with proximal segment 2.1 times as long as distal one. Mx I with palp 2.4 times as long as wide and 0.06 times as long as Cp; endopod 1.9 times as long as wide and

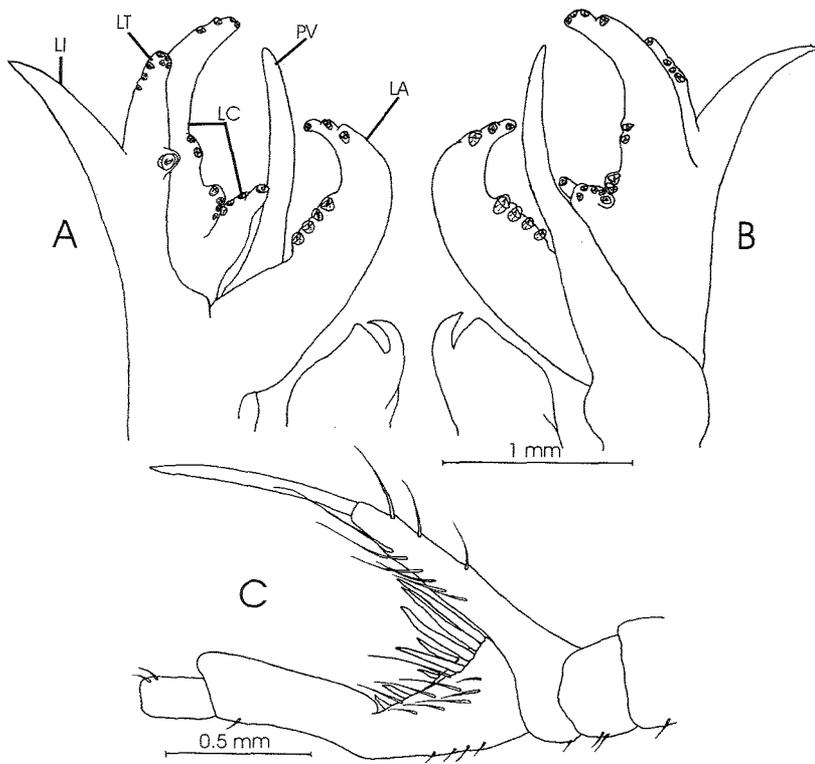


Fig. 48. *Sergia wolffi*, holotype, male, "Dana" St. 1217-1, Cp length 20.0 mm. - A, oral view of petasma. - B, caudal view of petasma. - C, male outer A I flagellum.

1.6 times as long as palp; endite 1.8 times as long as wide and 1.1 times as long as palp. Mx II with exopod 3.3 times as long as wide and 0.32 times as long as Cp; palp 3.8 times as long as wide and 0.12 times as long as Cp; endopod 2.3 times as long as wide and 1.0 times as long as palp; endites subequal, 1.9 times as long as wide and 0.4 times as long as palp.

Mxp I with exopod 4.0 times as long as wide and 0.21 times as long as Cp; endopod 0.9 times as long as exopod, segments 2 and 3 1.1 and 1.0 times as long as segment 1, respectively. Mxp II 0.9 times as long as Cp, with merus 1.0, carpus 0.9, propodus 1.0, and dactyl 0.4 times as long as ischium. Mxp III 1.6 times as long as Cp, with merus 1.0, carpus 1.4, propodus 1.1, and dactyl 1.0 times as long as ischium; propodus and dactyl divided into 3 and 7 subsegments, respectively.

PI 1.0 times as long as Cp, with merus 2.9, carpus 1.6, and propodus 2.4 times as long as ischium; propodus divided into 10 subsegments. P II 1.6 times as long as Cp, with merus 2.8, carpus 2.4, propodus 3.0, and dactyl 0.1 times as long as ischium; propodus divided into 13 subsegments. P III 1.9 times as long as Cp, with merus 3.0, carpus 2.6, propodus 3.1, and dactyl 0.1 times as long as ischium; propodus divided into 13 subsegments. P IV

1.2 times as long as Cp, with merus 1.4, carpus 0.9, and propodus 1.0 times as long as ischium. P V 0.7 times as long as Cp, with merus 1.0, carpus 0.8 and propodus 0.6 times as long as ischium.

Somite VIII with arthrobranch 0.13 times as long as Cp and 2.4 times as long as epipod. Somite IX with anterior pleurobranch 0.20 times as long as Cp and 4.7 times as long as posterior pleurobranch. Somite X with anterior pleurobranch 0.26 times as long as Cp and 3.7 times as long as posterior pleurobranch. Somite XI with anterior pleurobranch 0.29 times as long as Cp and 3.4 times as long as posterior pleurobranch. Somite XII with anterior pleurobranch 0.29 times as long as Cp and 1.3 times as long as posterior pleurobranch, posterior lobe not hidden under anterior lobe. Somite XIII with anterior pleurobranch 0.24 times as long as Cp and 1.3 times as long as posterior pleurobranch.

PI I with basipod 0.29 times as long as Cp and exopod 2.7 times as long as basipod. PI II with basipod 0.28 times as long as Cp; exopod 2.9 and endopod 1.6 times as long as basipod, respectively. PI III with basipod 0.28 times as long as Cp; exopod 2.8 and endopod 1.5 times as long as basipod, respectively. PI IV with basipod 0.27 times as long as Cp; exopod 2.5 and endopod 1.3 times as long as basipod, respectively. PI V with basipod 0.23 times as

long as Cp; exopod 2.3 and endopod 1.3 times as long as basipod, respectively.

Up with exopod 4.3 times as long as wide, 6.3 times as long as basipod and 0.6 times as long as Cp; endopod 3.4 times as long as wide and 0.7 times as long as exopod (Fig. 47C).

Petasma (Fig. 48A-B). PV long and slender, 4.1 times as long as wide, tip not curved. LI well developed, overlapping PV, 2.6 times as long as wide and 0.4 times as long as PV. LT slender, reaching end of LI, 2.0 times as long as wide and 0.3 times as long as PV, armed with few small hooks on distomedial margin and near apex. LC with distal lobule slightly overlapping other lobes and processes, 2.4 times as long as wide and 0.5 times as long as PV, bearing few papillae with hooks at base and several hooks near apex, slightly curved, tip directed distolaterally; proximal lobule 1.9 times as long as wide and 0.2 times as long as PV, armed with several hooks on medial side. LA voluminous, reaching 0.7 to 0.9 PV, 2.1 times as long as wide and 0.7 times as long as PV, armed with few smaller hooks near apex and 4-6 stronger hooks in middle.

Photophores. 1 on Up endopod, in proximomedial corner.

Remarks: This species was described a few years ago (Vereshchaka 1994a) and has not been recorded since. Having got more experience in the examination of vanishing photophores on the alcohol-preserved shrimps, I finally found the single, very inconspicuous organ mentioned above to be visible in some specimens. In addition, a single photophore was recorded on the basal part of the scaphocerite in some specimens (Vereshchaka 1994a). Thus, in the photophore position, this species seems to be similar to *S. bisulcata* in having a reduced number of these organs. According to the methods of measurements adopted in this paper, the ratio somite VI length/telson length is 1.2 (not "almost 1.5" as reported in the original description when segments were measured along their lateral sides). After repeated examination of the "Dana" material, I found the number of strong medial hooks on LA ranging from 3 to 5 (4 hooks in the original description). In spite of variability of the petasma, *S. wolffi* always possesses an LA reaching about 3/4 PV, strongly curved at the tip, and bearing a few strong hooks at the middle.

Sergia wolffi differs from all other species of the species group in having (1) basal lobule of LC

directed distolaterally, and (2) LA strongly curved an about 3/4 length. Other affinities and differences between *S. wolffi* and all other species of the species group are shown in Table 5.

Geographical distribution (Fig. 30): North Atlantic only: Caribbean Sea, West and Central North Atlantic ("Dana"; Vereshchaka 1994a).

Sergia wolffi occurs in a single area. It is sympatric with *S. grandis* and allopatric to all other species of the species group.

Vertical range: An interzonal species, migrating daily between the meso-/upper bathypelagic and upper mesopelagic zones. "Dana" specimens were taken within the depth range 100-2000 m. Most specimens occur at 200-300 m at night and at 700-1300 m during the day.

Sergia robusta species group

Diagnosis: Lens-less photophores present: 1 long continuous row close to central axis of scaphocerite (sometimes reduced to 1 basal photophore), 2 rows close to central axis in proximal and distal parts of Up exopod (sometimes reduced to 1 proximal photophore); hepatic tubercle blunt; postdorsal spine on VI abdominal somite present; ocular papilla small, 1/4-1/3 as long as wide; A I with segment 1 longer than segment 2; clasping organ with 0-7 serrated bristles; endopod of Mxp I with 3 segments; scaphocerite with distal tooth not overlapping blade; propodus in Mxp III divided into 3 subsegments; posterior branchial lobe above P III well developed, not lamellar; petasma with all lobes entire, PV of petasma tapering into point; LC and LT twisted, former with thickened proximal part armed with numerous hooks.

Species included: *Sergia extenuata* (Burkenroad, 1940), *S. regalis* (Gordon, 1939), *S. robusta* (Smith, 1882), *S. vityazi* n. sp.

Key to species of the *Sergia robusta* species group

1. Segment 3 of male outer A I flagellum with tubercle rudimentary and 2 long setae overlapping tubercle and segment 4 with more than 5 serrated bristles on dorsal side. P III

Table 6. Affinities and differences between species of the *Sergia robusta* species group. L = length, ph = photophore(s), r = rudimentary, Sc = scaphocerite, ss = subsegments, w = well developed, + = present, - = absent.

Characters	<i>S. extenuata</i>	<i>S. regalis</i>	<i>S. robusta</i>	<i>S. vityazi</i> n. sp.
Additional dorsal tooth on rostrum	+	+	-	+
Tubercle on male A I outer flagellum	w	w	r	W
No of segments overlapped by tubercle	4	5	4	4
No of terminal setae overreaching tubercle	1	1	2	0
No of serrated bristles in clasping organ	0	3-4	6-7	3-4
Protrusion on segment 5 of male A I flagellum	-	-	-	+
L of PV relative to L of LA	=	<	>	>
L of LC relative to L of LT	> or =	>	=	>
No of apical teeth on LC	1	3-6	1	1
LAc of petasma	-	+	-	+
LA of petasma curved	strongly at 3/4	strongly at 1/4	evenly	evenly
Ph row throughout Sc	-	+	+	+
Distal ph on Up expopd	-	+	+	-
No of ss in Mxp III dactylus	7	6	5-6	7
No of ss in P I propodus	12	10	11	10
No of ss in P II propodus	13	12	13	12
No of ss in P III propodus	10	10	13	10

- with propodus divided into 13 subsegments. LC of petasma not overlapping LT
.....*Sergia robusta*
- Segment 3 of male outer A I flagellum with tubercle well-developed and 0-1 long seta overlapping tubercle and segment 4 with fewer than 5 serrated bristles on dorsal side. P III with propodus divided into 10 subsegments. LC of petasma overlapping LT 2
2. Distal row of photophores on Up expopd usually present; Mxp III with dactyl divided into 6 subsegments; segment 3 of male outer A I flagellum with tubercle overlapping segment 4. LA of petasma overlapping PV; LC with few strong apical hooks; LA strongly curved at 1/4 length *Sergia regalis*
- Distal row of photophores on Up expopd absent; Mxp III with dactyl divided into 7 subsegments; segment 3 of male outer A I flagellum with tubercle not overlapping segment 4. LA of petasma not overlapping PV; LC with single very strong apical hook; LA, if strongly curved, not at 1/4 length 3
3. Scaphocerite with 1 basal photophore. Segment 3 of male outer A I flagellum with single terminal seta overlapping tubercle, segment 4 without serrated bristles on dorsal side and segment 5 without distodorsal protrusion. Scaphocerite less than 3.0 times as long as wide; propodi of P I and P II

- divided into 12 subsegments and 13 subsegments, respectively. PV of petasma not overlapping LA; LAc absent; LA strongly curved at 3/4 length.....*Sergia extenuata*
- Scaphocerite with longitudinal row of photophores. Segment 3 of male outer A I flagellum without terminal setae overlapping tubercle, segment 4 with 3-4 serrated bristles on dorsal side and segment 5 with distodorsal protrusion. Scaphocerite 3.0 or more times as long as wide; propodus of P I divided into 10 and 12 subsegments, respectively. PV of petasma overlapping LA; LAc present; LA curved evenly ... *Sergia vityazi* n. sp.

***Sergia extenuata* (Burkenroad, 1940)**

Figs. 49-51

- Sergestes robustus*. - Illig 1927 (part): 301, figs. 44b-c, 46 [not Smith, 1882].
- Sergestes extenuatus* Burkenroad, 1940: 46.
- Sergestes (Sergia) extenuatus*. - Yaldwyn 1957: 9. - Crosnier & Forest 1973: 338, figs. 112-114.
- Sergia extenuata*. - Vereshchaka 1994a: 87, figs. 8, 18, 26.

Material examined: "Dana" stations: 1157-10 (1f 15 & 1m 12¹/₂); 1159-5 (2f 14¹/₂-15¹/₂ & 5m 12¹/₂-15¹/₂); 1160-2 (1f 19 & 2m 11-18); 1162-1 (2f 15-

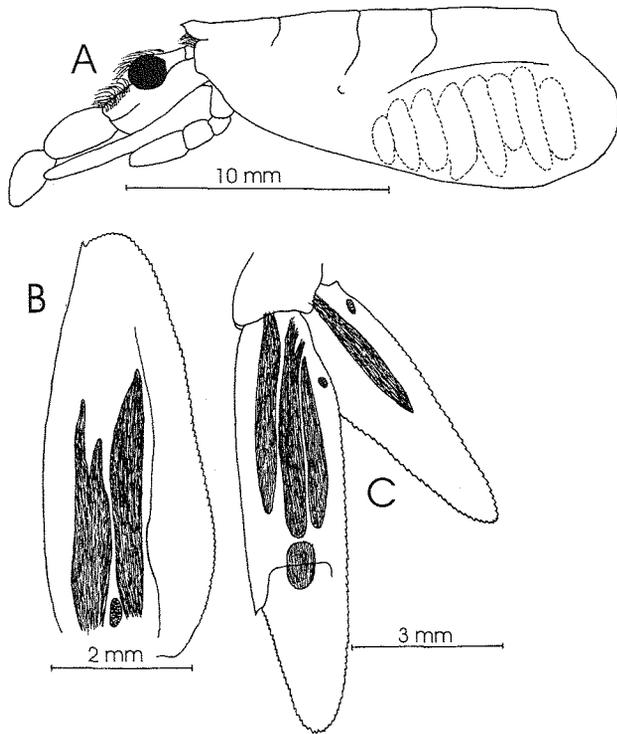


Fig. 49. *Sergia extenuata*, male, "Dana" St. 1159-5, Cp length 15.3 mm. – A, lateral view of Cp. – B, scaphocerite. – C, Up.

20 $\frac{1}{2}$ & 1m 14 $\frac{1}{2}$); 1165-2 (2m 15-16); 1168-2 (1m 17); 1171-2 (1f 17); 3996-3 (1f 12); 3996-5 (2f 10 $\frac{1}{2}$ -11 $\frac{1}{2}$); 3996-7 (2f 10-12); 3997-2 (1f 10); 3998-2 (2f 9 & 1m 11); 3998-7 (1f 11); 3999-1 (1f 19 & 1m 13); 4000-2 (15f 6-14 & 9m 6-12); 4000-6 (20f 7 $\frac{1}{2}$ -13 & 4m 9-10); 4000-7 (1m 11 $\frac{1}{2}$); 4000-9 (2f 6-11 & 1m 16); 4000-10 (2f 12 $\frac{1}{2}$ -15 & 2m 10-11).

Remarks: The holotype of *Sergestes extenuatus* (ZMUC CRU 1602) was referred to "Dana" St. 3999-2 in the original description (Burkenroad 1940); however, in the collection, the label of the type indicates "Dana" St. 4000-6, while in the journal of the ZMUC crustacean collections the type was registered as taken from "Dana" St. 1602. The latter number is not true by any means, whereas the 2 former numbers are for similar geographical locations.

Type locality: Equatorial Atlantic, either 3°45'S, 10°00'W or 0°31'S, 11°02'W.

Type material: Holotype of *Sergestes extenuatus* (ZMUC, see above, examined).

Diagnosis: Integument firm; rostrum long and acute, sometimes bidentate; cornea well pigmented,

dark brown, considerably wider than eyestalk; A I peduncle with segment 3 of outer A I flagellum in male with well developed tubercle reaching end of segment 4 of flagellum and single long terminal seta overlapping tubercle; segment 4 of flagellum without serrated bristles on dorsal surface, segment 5 without distodorsal protrusion; PV of petasma not overlapping LA; LC overlapping LT and LI, bearing single very strong apical tooth; LAC absent; LA curved medially at 3/4 length; 1 proximal photophore lateral to inner muscle strip on scaphocerite and 1 proximal organ near medial margin on Up endopod.

Description: Cp 2.0 times as long as high and 0.45 times as long as abdomen (Fig. 49A). Abdomen with somite VI 1.5 times as long as high and 1.1 times as long as telson; telson 3.0 times as long as wide.

Ocular papilla inconspicuous, 0.3 times as long as wide; cornea 1.1 times as long as wide, 0.8 times as long and 1.5 times as wide as eyestalk. A I peduncle 0.6 times as long as Cp, with segment 1 very hairy on dorsal side and segments 2 and 3 0.71 and 0.63 times as long as segment 1, respectively; segment 3 of outer A I flagellum in male with tubercle reaching end of segment 4 of flagellum, with single very strong seta overlapping tubercle; segment 4 of flagellum lacking serrated bristles and bearing several setae on dorsal surface (Fig. 50C). A II peduncle 0.5 times as long as scaphocerite; latter 2.6 times as long as wide (Fig. 49B), 0.77 times as long as A I peduncle.

Md palp 0.31 times as long as Cp, with proximal segment 2.7 times as long as distal one. Mx I with palp 2.2 times as long as wide and 0.06 times as long as Cp; endopod 1.7 times as long as wide and 1.7 times as long as palp; endite 1.6 times as long as wide and 1.0 times as long as palp. Mx II with exopod 3.2 times as long as wide and 0.32 times as long as Cp; palp 3.0 times as long as wide and 0.11 times as long as Cp; endopod 1.8 times as long as wide and 1.0 times as long as palp; endites sub-

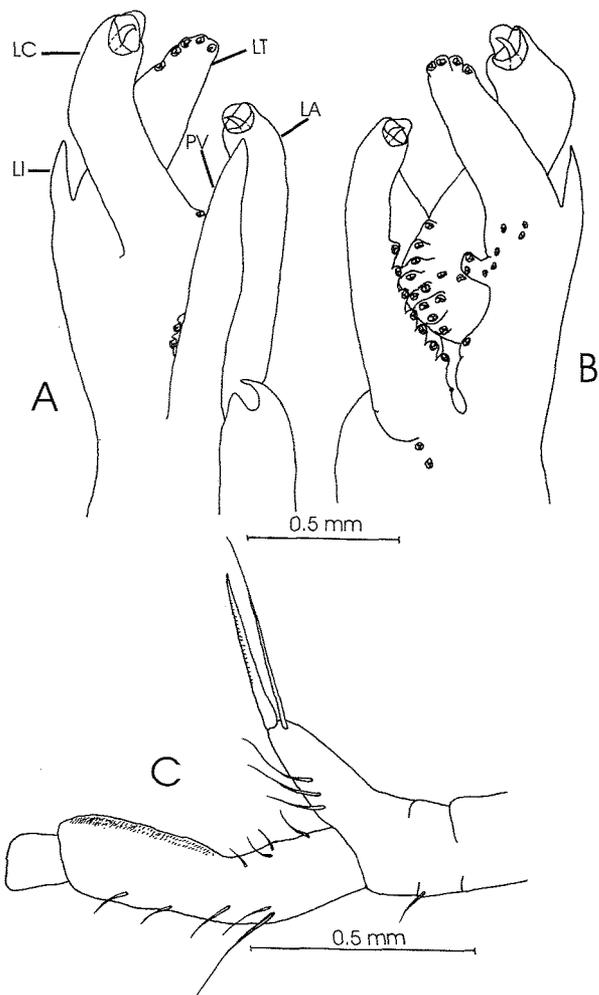


Fig. 50. *Sergia extenuata*, male, "Dana" St. 1159-5, Cp length 15.3 mm. - A, caudal view of petasma. - B, oral view of petasma. - C, male outer A I flagellum.

equal, 2.4 times as long as wide and 0.5 times as long as palp.

Mxp I with exopod 3.1 times as long as wide and 0.21 times as long as Cp, endopod 0.9 times as long as exopod, junction between segments 1 and 2 incomplete; segments 2 and 3 1.0 and 0.9 times as long as segment 1, respectively. Mxp II 0.9 times as long as Cp, with merus 1.1, carpus 1.0, propodus 1.2, and dactyl 0.5 times as long as ischium. Mxp III 1.4 times as long as Cp, with merus 1.1, carpus and propodus 1.0, and dactyl 0.9 times as long as ischium; dactyl incompletely divided into 6-7 subsegments.

P I 1.1 times as long as Cp, with merus 2.6, carpus 1.7, and propodus 2.9 times as long as ischium; propodus incompletely divided into 12 subsegments. P II 1.6 times as long as Cp, with merus 3.0,

carpus 2.7, propodus 2.1, and dactyl 0.2 times as long as ischium; propodus divided into 13 subsegments. P III 1.9 times as long as Cp, with merus 3.1, carpus 2.8, propodus 3.0, and dactyl 0.2 times as long as ischium; propodus divided into 10 subsegments. P IV 1.4 times as long as Cp, with merus 1.4, carpus and propodus 1.0 times as long as ischium. P V 0.7 times as long as Cp, with merus 1.1, carpus 0.8, and propodus 0.6 times as long as ischium.

Somite VIII with arthrobranch 0.14 times as long as Cp and 3.4 times as long as epipod. Somite IX with anterior pleurobranch 0.23 times as long as Cp and 5.3 times as long as posterior pleurobranch. Somite X with anterior pleurobranch 0.27 times as long as Cp and 5.6 times as long as posterior pleurobranch. Somite XI with anterior pleurobranch 0.31 times as long as Cp and 5.9 times as long as posterior pleurobranch. Somite XII with anterior pleurobranch 0.33 times as long as Cp and 1.5 times as long as posterior pleurobranch. Somite XIII with anterior pleurobranch 0.25 times as long as Cp and 1.1 times as long as posterior pleurobranch.

Pl I with basipod 0.36 times as long as Cp and exopod 2.2 times as long as basipod. Pl II with basipod 0.31 times as long as Cp; exopod 2.8 and endopod 1.6 times as long as basipod, respectively. Pl III with basipod 0.30 times as long as Cp; exopod 2.5 and endopod 1.4 times as long as basipod, respectively. Pl IV with basipod 0.29 times as long as Cp; exopod 2.4 and endopod 1.5 times as long as basipod, respectively. Pl V with basipod 0.24 times as long as Cp; exopod 2.2 and endopod 1.3 times as long as basipod, respectively.

Up with exopod 4.0 times as long as wide, 5.7 times as long as basipod and 0.7 times as long as Cp; endopod 3.3 times as long as wide and 0.7 times as long as exopod (Fig. 49C).

Petasma (Fig. 50A-B). PV slender, with distolateral margin slightly concave, 5.1 times as long as wide. LI small, nearly reaching tip of PV, 3.0 times as long as wide and 0.2 times as long as PV. LT directed laterally, overlapping PV and LA, not reaching end of LC, 2.7 times as long as wide and 0.7 times as long as PV, armed with several hooks near apex. LC overlapping all other lobes and processes, 2.7 times as long as wide and 0.8 times as long as PV, bearing numerous papillae with hooks on proximolateral side. LA slightly overlapping PV, 3.9 times as long as wide and 1.1 times as

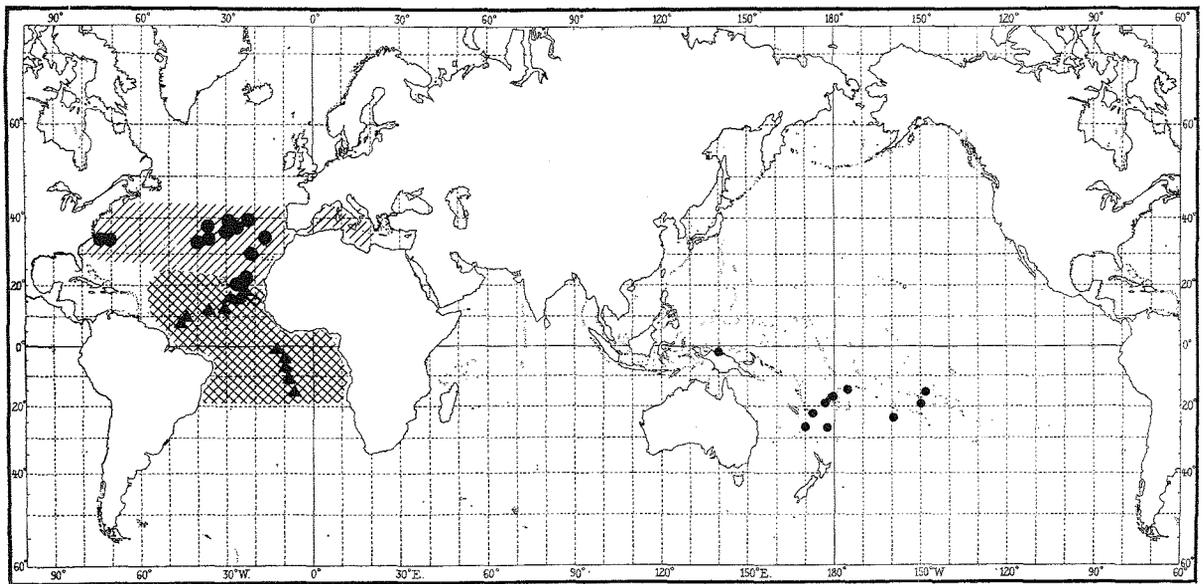


Fig. 51. Probable geographical distribution of *Sergia robusta* (large circles, hatching), *Sergia extenuata* (triangles, cross hatching), and *Sergia vityazi* n. sp. (small circles). Symbols indicate "Dana" stations. Shaded areas without symbols are supported by literature data.

long as PV, armed with row of papillae with hooks along proximomedial margin and 1-2 very strong apical hooks.

Photophores. Scaphocerite: 1 proximal organ, lateral to base of inner strip of muscle. Up exopod: 1 proximal organ near medial margin at about 0.2 exopod length. Up endopod: 1 photophore near proximomedial corner.

Remarks: This species varies in the form of the rostrum (usually unidentate, but sometimes bidentate) and armature of LA. The latter character was proposed by Burkenroad (1940) to be distinguishing for this species; however, this varies individually to a great extent and seems not to be of value. The basal photophore on the scaphocerite varies in form and size and may appear as a short thin line throughout about 1/8 scaphocerite length. Vereshchaka (1994a) reported that photophores were absent on the Up exopod; having got more experience in observing such vanishing organs in the alcohol-preserved specimens, I did find the single basal photophore recorded by Burkenroad (1940), who observed it in much fresher material. *S. extenuata* was first mentioned under the name *Sergestes robustus* (Illig 1927), and part of the description and specimens figured by Illig were referred to this species by Crosnier & Forest (1973:

338, see their synonymy). Since the detailed description and figures by Crosnier & Forest (1973), this species has been correctly identified and no younger synonyms have appeared.

Sergia extenuata differs from all other species of the species group by (1) the absence of dorsal serrated bristles on segment 4 of the male outer A I flagellum, (2) a relatively wider scaphocerite (less than 3 times as long as wide), (3) LA of the petasma just reaching the end of PV, (4) LA of the petasma almost straight and curved only at 3/4 length, and (5) 1 proximal photophore on the scaphocerite. Other differences and affinities between *S. extenuata* and all other known species of the species group are shown in Table 6.

Geographical distribution (Fig. 51): Tropical Atlantic only: North Central Atlantic from off Cape Verde Isles to about 20°N ("Dana" stations; Vereshchaka 1994a), Ivory Coast (Burkenroad 1940), southern Central Atlantic between 0° and 15°S ("Dana"; Crosnier & Forest 1973).

Sergia extenuata is parapatric to *S. robusta*, the former occurring in the tropical Atlantic waters south of 20-30°N, the latter living mainly in the temperate Atlantic waters north of 20-30°N. *S. extenuata* is sympatric with *S. regalis* and allopatric to *S. vityazi* n. sp.

Vertical range: An interzonal species, migrating daily between the upper bathypelagic and upper mesopelagic zones. "Dana" specimens were taken within the depth range 200-2000 m. Most specimens occur at 200-300 m at night and at 1000-1700 m during the day. These data agree with those of Vereshchaka (1994a), who recorded this species from 200-500 m at night.

***Sergia regalis* (Gordon, 1939)**

Figs. 52A-D, 53A-C, 54; Pl. 2A

Sergestes regalis Gordon, 1939: 498, figs. 1-4.

Sergestes creber Burkenroad, 1940: 44. – Synonymized with *Sergestes regalis* by Vereshchaka (1994a).

Sergestes (Sergia) creber. – Yaldwyn 1957: 9. – Kensley 1971: 247, fig. 16.

Sergestes (Sergia) regalis Yaldwyn 1957: 9. – Kensley 1971: 256, fig. 21; 1977: 18.

Sergia creber. – Krygier & Wasmer 1988: 50.

Sergia regalis. – Vereshchaka 1994a: 86, figs. 8, 16-18, 26; 1995a: 1651.

Material examined: "Dana" stations: 1171-2 (1f 14); 1174-1 (1m 12); 1174-2 (1f 11^{1/2}); 1177-1 (4f 13^{1/2}-16^{1/2}); 1178-1 (1f 15); 1183-1 (2m 17^{1/2}-20); 1183-6 (6f 10^{1/2}-17 & 2m 13-15); 1183-9 (13f 9-22^{1/2} & 21m 9^{1/2}-19^{1/2}); 1184-1 (6f 13-18 & 3m 13^{1/2}-16); 1185-11 (1f 18); 1188-2 (2f 12-13 & 1m 11^{1/2}); 1196-1 (2f 13^{1/2}); 1198-1 (2f 11 & 4m 11-12^{1/2}); 1198-2 (2m 12-12^{1/2}); 1214-3 (1m 18); 1215-3 (2f 13^{1/2}-14); 1216-6 (1f 11); 1217-4 (1m 15); 1223-2 (3f 14-17^{1/2} & 2m 13-13^{1/2}); 1225-2 (1f 11^{1/2}); 1266-2 (1f 14); 1269-4 (1f 13^{1/2}); 1270-7 (1m 15); 1281-3 (1m 13); 1281-9 (1m 13); 1283-1 (1f 21^{1/2} & 1m 16); 1283-7 (2f 17-19^{1/2}); 1284-1 (4f 11-21^{1/2} & 1m 16^{1/2}); 1285-1 (1f 13 & 1m 17); 1287-1 (1f 14^{1/2}); 1287-2 (1f 17); 1288-4 (1m 10); 1293-3 (2f 11-13^{1/2}); 3556-1 (4f 13^{1/2}-21 & 5m 14-18^{1/2}); 3556-4 (1f 18^{1/2}); 3558-5 (1m 19^{1/2}); 3561-3 (1f 17^{1/2} & 1m 13); 3585-1 (4f 15^{1/2}-18 & 2m 15-15^{1/2}); 3585-8 (1m 14^{1/2}); 3587-7 (1f 13^{1/2}); 3630-2 (1m 16); 3656-3 (1f 15); 3676-1 (9f 11-19^{1/2} & 13m 11-18); 3676-6 (3f 9-16 & 2m 16); 3676-7 (1f 11^{1/2}); 3676-9 (1m 9 & 1j 5); 3677-1 (2f 14-14^{1/2} & 1m 17^{1/2}); 3677-2 (1m 13); 3677-3 (1f 14); 3678-4 (1f 15 & 1m 12); 3678-5 (2f 12-13 & 2m 12-13); 3678-6 (2f 12-19^{1/2} & 3m 12-19); 3680-1 (1f 15); 3680-2 (1f 8); 3680-3 (2f 11^{1/2}-13^{1/2} & 2m 7^{1/2}-12); 3680-4

(3m 11-13^{1/2}); 3680-6 (2m 14); 3680-7 (2f 8^{1/2}-11^{1/2}); 3681-1 (4f 16-18^{1/2} & 3m 15^{1/2}-18); 3682-1 (1f 13 & 1m 17^{1/2}); 3682-2 (1f 8 & 1m 9); 3683-1 (2f 9^{1/2}-14^{1/2} & 1m 17); 3683-2 (1m 10^{1/2}); 3683-6 (4f 10^{1/2}-20 & 3m 10-14); 3683-7 (3m 6^{1/2}-10); 3684-6 (4f 11^{1/2}-16 & 1m 17^{1/2}); 3684-8 (3f 9-13); 3685-1 (1m 9); 3685-2 (3f 8-10 & 4m 7-11); 3685-6 (1f 12 & 1m 17); 3685-7 (1f 8^{1/2}); 3685-8 (1f 8^{1/2} & 2m 9-9^{1/2}); 3685-9 (10f 8-20^{1/2} & 8m 8^{1/2}-13); 3686-2 (1f 8 & 2m 9-10); 3686-6 (1f 9 & 1m 10); 3686-8 (9f 8^{1/2}-16 & 1m 7^{1/2}); 3687-1 (5f 9-16); 3687-2 (2f 10-11^{1/2} & 3m 7^{1/2}-11); 3688-1 (1f 9^{1/2} & 1m 13^{1/2}); 3688-3 (1m 10); 3688-4 (1f 10^{1/2} & 2m 8); 3688-5 (1f 8 & 1m 8^{1/2}); 3689-1 (1f 10 & 3m 10-14); 3689-3 (2f 10-13^{1/2} & 1m 10^{1/2}); 3689-4 (1f 11); 3690-2 (1f 12 & 3m 10-17); 3690-3 (4f 8-9 & 1m 8); 3712-1 (1f 11); 3713-1 (3f 8^{1/2}-14 & 2m 8^{1/2}-10); 3713-2 (2f 13-20 & 2m 12); 3713-3 (3j 6^{1/2}); 3714-2 (5f 8-11^{1/2}); 3714-3 (3f 9^{1/2}-16); 3714-6 (1m 13^{1/2}); 3714-8 (2f 13^{1/2}-15); 3714-9 (1f 18); 3714-10 (2f 12-15); 3715-1 (1m 15^{1/2}); 3716-1 (2f 10-12); 3716-2 (4f 10-12 & 2m 10^{1/2}-12^{1/2}); 3716-3 (4f 11-20 & 7m 11^{1/2}-18 & 1j 7^{1/2}); 3729-1 (1f 13); 3730-1 (4m 10-12^{1/2}); 3730-2 (2j 5^{1/2}-7); 3731-13 (1m 12^{1/2}); 3733-1 (1f 19 & 2m 13-16); 3734-1 (3f 17-21 & 4m 10^{1/2}-18); 3734-2 (2m 8^{1/2}-16^{1/2}); 3735-1 (1f 16 & 2m 14^{1/2}-15); 3736-1 (2f 14^{1/2}-16^{1/2}); 3736-3 (7f 12-17 & 5m 12-15); 3736-5 (2f 14-15); 3736-6 (1m 13); 3737-1 (7f 12-14 & 1m 12^{1/2}); 3737-2 (8f 11^{1/2}-13^{1/2} & 20m 12-14); 3738-1 (5f 12-18 & 6m 10^{1/2}-19); 3738-2 (2f 9^{1/2}-10^{1/2}); 3739-1 (1f 16 & 1m 17); 3739-8 (2m 16-17^{1/2}); 3739-9 (1m 17); 3740-1 (1f 16); 3744-1 (3m 13-17^{1/2}); 3744-2 (1f 13); 3745-1 (4f 12^{1/2}-20); 3746-1 (2f 17^{1/2}); 3746-2 (3f 7-11^{1/2}); 3749-1 (2f 12-13^{1/2} & 1m 9); 3750-1 (2f 8^{1/2}-15); 3751-2 (3f 7^{1/2}-11 & 4m 10-12^{1/2}); 3751-6 (2f 13-18); 3751-7 (3f 10-13 & 2m 9^{1/2}-15); 3752-2 (1m 11^{1/2}); 3753-1 (2m 15-17); 3753-2 (2f 6^{1/2}-13 & 1m 8^{1/2}); 3755-1 (2f 15^{1/2}-17^{1/2} & 2m 14-15); 3755-2 (1m 10); 3766-13 (3f 10-15^{1/2}); 3766-18 (9f 15-18^{1/2} & 2m 10^{1/2}-16^{1/2}); 3767-5 (4f 12^{1/2}-21 & 1m 11^{1/2}); 3767-6 (8f 9^{1/2}-21); 3768-1 (1m 15); 3768-3 (5f 8-18^{1/2} & 2m 15-17); 3768-4 (4f 14-19 & 5m 14-19); 3768-5 (1m 17.5); 3768-6 (2f 28); 3782-1 (1f 15); 3784-6 (1m 13); 3784-7 (2m 11); 3786-6 (1f 10^{1/2} & 2m 11-11^{1/2}); 3786-7 (1f 8); 3786-8 (2f 7-8); 3788-1 (3f 7-17^{1/2}); 3789-1 (1m 11); 3789-2 (2f 8-14); 3789-6 (1m 13); 3789-8 (1f 13); 3791-1 (2f 15-18); 3791-2 (2f 9-16 & 1m 16); 3792-1 (3m 12-13^{1/2}); 3795-1 (1f 12^{1/2}); 3795-2 (2f 6^{1/2}-7); 3800-1 (2f 12-15); 3800-2 (8f 6^{1/2}-15);

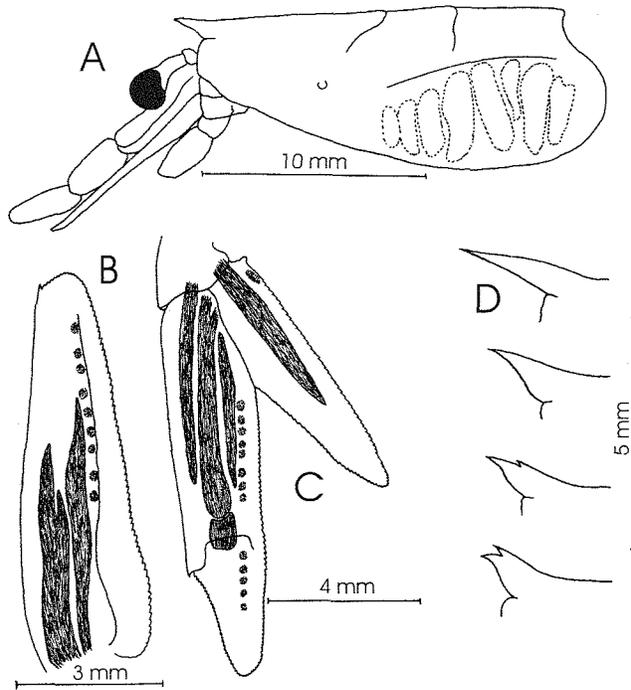


Fig. 52. *Sergia regalis*, male, "Dana" St. 3766-18, Cp length 16.5 mm. – A, lateral view of Cp. – B, scaphocerite. – C, Up. – D, variability of rostrum shape, "Dana" St. 3869.

3804-2 (10f 8-14 $\frac{1}{2}$ & 8m 12 $\frac{1}{2}$ -13 $\frac{1}{2}$); 3804-3 (1f 12 & 18j 6-8 $\frac{1}{2}$); 3809-2 (14j 6-7 $\frac{1}{2}$); 3812-1 (1f 9 & 1m 9 & 32j 6-8); 3812-3 (2f 9 & 13j 7-8); 3814-1 (7f 7 $\frac{1}{2}$ -12 $\frac{1}{2}$); 3817-1 (8f 8-15 & 5m 8 $\frac{1}{2}$ -14); 3817-2 (19f 7-14 & 8m 7-12 $\frac{1}{2}$); 3817-3 (6f 7 $\frac{1}{2}$ -13 & 3m 7 $\frac{1}{2}$ -11); 3821-1 (2f 13 $\frac{1}{2}$ -14 $\frac{1}{2}$ & 1m 12 $\frac{1}{2}$); 3821-3 (6f 8-13 $\frac{1}{2}$); 3824-6 (2f 7 $\frac{1}{2}$ -14); 3828-5 (4f 13-15 & 4m 12-12 $\frac{1}{2}$); 3828-6 (1f 13); 3828-7 (8f 8-16 & 6m 11-14); 3828-8 (1f 16); 3828-9 (2f 13); 3828-10 (10f 13-17 $\frac{1}{2}$ & 7m 11 $\frac{1}{2}$ -13); 3828-12 (3f 13-15 & 1m 13); 3828-13 (1m 8); 3828-14 (7f 12 $\frac{1}{2}$ -14); 3828-15 (5f 8 $\frac{1}{2}$ -16); 3830-5 (5f 12 $\frac{1}{2}$ -14 $\frac{1}{2}$ & 1m 11 $\frac{1}{2}$); 3844-5 (1f 15 $\frac{1}{2}$ & 2m 10 $\frac{1}{2}$ -12 $\frac{1}{2}$); 3844-6 (5f 7-12 & 2m 13-14); 3847-1 (1m 11); 3851-1 (1f 8); 3860-18 (1m 9 $\frac{1}{2}$); 3860-20 (2m 7 $\frac{1}{2}$ -10); 3869-5 (15f 7-9 $\frac{1}{2}$ & 8m 8 $\frac{1}{2}$ -11); 3869-6 (5f 6-9 $\frac{1}{2}$ & 3m 8 $\frac{1}{2}$ -9); 3869-7 (3f 8-9 & 4m 8 $\frac{1}{2}$ -9 $\frac{1}{2}$); 3869-8 (1f 8-9 & 1m 6 $\frac{1}{2}$); 3873-1 (6f 7 $\frac{1}{2}$ -11 $\frac{1}{2}$ & 1m 8); 3874-1 (1f 9 $\frac{1}{2}$ & 2m 6 $\frac{1}{2}$ -11); 3874-2 (2f 10); 3874-3 (1f 10); 3876-1 (2f 8 & 1m 8); 3892-1 (1f 7 $\frac{1}{2}$); 3894-1 (1f 7 $\frac{1}{2}$); 3902-1 (1f 9 $\frac{1}{2}$ & 2m 14 $\frac{1}{2}$ -15 $\frac{1}{2}$); 3903-1 (4f 11 $\frac{1}{2}$ -18 & 2m 12-13 $\frac{1}{2}$); 3903-2 (1f 12 $\frac{1}{2}$ & 2m 10-12); 3905-1 (2f 12 $\frac{1}{2}$ -16 & 2m 9 $\frac{1}{2}$ -17 $\frac{1}{2}$); 3905-2 (3f 9-17 & 4m 9-11 $\frac{1}{2}$); 3906-2 (1f 9 & 2m 10-14); 3906-3 (10f 8-11 & 4m 8-11 $\frac{1}{2}$); 3907-1 (5f 9-21 & 5m 8-17); 3907-2 (12f 7 $\frac{1}{2}$ -18 & 7m 8-13 $\frac{1}{2}$); 3907-3 (4f 8-11 & 2m 7-8 $\frac{1}{2}$); 3908-1 (2f 11 $\frac{1}{2}$ -14); 3909-1 (3f 10 $\frac{1}{2}$ & 1m 16 $\frac{1}{2}$); 3909-2 (1f 11 & 1m 9 $\frac{1}{2}$); 3909-4 (2f 9-12); 3909-5 (3m 9-10 $\frac{1}{2}$); 3912-2

(1f 14); 3912-3 (1f 14 & 1m 13); 3913-1 (9f 11 $\frac{1}{2}$ -14 $\frac{1}{2}$ & 5m 11 $\frac{1}{2}$ -14); 3913-2 (1f 10); 3915-1 (3f 8 $\frac{1}{2}$ -15); 3915-2 (10f 6 $\frac{1}{2}$ -9 $\frac{1}{2}$ & 4m 7-11 $\frac{1}{2}$); 3915-3 (8f 7-12 & 1m 9 $\frac{1}{2}$); 3916-1 (1f 13); 3916-3 (1f 7 & 1m 6); 3917-1 (1f 16 & 1m 17); 3917-5 (3f 7 $\frac{1}{2}$ -11 & 1m 15); 3917-6 (3m 8-13 $\frac{1}{2}$); 3917-7 (1m 9 $\frac{1}{2}$ & 1j 7); 3917-8 (2f 6-8); 3918-1 (1f 14 $\frac{1}{2}$); 3918-2 (2f 15-16 $\frac{1}{2}$); 3919-2 (1f 16); 3921-2 (1m 13); 3922-2 (2f 10-20 & 1m 17); 3924-1 (4f 11-14 & 1m 10 $\frac{1}{2}$); 3925-1 (3f 9-13 & 2m 12 $\frac{1}{2}$); 3933-2 (2f 11-13 & 3m 7-13); 3933-3 (1f 16); 3946-1 (1m 10); 3949-1 (2f 11-12); 3951-1 (5m 13-19); 3964-6 (1f 13 & 1m 10); 3964-10 (4f 7-8 $\frac{1}{2}$); 3969-2 (3f 10 $\frac{1}{2}$ -11 $\frac{1}{2}$ & 1m 11); 3978-8 (1f 14 & 1m 10); 3999-1 (1m 17 $\frac{1}{2}$).

"Galathea" stations: 263 (2f 14-17 & 2m 12-13 $\frac{1}{2}$); 406 (1f 16 & 1m 13 $\frac{1}{2}$); 407 (1m 12 $\frac{1}{2}$); 443 (1m 16); 444 (1m 13 $\frac{1}{2}$); 448 (3f 12-18 $\frac{1}{2}$ & 2m 14-15 $\frac{1}{2}$); 453 (1f 10); 464 (1f 11 & 2m 10-12 $\frac{1}{2}$); 466 (1m 10); 474 (1f 13 $\frac{1}{2}$ & 1j 8); 491 (1m 17 $\frac{1}{2}$); 494 (2f 11-12 $\frac{1}{2}$ & 1m 16 $\frac{1}{2}$); 495 (1m 9 $\frac{1}{2}$); 517 (1f 17). Holotype of *Sergestes creber*, "Dana" St. 3766-18 (male, ZMUC CRU 1601).

Type locality: South Atlantic, 32°45' S, 8°47' W.

Type material: Holotype (BMNH 1939.3.8.21) + 1 paratype (BMNH 1939.3.8.22) of *Sergestes regalis*, "Discovery" St. 81 (not examined).

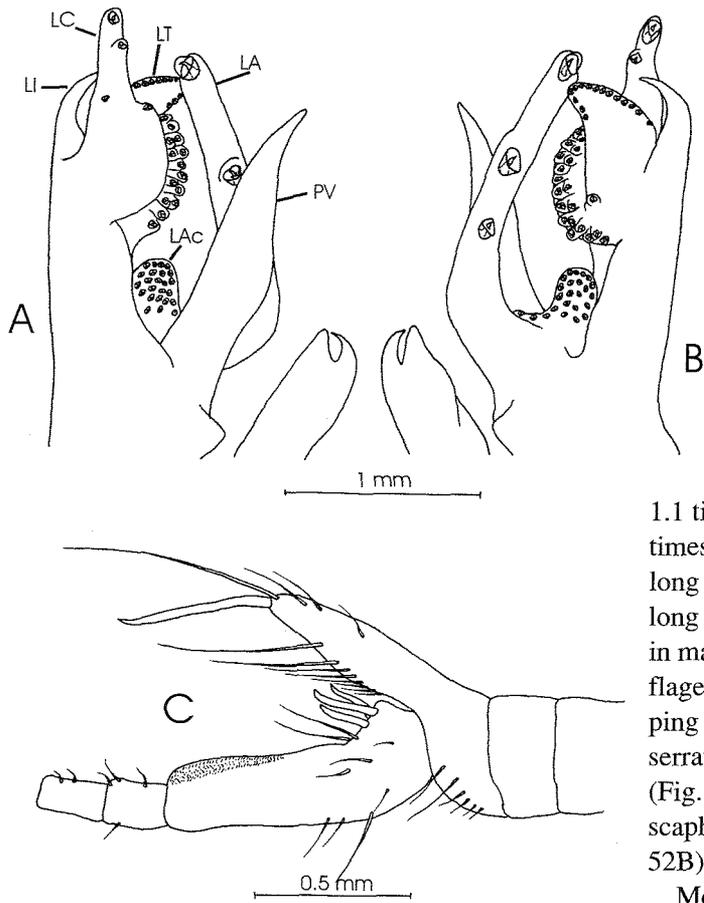


Fig. 53. *Sergia regalis*, male, "Dana" St. 3766-18, Cp length 16.5 mm. - A, caudal view of petasma. - B, oral view of petasma. - C, male outer A I flagellum.

Diagnosis: Integument firm; rostrum long and acute, uni- or bidentate; cornea well pigmented, dark brown, considerably wider than eyestalk; A I peduncle with segment 3 of outer A I flagellum in male with well developed tubercle reaching end of segment 5 of flagellum and single long terminal setae overlapping tubercle; segment 4 of flagellum bearing 3-4 serrated bristles on dorsal surface, segment 5 without distodorsal protrusion; PV of petasma overlapped by LA; LC overlapping LT and LI, bearing apical teeth; LAc present; LA curved medially at 1/4 length, photophores arranged in single wavy row medial to inner muscle strips on scaphocerite and in 1 proximal lateral row (near medial margin) and 1 distal medial row on Up endopod.

Description: Cp 2.1 times as long as high and 0.42 times as long as abdomen (Fig. 52A); rostrum varying in shape (Fig. 52D), long and acute at tip, sometimes bidentate. Abdomen with somite VI 1.6 times as long as high and 1.1 times as long as telson; telson 3.2 times as long as wide.

Ocular papilla 0.3 times as long as wide, cornea

1.1 times as long as wide, 0.6 times as long and 1.7 times as wide as eyestalk. A I peduncle 0.7 times as long as Cp, with segments 2 and 3 0.59 times as long as segment 1, segment 3 of outer A I flagellum in male with tubercle, reaching end of segment 5 of flagellum and with single very strong seta overlapping tubercle; segment 4 of flagellum bearing 3-4 serrated bristles and several setae on dorsal surface (Fig. 53C). A II peduncle 0.5 times as long as scaphocerite; latter 3.3 times as long as wide (Fig. 52B), 0.83 times as long as A I peduncle.

Md palp 0.34 times as long as Cp, with proximal segment 2.3 times as long as distal one. Mx I with palp 2.0 times as long as wide and 0.06 times as long as Cp; endopod 1.5 times as long as wide and 1.4 times as long as palp; endite 1.6 times as long as wide and 0.9 times as long as palp. Mx II with exopod 3.2 times as long as wide and 0.31 times as long as Cp; palp 3.8 times as long as wide and 0.13 times as long as Cp; endopod 2.0 times as long as wide and 1.0 times as long as palp; endites subequal, 1.6 times as long as wide and 0.5 times as long as palp.

Mxp I with exopod 3.4 times as long as wide and 0.21 times as long as Cp; endopod 0.8 times as long as exopod; segments 2 and 3 1.0 and 0.5 times as long as segment 1, respectively. Mxp II 0.9 times as long as Cp, with merus 1.0, carpus 0.8, propodus 1.0, and dactyl 0.5 times as long as ischium. Mxp III 1.4 times as long as Cp, with merus 0.8, carpus 0.8, propodus 0.8, and dactyl 0.9 times as long as ischium; dactyl divided into 6 subsegments.

P I 1.1 times as long as Cp, with merus 3.0, carpus 1.6, and propodus 3.0 times as long as ischium; propodus divided into 10 subsegments. P II 1.4 times as long as Cp, with merus 3.1, carpus 2.6, propodus 3.0, and dactyl 0.1 times as long as ischi-

um; propodus divided into 12 subsegments. P III 1.9 times as long as Cp, with merus 3.0, carpus 2.4, propodus 2.8, and dactyl 0.2 times as long as ischium; propodus divided into 10 subsegments. P IV 1.1 times as long as Cp, with merus 1.4, carpus and propodus 1.1 times as long as ischium. P V 0.6 times as long as Cp, with merus 1.2, carpus 0.9, and propodus 0.7 times as long as ischium.

Somite VIII with arthrobranch 0.13 times as long as Cp and 1.9 times as long as epipod. Somite IX with anterior pleurobranch 0.22 times as long as Cp and 4.6 times as long as posterior pleurobranch. Somite X with anterior pleurobranch 0.23 times as long as Cp and 4.2 times as long as posterior pleurobranch. Somite XI with anterior pleurobranch 0.26 times as long as Cp and 3.3 times as long as posterior pleurobranch. Somite XII with anterior pleurobranch 0.29 times as long as Cp and 1.4 times as long as posterior pleurobranch. Somite XIII with anterior pleurobranch 0.26 times as long as Cp and 1.2 times as long as posterior pleurobranch.

Pl I with basipod 0.29 times as long as Cp and exopod 2.2 times as long as basipod. Pl II with basipod 0.29 times as long as Cp; exopod 2.6 and endopod 1.5 times as long as basipod, respectively. Pl III with basipod 0.29 times as long as Cp; exopod 2.6 and endopod 1.4 times as long as basipod, respectively. Pl IV with basipod 0.28 times as long as Cp; exopod 2.4 and endopod 1.3 times as long as basipod, respectively. Pl V with basipod 0.25 times as long as Cp; exopod 2.1 and endopod 1.1 times as long as basipod, respectively.

Up with exopod 4.4 times as long as wide, 4.9 times as long as basipod and 0.7 times as long as Cp; endopod 3.5 times as long as wide and 0.7 times as long as exopod (Fig. 52C).

Petasma (Fig. 53A-B). PV long and narrow, with distolateral margin slightly concave, 3.3 times as long as wide. LI slender, slightly overlapping PV, 2.4 times as long as wide and 0.3 times as long as PV. LT slightly curved laterally, short, reaching end of LI, not reaching end of LC, 1.6 times as long as wide and 0.4 times as long as PV, armed with row of small hooks along ventral and distolateral margins. LC overlapping all other lobes, 2.2 times as long as wide and 0.7 times as long as PV, bearing numerous papillae with hooks on proximolateral margin and few hooks near apex. LAc 1.6 times as long as wide and 0.2 times as long as PV, covered with numerous small hooks. LA ranging in propor-

tions, in average 4.2 times as long as wide and 1.1 times as long as PV, armed with several strong hooks.

Photophores. Scaphocerite: continuous wavy row of 7-16 photophores medial to inner strip of muscle from 0.3 to 0.9 blade length. Up exopod: 6-14 photophores arranged in two series, (1) proximal photophores in continuous row medial to inner strip of muscle from 0.3 to 0.6 exopod length and (2) distal photophores in continuous row distal to terminal muscle strip from 0.7 to 0.8 exopod length. Up endopod: 1 photophore in proximomedial corner.

Remarks: Colour in life is shown in Pl. 2A.

This species is very variable in the form of the rostrum, proportions of the petasma, and a few minor characters. It was described and figured in detail by Gordon (1939). In his brief description of *S. creber*, Burkenroad (1940) may have not been aware of Gordon's recent description; at least the close similarity of the two species is obvious. Kensley (1971) recorded the presence of both species in South African waters and found the following distinctions between *S. regalis* and *S. creber*: (1) the form of the rostrum (elongate-lanceolate in *S. creber* and bidentate in *S. regalis*); (2) spination of the male outer A I flagellum; (3) the number of photophores on Up exopod (higher in *S. creber*); (4) the form of LI (more slender in *S. creber*); (5) the number of hooks on LA (fewer in *S. creber*). The form of the rostrum varies remarkably in the species, as is shown in Fig. 52D (specimens from the same "Dana" St. 3869). The spination of the male outer A I flagellum, although much more conservative, in Burkenroad's holotype looks more similar to that in *S. regalis* as figured by Gordon (1939) than to that in *S. creber* figured by Kensley (1971). The number of photophores on the Up exopod in the "Dana" specimens ranges from 6 to 14 in *S. creber* instead of from 6 to 9 in *S. regalis*, thus demonstrating significant overlapping and little taxonomic value of the character. The form of LI and the number of hooks of LA vary greatly and overlap even within the same sample. Thus, *S. creber* should be considered a junior synonym of *S. regalis*, as proposed by Vereshchaka (1994a). It is possible, however, to record 2 forms of this species, form *regalis* and form *crebra*, often appearing together in the same population (sample) and differing in the following main characters:

Form *regalis*: rostrum short, bidentate, LA wide

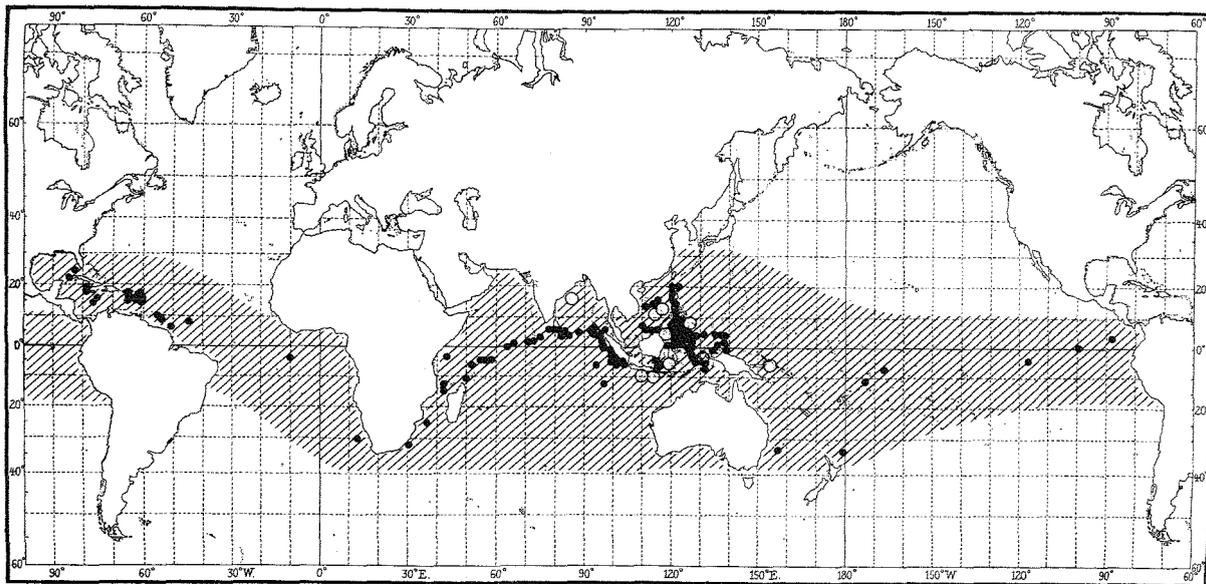


Fig. 54. Probable geographical distribution of *Sergia regalis* (circles, hatching). Black symbols indicate "Dana" stations, white symbols "Galathea" stations.

and short (but always slightly overlapping PV), with 6-15 strong hooks;

Form *crebra*: rostrum longer, unidentate, LA thin and long (considerably overlapping LI and LC), with 3-5 very strong hooks.

Sergia regalis is closely related to *S. extenuata* and *S. vityazi* n. sp. *S. regalis* is distinguished from all other species of the species group by (1) the tubercle on segment 3 of the male outer A I flagellum reaching end of segment 5 (not 4) of flagellum, (2) LA of the petasma overlapping PV, (3) few strong (not one very strong) hooks near the apex of LC, (4) LA strongly curved at 1/4 length. Other differences and affinities between *S. regalis* and all other known species of the species group are shown in Table 6.

Sergia regalis is parapatric to *S. robusta*, the former appearing south of 25-30°N in the Atlantic, the latter living mainly north of 20-30°N in the same region. *S. regalis* is sympatric with *S. extenuata* and *S. vityazi* n. sp.

Vertical range: An interzonal species, migrating daily between the upper bathypelagic and upper mesopelagic zones. "Dana" specimens were taken within the depth range 100-2000 m. Most specimens occur at 200-400 m at night and at 1000-1700 m during the day. These data agree with those of Vereshchaka (1994a).

Sergia robusta (Smith, 1882)

Figs. 51, 55-56; Pl. 3A-B

Geographical distribution (Fig. 54): A circumpolar species, occurring in the tropical zones of all oceans.

Atlantic: Caribbean and Northwest Atlantic ("Dana", Vereshchaka 1994a), Southeast Atlantic, around South Africa ("Dana", Gordon 1939, Kensley 1971).

Indian Ocean: Throughout the Indian Ocean, Indo-West Pacific ("Dana" and "Galathea" stations).

Pacific: Western tropical part ("Dana" and "Galathea", off Australia and New Zealand, Central and Eastern tropical Pacific ("Dana").

Sergestes sp. - Smith 1881: 445.

Sergestes robustus Smith, 1882: 97 (refers to 3 specimens listed in 1881), pl. 16, figs. 5-8; 1884: 416, pl. 8, figs. 3-6; 1886: 89. - Faxon 1895: 163. - Adensamer 1898: 626. - Riggio 1900: 20; 1905: 151, pl. 2, fig. 8-12. - Hansen 1903: 70; 1908: 83; 1920: 479; 1922: 106, pl. 1, figs. 4-5, pl. 6, figs. 2-3, pl. 7, fig. 1; 1927: 4. - Lo Bianco 1903: 181. - Kemp 1910a: 25, pl. 3, figs. 1-12. - Pesta 1913a: 64, figs. 1-5; 1913b: 405, fig. 2; 1914: 195; figs. 5-8, 15, 21, fig. 1; 1915: 120; 1916: 227; 1918: 53, fig. 14. - Illig 1914: 353,

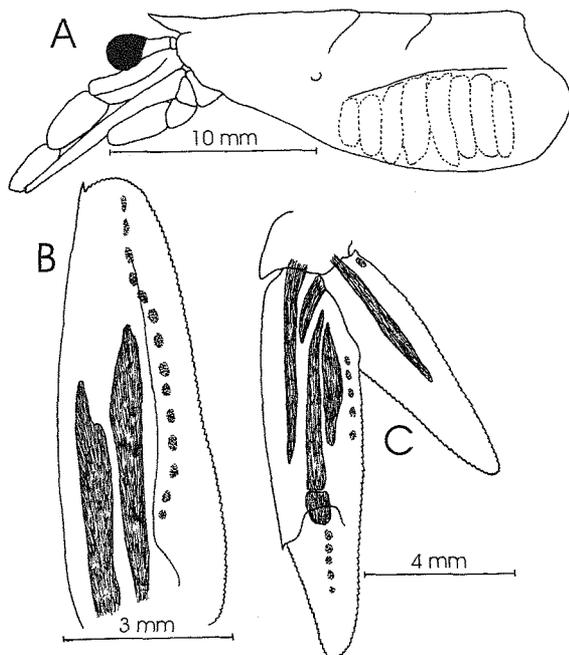


Fig. 55. *Sergia robusta*, male, "Dana" St. 1371-1, Cp length 18.6 mm. – A, lateral view of Cp. – B, scaphocerite. – C, Up.

fig. 5; 1927: 301, fig. 44 (part). – Sund 1920: 11, figs. 11-15. – Cecchini 1928: 34, fig. 5a. – Boone 1930: 124, pl. 41. – Miranda 1933: 5. – Gordon 1939: 508. – Gurney & Lebour 1940: 27, figs. 20-24. – Legendre 1940: 224, fig. 39. – Zariquiey Alvarez 1946: 57; 1956: 407; 1968: 61, fig. 18a. – Holthuis 1952b: 87. – Dieuzeide 1955: 20. – Dennell 1955: 401, fig. 5. – Kurian 1956: 23, figs. 39-49. – Springer & Bullis 1956: 134. – Dieuzeide & Roland 1958: 59. – Holthuis & Gottlieb 1958: 111. – Bacescu & Mayer 1961: 192, fig. 5b-c. – Maurin 1963: 2; 1968: 480. – Allen 1967: 33. – Lagardère 1970: 1027; 1972: 661. – Foxton 1970: 974, fig. 8. – Ribeiro 1970: 6. – Vilela 1970: 122.

Sergestes dissimilis Bate, 1888: 437. – Synonymized with *Sergestes robustus* by Hansen (1922).

Sergia robusta. – Ortmann 1893: 37. – Caullery 1896: 371. – Kemp 1906: 7. – Vereshchaka 1994a: 81, figs. 8-9, 26.

Sergestes mediterraneus Hansen, 1896: 954. – Synonymized with *Sergestes robustus* by Hansen (1922).

Sergestes Robustus [sic]. – Zariquiey y Cenarro 1935: 94.

Sergestes (Sergia) robustus. – Yaldwyn 1957: 9. –

Crosnier & Forest 1973: 327, figs. 111-112.

Sergia robustus. – Omori 1974: 236.

Material examined: "Dana" stations: 1142-7 (1f 10 & 1m 12); 1152-1 (1m 12½); 1157-1 (1f 13); 1157-10 (1f 10 & 1m 13); 1159-5 (1m 10); 1342-1 (2f 18-19 & 1m 8); 1342-3 (1m 16½); 1353-5 (1m 8); 1366-1 (1f 6½); 1367-1 (1m 15½ & 1j 7); 1369-1 (4f 7-13 & 1m 8); 1369-2 (1m 8); 1370-1 (3f 6½-7½ & 1m 9½); 1371-1 (1m 18½); 1371-3 (1j 8); 1374-1 (4j 7-9 & 2m 10-10½); 1377-1 (8f 8-15 & 6m 7-10); 1377-8 (1f 10½); 1379-2 (3j 7-8½); 1379-3 (9j 7-8½); 1380-1 (1f 10).

"Galathea" station: 99 (1f 19).

"Type" [= syntype] of *Sergestes robustus*, western North Atlantic off Martha's Vineyard, Massachusetts, 37°17'N, 73°21'W (USNM 7316).

Type localities: North Atlantic, off Martha's Vineyard, Massachusetts, U. S. Fish Commission Stations 893 and 952, 37°17'N, 73°21'W (USNM syntype); and 34°28'50"N, 75°22'50"W (MCZ syntype).

Type material: 4 male syntypes of *Sergestes robustus*, all labeled "type": 1 at NMNH (USNM 7316, examined); 1 at MCZ (MCZ 3274, "Blake" St. 328, 2987 m, coll. 1890, not examined); 2 from off Martha's Vineyard presently unaccounted for.

Diagnosis: Integument firm; rostrum long and acute, unidentate; cornea well pigmented, dark brown, considerably wider than eyestalk; A I peduncle with segment 3 of outer A I flagellum in male with rudimentary tubercle reaching end of segment 4 of flagellum and with 2 long terminal setae overlapping tubercle; segment 4 of flagellum bearing 6-7 serrated bristles on dorsal surface, segment 5 without distodorsal protrusion; PV of petasma overlapping LA; LC reaching end of LT and bearing very strong apical tooth; LAc absent; LA evenly curved medially; photophores arranged in single wavy row medial to inner muscle strips on scaphocerite and in 1 proximal lateral row and 1 distal medial row on Up endopod.

Description: Cp 2.0 times as long as high and 0.4 times as long as abdomen (Fig. 55A). Abdomen with somite VI 1.5 times as long as high and 1.2 times as long as telson; telson 3.1 times as long as wide.

Ocular papilla about 0.3 as long as wide; cornea well pigmented, dark brown, 1.1 times as long as wide, 0.8 times as long and 1.8 times as wide as eyestalk. A I peduncle 0.7 times as long as Cp, with segments 2 and 3 0.83 and 0.71 times as long as segment 1, respectively; segment 3 of outer A I flagellum in male with tubercle rudimentary, just reaching end of segment 4 of flagellum and 2 very strong setae as long as segment 3; segment 4 of flagellum bearing 6-7 serrated bristles arranged in 2 rows and several setae on dorsal surface (Fig. 56C). A II peduncle 0.5 times as long as scaphocerite; latter 3.0 times as long as wide (Fig. 55B), 0.77 times as long as A I peduncle.

Md palp 0.33 times as long as Cp, with proximal segment 2.5 times as long as distal one. Mx I with palp 2.4 times as long as wide and 0.07 times as long as Cp; endopod 1.3 times as long as wide and 1.2 times as long as palp; endite 1.8 times as long as wide and 0.9 times as long as palp. Mx II with exopod 3.0 times as long as wide and 0.31 times as long as Cp; palp 3.5 times as long as wide and 0.12 times as long as Cp; endopod 2.0 times as long as wide and 1.0 times as long as palp; endites subequal, 1.6 times as long as wide and 0.5 times as long as palp.

Mxp I with exopod 3.1 times as long as wide and 0.20 times as long as Cp; endopod 0.9 times as long as exopod, segments 2 and 3 0.9 and 0.7 times as long as segment 1, respectively. Mxp II 0.9 times as long as Cp, with merus 1.0, carpus and propodus 0.9, and dactyl 0.5 times as long as ischium. Mxp III 1.5 times as long as Cp, with merus and carpus 1.0, propodus and dactyl 0.9 times as long as ischium; dactyl divided into 5-7 subsegments, respectively.

P I 1.1 times as long as Cp, with merus 2.4, carpus 1.5, and propodus 2.3 times as long as ischium; propodus divided into 11 subsegments. P II 1.6 times as long as Cp, with merus 3.4, carpus 2.6, propodus 3.2, and dactyl 0.2 times as long as ischium; propodus divided into 13 subsegments. P III 1.9 times as long as Cp, with merus 3.1, carpus 2.6, propodus 3.0, and dactyl 0.2 times as long as ischium; propodus divided into 13 subsegments. P IV 1.3 times as long as Cp, with merus 1.5, carpus 1.0 and propodus 1.0 times as long as ischium. P V 0.7 times as long as Cp, with merus 1.1, carpus 0.9, and propodus 0.8 times as long as ischium.

Somite VIII with arthrobranch 0.13 times as long as Cp and 2.2 times as long as epipod. Somite IX

with anterior pleurobranch 0.22 times as long as Cp and 4.4 times as long as posterior pleurobranch. Somite X with anterior pleurobranch 0.27 times as long as Cp and 4.6 times as long as posterior pleurobranch. Somite XI with anterior pleurobranch 0.31 times as long as Cp and 3.7 times as long as posterior pleurobranch. Somite XII with anterior pleurobranch 0.32 times as long as Cp and 1.2 times as long as posterior pleurobranch. Somite XIII with anterior pleurobranch 0.29 times as long as Cp and 1.2 times as long as posterior pleurobranch.

Pl I with basipod 0.34 times as long as Cp and exopod 2.2 times as long as basipod. Pl II with basipod 0.32 times as long as Cp; exopod 2.7 and endopod 1.4 times as long as basipod, respectively. Pl III with basipod 0.32 times as long as Cp; exopod 2.2 and endopod 1.3 times as long as basipod, respectively. Pl IV with basipod 0.32 times as long as Cp; exopod 2.1 and endopod 1.2 times as long as basipod, respectively. Pl V with basipod 0.28 times as long as Cp; exopod 1.8 and endopod 1.2 times as long as basipod, respectively.

Up with exopod 4.2 times as long as wide, 5.8 times as long as basipod and 0.7 times as long as Cp; endopod 3.3 times as long as wide and 0.7 times as long as exopod (Fig. 55C).

Petasma (Fig. 56A-B). PV long and narrow, overlapping LI, 3.7 times as long as wide. LI small, 2.1 times as long as wide and 0.2 times as long as PV. LT slightly curved laterally, overlapping PV and reaching end of LC, 2.0 times as long as wide and 0.6 times as long as PV, armed with row of stronger hooks on lateral margin near base and with smaller hooks in distomedial part. LC 2.7 times as long as wide and 0.5 times as long as PV, bearing several papillae with hooks on proximolateral margin. LA ranging in proportion, in average 3.3 times as long as wide and 0.8 times as long as PV, armed with row of numerous hooks along medial side and few very strong hooks near apex.

Photophores. Scaphocerite: continuous wavy row of 6-15 photophores medial to inner strip of muscle from 1/4 blade length nearly to tip. Up exopod: 3-11 photophores arranged in two series, (1) proximal photophores in continuous row medial to inner strip of muscle from 0.2 to 0.5 exopod length and (2) distal photophores in continuous row distal to terminal muscle strip from 0.7 to 0.9 exopod length, latter row sometimes absent. Up endopod: 1 photophore in proximomedial corner.

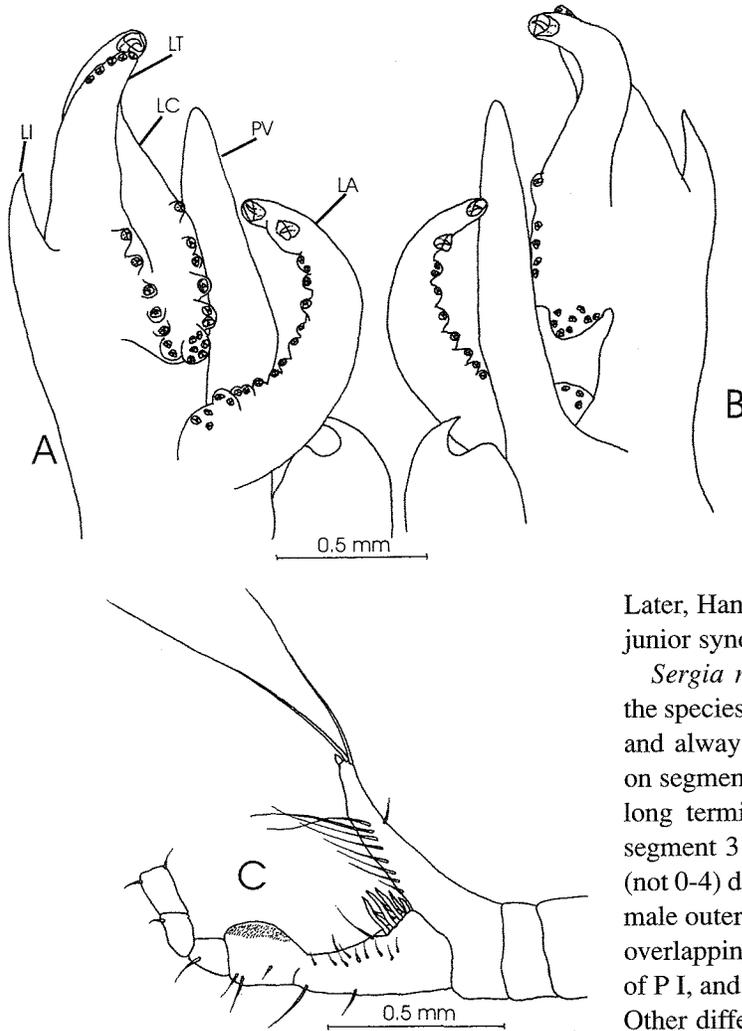


Fig. 56. *Sergia robusta*, male, "Dana" St. 1371-1, Cp length 18.6 mm. – A, oral view of petasma. – B, caudal view of petasma. – C, male outer A I flagellum.

Later, Hansen (1922) showed all these names to be junior synonyms of *S. robusta*.

Sergia robusta differs from all other species of the species group in having (1) the rostrum elongate and always unidentate, (2) a rudimentary tubercle on segment 3 of the male outer A I flagellum, (3) 2 long terminal setae overreaching the tubercle on segment 3 of the male outer A I flagellum, (4) 6-7 (not 0-4) dorsal serrated bristles on segment 4 of the male outer A I flagellum, (5) LC of the petasma not overlapping LT, (6) 11 subsegments in the propodus of P I, and (7) 13 subsegments in propodus of P III. Other differences and affinities between *S. robusta* and all other known species of the species group are shown in Table 6.

Remarks: Variations of colour in life are shown in Pl. 3A-B.

Sergia robusta seems to be one of the most variable species in the form of the rostrum, the fine structure of the petasma, and the number of photophores, which are sometimes absent in the distal part. However, the number of photophores on the scaphocerite (6-15) and on the Up exopod (3-11), as well as the form and proportions of all lobes and processes of the petasma make referral of all studied specimens to this species reliable. *S. robusta* undergoes significant morphological variations during development and has been described under different names. Bate (1888) described the mastigopod stage of this species under the name *Sergestes dissimilis*, Hansen (1896) described a juvenile as *Sergestes mediterraneus* and a young immature specimen as *Sergestes inermis* (Hansen 1903).

Geographical distribution (Fig. 51): North Atlantic and Mediterranean only: A common species (Hansen 1922) which seems to prefer temperate waters and has been recorded mainly from the stations north of 30°N ("Dana"; Vereshchaka 1994a). Mediterranean (Sund 1920, Zariquiey Alvarez 1968, Kurian 1956).

The records of this species by Holthuis (1952a), without any description and figure, and by Illig (1914), from the South Atlantic, are doubtful and not included in Fig. 51. Holthuis' and Illig's locations are separated from the main area, and no other indications (including extensive "Dana" and "Galathea" material) show that this species, preferring temperate waters, occurs also in the Central or South Atlantic. Illig's report (1927) of this species from the Indian Ocean seems very doubtful (Hansen 1927). Pesta (1918) mentions it from

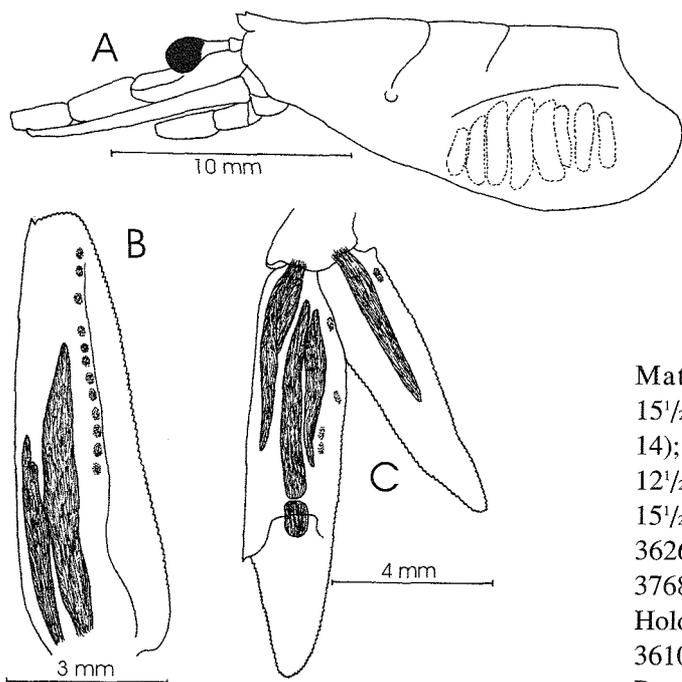


Fig. 57. *Sergia vityazi* n. sp., holotype, male, "Dana" St. 3601-1, Cp length 16.0 mm. – A, lateral view of Cp. – B, scaphocerite. – C, Up.

Sergia vityazi n. sp.

Figs. 51, 57-58

Material examined: "Dana" stations: 3570-2 (2f 15½-18); 3576-4 (1f 20½); 3579-1 (1f 10½ & 1m 14); 3591-1 (1f 10½ & 1m 15½); 3593-1 (1m 12½); 3601-1 (2m 16-17½); 3602-1 (1f 15½ & 1m 15½); 3620-1 (3f 15½-16½); 3620-3 (1f 13½); 3626-1 (1f 15); 3626-2 (1f 15); 3626-7 (1f 16); 3768-1 (1f 20 & 1m 15).

Holotype: male (Cp length 16.0 mm, ZMUC CRU 3610), "Dana" St. 3601-1, sampled 20 Nov. 1928.

Paratypes: 1 male (Cp length 15.6 mm, ZMUC CRU 3611), "Dana" St. 3601-1 (data as for holotype) and 1 female (Cp length 15.8 mm, ZMUC CRU 3612), "Dana" St. 3570-2, 14°01'S, 147°51'W, sampled 07 Oct. 1928.

Type locality: Southwestern Pacific, 18°21'S, 178°21'E.

Type material: Holotype + 2 paratypes (ZMUC, see above).

Diagnosis: Integument firm; rostrum long and acute, bi- or unidentate; cornea well pigmented, dark brown, considerably wider than eyestalk; A I peduncle with segment 3 of outer A I flagellum in male with well developed tubercle reaching end of segment 4 of flagellum, without terminal setae overlapping tubercle; segment 4 of flagellum bearing 3-4 serrated bristles on dorsal surface, segment 5 with distodorsal protrusion; PV of petasma overlapping LA; LC overlapping LT and LI, bearing very strong apical tooth; LAc present; LA evenly curved medially, photophores arranged in single row medial to inner muscle strips on scaphocerite and in single proximal group near medial margin on Up endopod.

Description: Cp 1.9 times as long as high and 0.37 times as long as abdomen (Fig. 57A). Abdomen with somite VI 1.5 times as long as high and 1.2 times as long as telson; telson 3.6 times as long as wide.

Hawaii without further details; this seems to be a mistake as this species may be reliably distinguished from several Pacific species only after observation of the petasma, a procedure rarely performed early in this century. The record by Vereshchaka (1990b) from the area of the Nazca and Sala-y-Gomez Ridges is an error, as this species now appears to be one of those briefly described by Burkenroad (1940), being juveniles of *S. maxima* and *S. potens*.

Sergia robusta thus occupies a single area only. It is parapatric to *S. extenuata*, the former occurring north of 20-30°N, the latter south of 20°N. *S. robusta* is sympatric with *S. regalis* and allopatric to *S. vityazi*.

Vertical range: An interzonal species, migrating daily between the upper bathypelagic and upper mesopelagic zones. The "Dana" specimens were taken within the depth range 200-2300 m. Most specimens live at 200-300 m at night and at 1000-2300 m during the day. These data correspond to the results of Foxton (1970) and Vereshchaka (1994a), who reported this species from 200-600 m and 200-500 m, respectively, at night, and from below 700 m and from 1000-2000 m, respectively, during the day.

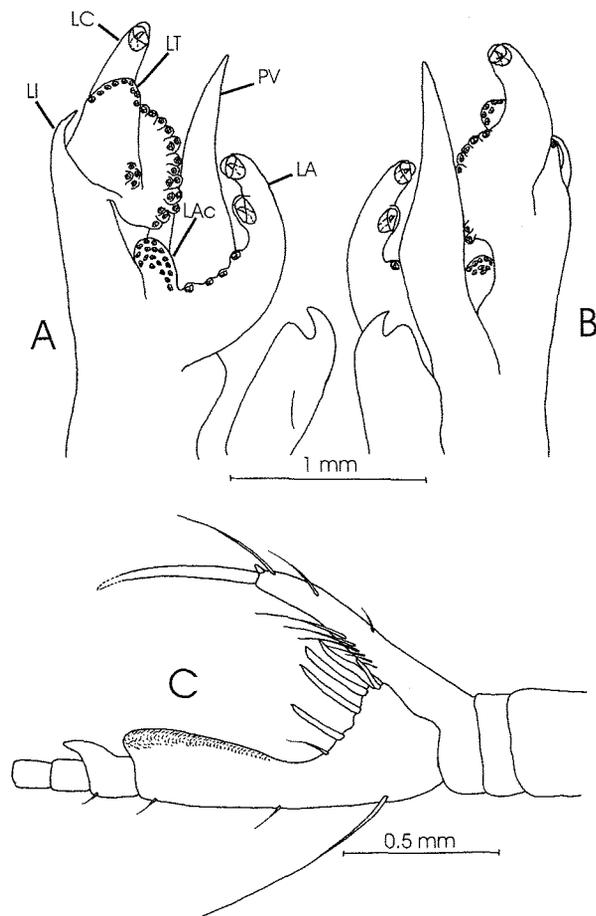


Fig. 58. *Sergia vityazi* n. sp., holotype, male, "Dana" St. 3601-1, Cp length 16.0 mm. — A, oral view of petasma. — B, caudal view of petasma. — C, male outer A I flagellum.

Ocular papilla 0.3 times as long as wide; cornea 1.1 times as long as wide, 0.6 times as long and 1.4 times as wide as eyestalk. A I peduncle 0.7 times as long as Cp, with segments 2 and 3 0.63 and 0.56 times as long as segment 1, respectively, segment 3 of outer A I flagellum in male with tubercle reaching end of segment 5 of flagellum and without setae overlapping tubercle; segment 4 of flagellum bearing 5-6 serrated bristles and several setae on dorsal surface (Fig. 58C); segment 5 with distolateral protrusion. A II peduncle 0.5 times as long as scaphocerite; latter 3.4 times as long as wide (Fig. 57B), 0.56 times as long as A I peduncle.

Md palp 0.36 times as long as Cp, with proximal segment 2.2 times as long as distal one. Mx I with palp 2.1 times as long as wide and 0.07 times as long as Cp; endopod 1.4 times as long as wide and 1.2 times as long as palp; endite 1.6 times as long

as wide and 0.9 times as long as palp. Mx II with exopod 3.7 times as long as wide and 0.33 times as long as Cp; palp 3.8 times as long as wide and 0.13 times as long as Cp; endopod 1.9 times as long as wide and 1.0 times as long as palp; endites subequal, 1.6 times as long as wide and 0.5 times as long as palp.

Mxp I with exopod 3.3 times as long as wide and 0.20 times as long as Cp; endopod 1.0 times as long as exopod; segments 2 and 3 1.1 and 0.7 times as long as segment 1, respectively. Mxp II 0.9 times as long as Cp, with merus 1.1, carpus and propodus 0.9, and dactyl 0.5 times as long as ischium. Mxp III 1.5 times as long as Cp, with merus 1.0, carpus 0.9, propodus 0.8, and dactyl 0.9 times as long as ischium; dactyl divided into 7 subsegments.

P I 1.1 times as long as Cp, with merus 2.6, carpus 1.6, and propodus 2.8 times as long as ischium; propodus divided into 10 subsegments. P II 1.6 times as long as Cp, with merus 2.9, carpus 2.3, propodus 3.1, and dactyl 0.2 times as long as ischium; propodus divided into 12 subsegments. P III 2.0 times as long as Cp, with merus 3.3, carpus 2.7, propodus 3.3, and dactyl 0.2 times as long as ischium; propodus incompletely divided into 10 subsegments. P IV 1.1 times as long as Cp, with merus 1.6, carpus and propodus 1.1 times as long as ischium. PV 0.6 times as long as Cp, with merus 1.1, carpus 0.8, and propodus 0.6 times as long as ischium.

Somite VIII with arthrobranch 0.14 times as long as Cp and 2.3 times as long as epipod. Somite IX with anterior pleurobranch 0.20 times as long as Cp and 5.3 times as long as posterior pleurobranch. Somite X with anterior pleurobranch 0.26 times as long as Cp and 6.7 times as long as posterior pleurobranch. Somite XI with anterior pleurobranch 0.29 times as long as Cp and 6.7 times as long as posterior pleurobranch. Somite XII with anterior pleurobranch 0.29 times as long as Cp and 1.3 times as long as posterior pleurobranch. Somite XIII with anterior pleurobranch 0.24 times as long as Cp and 1.2 times as long as posterior pleurobranch.

Pl I with basipod 0.34 times as long as Cp and exopod 2.0 times as long as basipod. Pl II with basipod 0.32 times as long as Cp; exopod 2.3 and endopod 1.3 times as long as basipod, respectively. Pl III with basipod 0.32 times as long as Cp; exopod 2.2 and endopod 1.3 times as long as basipod, respectively. Pl IV with basipod 0.30 times as long as Cp; exopod 2.2 and endopod 1.3 times as long as

basipod, respectively. Pl V with basipod 0.28 times as long as Cp; exopod 2.0 and endopod 1.2 times as long as basipod, respectively.

Up with exopod 4.6 times as long as wide, 5.2 times as long as basipod and 0.6 times as long as Cp; endopod 3.6 times as long as wide and 0.7 times as long as exopod (Fig. 57C).

Petasma (Fig. 58A-B). PV long and narrow, with distolateral margin slightly concave, 4.8 times as long as wide. LI slender, not reaching end of PV, 2.2 times as long as wide and 0.3 times as long as PV. LT short, overlapping LI, not reaching end of LC, 1.4 times as long as wide and 0.3 times as long as PV, armed with several small hooks on lateral side near base and near apex. LC overlapping all other lobes and processes, 2.0 times as long as wide and 0.5 times as long as PV, bearing numerous papillae with hooks on proximolateral margin. LAc 1.4 times as long as wide and 0.2 times as long as PV, covered with numerous small hooks. LA not reaching end of PV, 2.6 times as long as wide and 0.6 times as long as PV, armed with smaller hooks along proximomedial margin and few stronger hooks in distal part.

Photophores. Scaphocerite: continuous row of 10-15 photophores medial to inner strip of muscle from 0.4 to 0.9 blade length. Up exopod: 2-5 proximal photophores near inner margin, from 0.1 to 0.5 exopod length. Up endopod: 1 photophore in proximomedial corner.

Remarks: *Sergia vityazi* n. sp. varies morphologically in the form of rostrum (which may sometimes be unidentate) and in minor proportions of the petasma. LA varies in form and length but always remains much shorter than PV.

This species most closely resembles *S. regalis* and *S. robusta* and differs from all other species of the species group in (1) the absence of terminal setae overlapping the tubercle on segment 3 of the male outer A I flagellum and in (2) the presence of distodorsal extension on segment 3 of the male outer A I flagellum. Other differences and affinities between *S. vityazi* and all other known species of the species group are shown in Table 6.

Etymology: *Sergia vityazi* is named after the famous Russian R/V "Vityaz", which has been exploring the oceans (especially the area where the species occurs) during several decades of the 20th century.

Geographical distribution (Fig. 51): Pacific Ocean only: Southwest part, off New Guinea, off Tahiti, mainly between 10°S and 30°S ("Dana").

Sergia vityazi is sympatric with *S. regalis* and allopatric to *S. robusta* and *S. extenuata*.

Vertical range: An interzonal species, migrating daily between the upper bathypelagic and upper mesopelagic zones. "Dana" specimens were taken within the depth range 100-1700 m. Most specimens occur at 200-300 m at night and 1000-1300 m during the day.

Sergia prehensilis species group

Diagnosis: Lens-bearing photophores (total of 225-359 organs on body) varying in position and number present: 7-14 on scaphocerite, 3-12 on Up exopod, 5-6 in upper and 12-18 in lower lateral Cp rows; hepatic tubercle prominent; postdorsal spine on abdominal Somite VI present; ocular papilla absent; A I peduncle with segment 2 shorter than segment 1, clasping organ with 2-5 serrated bristles; endopod of Mxp I with 3 segments; posterior branchial lobe above P III reduced but not lamellar; petasma with LA developed and LT reduced.

Species included: *Sergia prehensilis* (Bate, 1881), *S. scintillans* (Burkenroad, 1940).

Key to species of the *Sergia prehensilis* species group

1. Lower Cp row with 15-23 photophores, scaphocerite with 10-15 photophores, Up exopod with 8-14 photophores. Male outer A I flagellum with segment 3 bearing tubercle not overlapping segment 4 and segment 4 armed with 3-5 dorsal serrated bristles. PV of petasma developed; LI less voluminous than LC *Sergia prehensilis*
- Lower Cp row with 8-14 photophores, scaphocerite with 7 photophores, Up exopod with 3 photophores. Male outer A I flagellum with segment 3 bearing tubercle overlapping segment 4 and segment 4 armed with 0-2 dorsal serrated bristles. PV absent; LI more voluminous than LC.....
..... *Sergia scintillans*

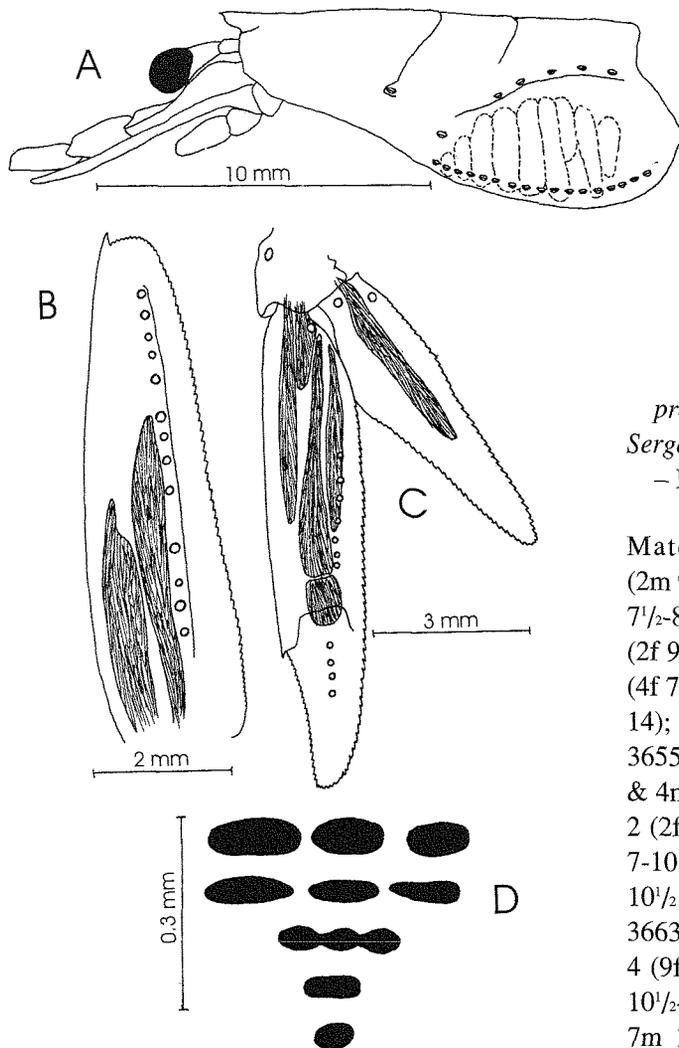


Fig. 59. *Sergia prehensilis*, male, "Dana" St. 3664-1, Cp length 11.4 mm. – A, lateral view of Cp. – B, scaphocerite. – C, Up. – D, shape of medial photophores on abdominal somites from I (above) to V (below), showing different degrees of fusion.

prehensilis by Sakai & Nakano (1985: 26).

Sergestes (Sergia) prehensilis. – Yaldwyn 1957: 9.

– Kensley 1971: 253, fig. 20; 1977: 18.

Material examined: "Dana" stations: 3637-1 (2m 9-9¹/₂); 3637-2 (1m 10¹/₂); 3638-1 (1f 8¹/₂ & 5m 7¹/₂-8¹/₂); 3653-1 (3f 7¹/₂-12¹/₂ & 8m 8-14); 3653-2 (2f 9); 3653-6 (1m 8¹/₂); 3653-7 (2m 7-11); 3653-8 (4f 7¹/₂-10 & 6m 6-8¹/₂); 3654-2 (7f 6-14 & 7m 6¹/₂-14); 3654-3 (10f 7-14¹/₂ & 4m 7-9¹/₂ & 5j 4-5¹/₂); 3655-1 (2f 8-11 & 4m 10¹/₂-15); 3655-2 (4f 5¹/₂-10 & 4m 6-8); 3655-5 (2f 5-5¹/₂ & 3m 5¹/₂-7¹/₂); 3656-2 (2f 6-8); 3656-3 (1f 5 & 2m 6¹/₂-7); 3656-4 (15f 7-10 & 15m 6-14¹/₂ & 4j 4¹/₂-5); 3656-8 (12f 7¹/₂-10¹/₂ & 9m 7-10 & 8j 5-6¹/₂); 3657-1 (1f 12¹/₂); 3663-1 (1m 8); 3663-3 (3f 5-6¹/₂ & 3m 5-9); 3663-4 (9f 8¹/₂-11¹/₂ & 5m 7¹/₂-10¹/₂ & 1j 5); 3663-6 (4f 10¹/₂-12¹/₂ & 9m 8¹/₂-14¹/₂); 3664-1 (11f 6¹/₂-14¹/₂ & 7m 12-14¹/₂); 3664-3 (2f 13-14¹/₂ & 6m 7-14¹/₂); 3665-2 (7f 9-12 & 1m 14 & 27j 5¹/₂-6¹/₂); 3677-2 (4f 5¹/₂-10 & 2m 6-8); 3722-2 (3f 8-17¹/₂ & 3m 7-16¹/₂); 3728-1 (2f 8-10 & 1m 10¹/₂); 3929-1 (5f 6-8); 3929-2 (5f 5¹/₂-6); 3929-3 (1m 5); 3931-1 (2f 8-10); 3931-2 (3j 6-6¹/₂); 3933-3 (1m 13); 3934-1 (14f 5-7¹/₂ & 1m 7¹/₂); 3934-2 (7f 5-7 & 1m 6¹/₂); 3934-3 (9f 5-7 & 1m 6); 3949-1 (1m 13¹/₂); 3949-2 (1m 13); 3952-2 (1f 11¹/₂); 3957-2 (2f 8¹/₂-9); 3959-1 (1m 7¹/₂); 3962-1 (3f 12-13 & 2m 11-12 & 1j 5); 3962-2 (1m 11); 3964-1 (3m 12¹/₂-13); 3964-2 (6f 9-11 & 3m 11-11¹/₂); 3964-7 (1f 9); 3964-10 (3f 6-9 & 6m 10-14¹/₂); 3966-1 (3f 10-11¹/₂ & 3m 9-13); 3966-2 (9f 7¹/₂-12 & 2m 8¹/₂-10¹/₂); 3966-3 (3f 10-10¹/₂ & 1m 9¹/₂); 3969-1 (2f 10¹/₂-11¹/₂ & 1m 12¹/₂); 3969-2 (1f 12 & 1m 14); 3969-3 (12f 9-14 & 5m 8-11); 3969-4 (4f 5¹/₂-6 & 2m 6-8); 3971-2 (4f 7-10¹/₂ & 1m 9); 3971-3 (4f 5¹/₂-11 & 3m 9¹/₂-10); 3978-1 (2f 6¹/₂ & 1m 8); 3978-2 (2f 9-9¹/₂ & 3m 9-10).

"Galathea" station: 203 (1f 10).

Holotype of *Sergestes prehensilis* (BMNH 1888.22).

***Sergia prehensilis* (Bate, 1881)**

Figs. 2C, 59-61

- Sergestes prehensilis* Bate, 1881:193; 1888: 385, pl. 71. – Hansen 1896: 949; 1903: 56; 1919: 5. – Balss 1914: 17. – Yokoya 1933: 12. – Gordon 1935: 314. – Gurney & Lebour 1940:32. – Aizawa 1969: 60. – Okutani 1969: 30. – Omori 1969: 10. – Sakai & Nakano 1985: 26, figs. 6-9.
- Sergia prehensilis*. – Ortmann 1893: 38. – Krygier & Wasmer 1988: 50. – Vereshchaka 1995a: 1650.
- Sergestes gloriosus* Stebbing, 1905: 84, pl. 22-23; 1910: 318. – Hansen 1925: 24. – Gordon 1935: 310. – Barnard 1950: 642, fig. 120 h-j. – Synonymized with *Sergestes prehensilis* by Gordon (1935).
- Sergestes fujiyamaensis* Nakazawa, 1932b: 32. – Kubo 1965: 595. – Synonymized with *Sergestes*

Type locality: Western Pacific off Japan, 34° 58'N, 139°29'E.

Type material: Holotype of *Sergestes prehensilis* (NHM, see above, examined).

Diagnosis: Integument firm; rostrum acute, usually without small additional dorsal tooth; cornea well pigmented, black, considerably wider than eyestalk; outer A I flagellum in male with segment 3 bearing well developed tubercle reaching end of segment 4 of flagellum and segment 4 bearing 3-5 serrated bristles on dorsal surface; scaphocerite with strong distal tooth overlapping blade; PV and LI of petasma developed; LC overlapping other lobes and processes, divided into 2 lobules; LA rudimentary; LA strongly curved medially, reaching $\frac{1}{2}$ PV; photophores arranged in upper (4-8) and lower (15-23) rows on Cp, row (10-15) on scaphocerite, proximal row (4-8) and distal row (3-5) on Up exopod, 2 basal photophores on Up endopod.

Description: Cp 1.9 times as long as high and 0.38 times as long as abdomen (Fig. 59A). Abdomen with somite VI 1.6 times as long as high and 1.3 times as long as telson; telson 3.3 times as long as wide.

Cornea 1.2 times as long as wide, 0.8 times as long and 1.6 times as wide as eyestalk. A I peduncle 0.6 times as long as Cp, with segments 2 and 3 0.45 and 0.33 times as long as segment 1, respectively; outer A I flagellum in male with segment 3 bearing tubercle reaching end of segment 4 of flagellum and with segment 4 bearing 3-5 serrated bristles and few setae on dorsal surface and several setae on ventral surface (Fig. 60C). A II peduncle 0.4 times as long as scaphocerite; latter with strong distal tooth overreaching blade (Fig. 59B), 3.6 times as long as wide, 1.0 times as long as A I peduncle.

Md palp 0.36 times as long as Cp, with proximal segment 2.2 times as long as distal one. Mx I with palp 1.7 times as long as wide and 0.06 times as long as Cp; endopod 1.7 times as long as wide and 1.8 times as long as palp; endite 1.4 times as long as wide and 0.9 times as long as palp. Mx II with exopod 3.1 times as long as wide and 0.31 times as long as Cp; palp 3.8 times as long as wide and 0.11 times as long as Cp; endopod 1.8 times as long as wide and 1.1 times as long as palp; endites subequal, 2.0 times as long as wide and 0.5 times as long as palp.

Mxp I with exopod 2.8 times as long as wide and 0.22 times as long as Cp; endopod 1.2 times as long as exopod; segments 2 and 3 1.2 and 1.9 times as long as segment 1, respectively. Mxp II 0.9 times as long as Cp, with merus 1.0, carpus and propodus 0.9, and dactyl 0.5 times as long as ischium. Mxp III 1.4 times as long as Cp, with merus 0.8, carpus and propodus 0.7, and dactyl 0.6 times as long as ischium; propodus and dactyl divided into 3 and 5 subsegments, respectively.

P I 1.0 times as long as Cp, with merus 2.3, carpus 1.3, and propodus 2.4 times as long as ischium; propodus divided into 6 subsegments. P II 1.5 times as long as Cp, with merus 2.6, carpus 2.2, propodus 2.5, and dactyl 0.1 times as long as ischium; propodus divided into 8 subsegments. P III 1.7 times as long as Cp, with merus 2.9, carpus 2.4, propodus 2.7, and dactyl 0.1 times as long as ischium; propodus divided into 12 subsegments. P IV 1.0 times as long as Cp, with merus 1.5, carpus 1.0, and propodus 1.1 times as long as ischium. P V 0.6 times as long as Cp, with merus 1.3, carpus 1.0, and propodus 0.8 times as long as ischium.

Somite VIII with arthrobranch 0.10 times as long as Cp and 2.3 times as long as epipod. Somite IX with anterior pleurobranch 0.18 times as long as Cp and 2.7 times as long as posterior pleurobranch. Somite X with anterior pleurobranch 0.23 times as long as Cp and 3.5 times as long as posterior pleurobranch. Somite XI with anterior pleurobranch 0.28 times as long as Cp and 3.6 times as long as posterior pleurobranch. Somite XII with anterior pleurobranch 0.26 times as long as Cp and 1.8 times as long as posterior pleurobranch. Somite XIII with anterior pleurobranch 0.22 times as long as Cp and 1.3 times as long as posterior pleurobranch.

Pl I with basipod 0.29 times as long as Cp and exopod 2.2 times as long as basipod. Pl II-III with basipod 0.29 times as long as Cp; exopod 2.3 and endopod 1.4 times as long as basipod, respectively. Pl IV with basipod 0.29 times as long as Cp; exopod 2.2 and endopod 1.3 times as long as basipod, respectively. Pl V with basipod 0.26 times as long as Cp; exopod 1.8 and endopod 1.1 times as long as basipod, respectively.

Up with exopod 5.1 times as long as wide, 5.5 times as long as basipod and 0.7 times as long as Cp; endopod 3.6 times as long as wide and 0.7 times as long as exopod (Fig. 59C).

Petasma (Fig. 60A-B). PV short, tapering into

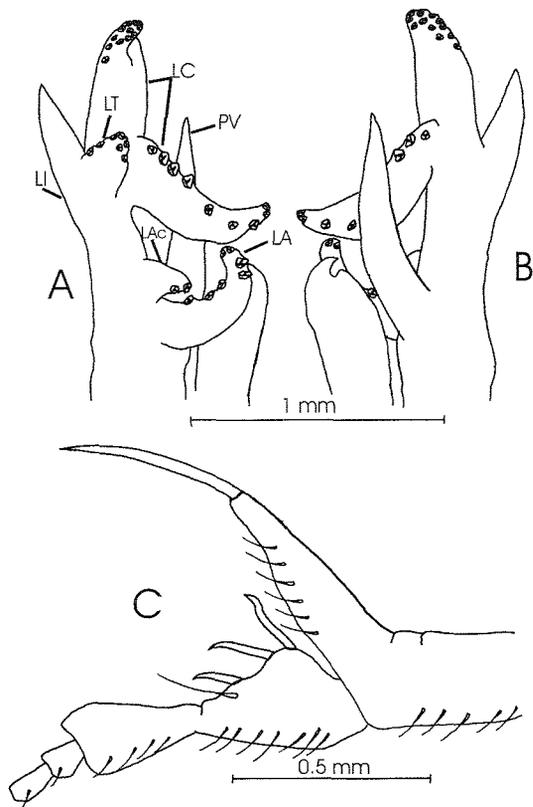


Fig. 60. *Sergia prehensilis*, male, "Dana" St. 3664-1, Cp length 11.4 mm. - A, oral view of petasma. - B, caudal view of petasma. - C, male outer A I flagellum.

point, 4.0 times as long as wide. LI voluminous, overlapping PV, 2.0 times as long as wide and 0.4 times as long as PV. LT reduced, not reaching end of LI and PV, 1.1 times as long as wide, 0.3 times as long as PV, armed with several hooks in distal part. LC divided at proximal part into 2 lobules: distal and proximal; distal lobule overlapping other lobes and processes, 2.6 times as long as wide and 0.8 times as long as PV, armed with numerous hooks in 1/4 distal part; proximal lobule directed laterally, 2.6 times as long as wide and 0.9 times as long as PV, armed with row of hooks along medial margin. LAc 1.1 as long as wide and 0.3 times as long as PV, armed with few distal hooks. LA 2.7 times as long as wide and 0.7 times as long as PV, armed with row of hooks along medial margin and with few apical hooks.

Photophores. Cp (Figs. 2C, 59A): 4-8 and 15-23 organs in upper and lower rows, respectively. Scaphocerite: 10-15 organs medial to inner strip of muscle from 0.2 to 0.9 blade length. Up exopod: 1 proximal near base, basal row of 4-8 organs medial to inner strips of muscle from 0.2-0.3 to 0.5-0.6

exopod length, and row of 3-5 organs distal to apical muscle strip, from 0.7 to 0.8-0.9 exopod length. Up endopod: 2 organs near base.

Other body photophores, all ventral, found on the following somites (al = anterolateral, l = lateral, m = medial): II (1m), III (4l), labrum (1m+2l), IV (2m+2l), V (2m+2l), VI (2l), VII (2m) VIII (1m+2l), IX (1m), X (3m), XI (3m), XII (3m (male), 1m (female)), XIII (3m+2al), XIV (2m+4pm+2al), XV (8m+6l); XVI (10m+6l), XVII (8m+6l), XVIII (6m+6l), XIX (6m+6l), XX (5m+12l). Total (with those in Cp rows): 167-193.

Other photophores found on the following appendages (d = distal, m = medial, p = proximal, Roman numerals indicate segments): eyestalk (lp+1d) A I (peduncle III - 1d), A II (peduncle I - 1p), Md (proper - 1d, palp I - 1d), Mx II (Exp - 2p+1d, End II - 1d), Mxp I (II - 1m, III - 1d), Mxp II (II - 1d, III - 1d, IV - 1p, V - 1d, VI - 1d), Mxp III (II - 1d, IV - 1d, V - 1d, VI - 1d, VII - 1d), P I (II - 1d, III - 1p, IV - 2p+1d, V - 2d), P II (II - 1d, III - 1p+1d, IV - 1d, V - 1d), P III (II - 1d, III - 1p+1d, IV - 10m, V - 1d), P IV (III - 1p+1d, IV - 1d, V - 1d), P V (II - 0 (male)/1 (female), III - 1p+1d, IV - 1d), P I I - P I V (I - 1p). Total (with those on scaphocerite and Up): 158-166.

Thus, the total number of observed photophores in all specimens examined ranges from 325 to 359 organs.

Remarks: Due to the incomplete original description of *Sergestes prehensilis*, Stebbing (1905) described this species under a different name, *S. gloriosus*, and several authors referred the shrimp to Stebbing's name. Several years later, Nakazawa & Terao (1915) described a new species from off Japan and named this *S. prehensilis* (name preoccupied by Bate, see details in remarks to *S. lucens*). After examination of the holotype of *S. prehensilis*, Gordon (1935) published on the arrangement of the photophores and on the morphology of the petasma and found *S. prehensilis* to be identical to *S. gloriosus* and different from *S. prehensilis* Nakazawa & Terao, the latter species being identical with *S. lucens* Hansen, 1922. Since Gordon's publication, no synonyms have appeared. Before Gordon (1935), this species was described under one more name, *S. fujiyamaensis* (Nakazawa 1932a). This description is in Japanese, but Sakai & Nakano (1985) gave sufficient arguments for the identity of the two species.

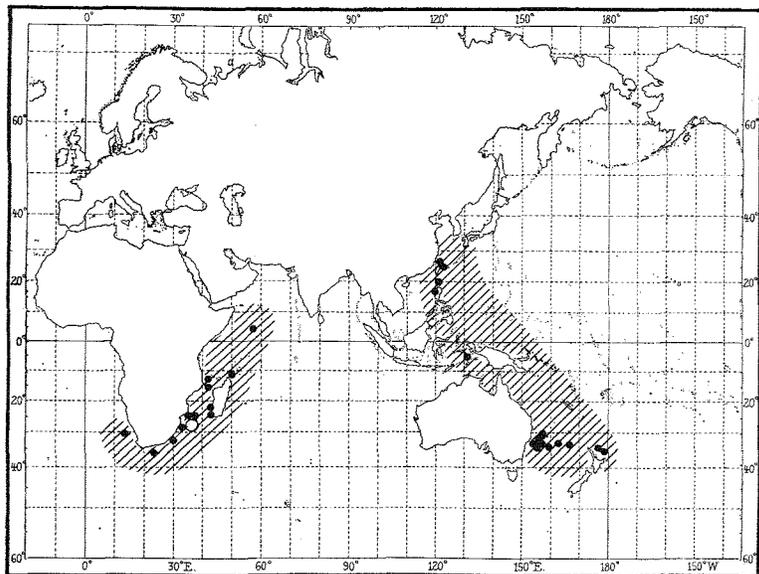


Fig. 61. Probable geographical distribution of *Sergia prehensilis*. Black symbols indicate "Dana" stations, white symbol a "Galathea" station. Shaded areas without symbols are supported by literature data.

"Dana" specimens of *S. prehensilis* differ from *S. scintillans* in the number and position of photophores on Cp, the form of the rostrum (rarely bidentate), Cp and abdomen proportions, the form of PV (sometimes more thin than illustrated), development of LT, form and armature of LA. Despite this, all variation observed may be regarded as of infraspecific level.

This species possesses lens-bearing photophores. Among all the lens-bearing species, *S. prehensilis* seems to be closest to the ancestor with lens-less photophores without fixed position on the integument. In contrast to the other species with lens-bearing photophores, the number of photophores in *S. prehensilis* varies and their position is not fixed. In addition, the lenses are often poorly developed, and the organs look rather like "opaque spots". Photophores in *S. prehensilis* are the most numerous of any species with lens-bearing photophores, almost as abundant as those in the species with "opaque spots"; however, this species has a tendency (common within the lens-bearing species) to reduce the number of photophores. This happens when the closely spaced organs fuse, and may be exemplified by the photophores on the sternites of abdominal somites XV-XIX (Fig. 59D).

Sergia prehensilis is close to *S. scintillans* in the following most important characters: (1) more numerous lens-bearing photophores than in other species with such, and they sometimes vary in position, (2) prominent hepatic tubercle (not spine), (3) presence of posterodorsal spine on abdominal

somite VI, (4) absence of ocular papilla, (5) LT of petasma reduced and undivided, and (6) LA developed. *Sergia prehensilis* differs from *S. scintillans* in having (1) more photophores on Cp (15-23 instead of 8-14 in lower row), (2) 10-15 (instead of 7) photophores on scaphocerite, (3) 1 (instead of 0) basal photophore on Up exopod, (4) 4-8 (instead of 2) photophores on medial and (5) 3-5 (instead of 1) distal photophores of Up exopod, (6) somite VI shorter, 1.6 (instead of 1.9) times as long as high, (7) scaphocerite wider, 3.3 (instead of 3.9) times as long as wide, (8) male outer A I flagellum with segment 3 bearing shorter tubercle not overlapping segment 4 and (9) segment 4 bearing more numerous serrated bristles (3-5 instead of 0-2), (10) presence of PV of petasma, (11) not very voluminous LI, (12) smaller LT, (13) divided LC, and in other minor characters concerning variations in the photophore position and proportions of lobes and processes of the petasma.

Geographical distribution (Fig. 61): Atlantic, Indian, and Pacific Oceans.

Atlantic: Southeastern part only, south of 25°S ("Dana"), off South Africa ("Dana"; Hansen 1925; Kensley 1971).

Indian Ocean: Western Equatorial part, off Comores and Madagascar ("Dana"), off South Africa ("Dana" and "Galathea"; Stebbing 1905; Barnard 1950, as *S. gloriosus*; Kensley 1971).

Pacific: Southwestern part, off New Zealand and Australia ("Dana" stations), off Japan (Bate 1888,

Nakazawa 1932, Aizawa 1969, Okutani 1969, and others).

S. prehensilis occurs in at least two isolated areas; it was sampled within a rather vast pelagic area, but the richest samples were taken near the shore, over the continental slope or over seamounts. Thus, this species has a transitional mode of life between pelagic and benthopelagic (Vereshchaka 1995a). The hatched area (Fig. 61) in the Western Pacific indicates the possible existence of independent populations near the islands or over seamounts between the two regions where this species was recorded: from off Japan and the Philippines to New Zealand and Australia. Inside this area, it may extend also into the pelagic zone. *S. prehensilis* and its sister species, *S. scintillans*, are sympatric.

Vertical range: An interzonal, partially benthopelagic, species, migrating daily between the upper bathypelagic (the upper continental slope contact zone, Vereshchaka 1995a, b) and epi-/upper mesopelagic zones. "Dana" specimens were taken within the depth range 30-1700 m. Most specimens occur at 100-300 m at night and 1000-1300 m during the day. This species is less numerous in the day samples, which may indicate a higher concentration of shrimps within a narrow near-bottom layer, which is usually not sampled.

Sergia scintillans (Burkenroad, 1940)

Figs. 62-64

Sergestes scintillans Burkenroad, 1940: 43.

Sergestes (Sergia) scintillans. – Yaldwyn 1957: 9. – Kensley 1971: 257, fig. 22; 1977: 18. – Vereshchaka 1990b: 138.

Sergia scintillans. – Walters 1976: 817. – Krygier & Wasmer 1988: 50. – Vereshchaka 1995a: 1651.

Material examined: "Dana" stations: 3602-2 (1m 5¹/₂); 3604-2 (1f 6¹/₂); 3604-3 (5f 4¹/₂-7¹/₂ & 4m 5-6¹/₂); 3613-9 (1f 9 & 2m 6¹/₂-7); 3620-1 (1m 6); 3621-1 (1f 6¹/₂); 3622-1 (8f 5-8 & 11m 6-7¹/₂); 3623-3 (1f 7¹/₂); 3624-6 (1m 6); 3624-9 (1f 5¹/₂); 3653-7 (1f 7); 3655-2 (1f 5¹/₂); 3655-5 (7f 4¹/₂-8¹/₂ & 6m 4-7); 3656-3 (1m 6); 3656-4 (1m 4¹/₂); 3663-3 (1m 5); 3663-4 (14f 4-8 & 11m 4¹/₂-6¹/₂); 3663-6 (1f 6¹/₂ & 1m 7¹/₂); 3663-7 (6f 4¹/₂-5¹/₂ & 8m 5-6); 3664-1 (1f 8 & 1m 6); 3921-6 (1m 7¹/₂); 3929-1 (2f 5¹/₂-8¹/₂); 3929-2 (4f 5-7¹/₂ & 4m 4¹/₂-6¹/₂); 3929-3

(2f 6-7 & 2m 6-7); 3933-3 (2f 6¹/₂-8); 3934-1 (5f 5-8 & 3m 6-6¹/₂); 3934-2 (6f 4¹/₂-6¹/₂ & 2m 6-6¹/₂); 3934-3 (4f 5-6); 3934-4 (2f 5-5¹/₂); 3937-1 (6f 6-7¹/₂ & 3m 5¹/₂-6); 3937-2 (2f 5¹/₂-6¹/₂ & 4m 5-6); 3937-3 (3f 5-6 & 2m 5-6¹/₂); 3937-4 (2f 7¹/₂-8); 3939-1 (3f 6¹/₂-8); 3939-3 (3f 6¹/₂-7¹/₂ & 7m 6¹/₂-7); 3939-4 (1f 8); 3941-3 (2f 7¹/₂); 3941-4 (1f 4¹/₂); 3943-2 (1f 7¹/₂ & 1m 6¹/₂); 3943-4 (1m 7); 3946-2 (1f 8); 3949-3 (1m 6); 3951-2 (2m 6-6¹/₂); 3951-3 (1f 6 & 1m 7); 3952-2 (1f 8); 3953-1 (1m 7); 3953-2 (1m 6); 3956-1 (26f 4¹/₂-8 & 9m 4¹/₂-7¹/₂); 3956-2 (1m 5¹/₂); 3956-3 (2f 4¹/₂-8); 3957-1 (3f 4¹/₂-5 & 2m 4¹/₂-7); 3957-2 (3f 4¹/₂-8 & 3m 4¹/₂-5¹/₂); 3958-1 (4f 4¹/₂-7¹/₂ & 1m 4¹/₂); 3959-1 (1m 7); 3959-2 (1f 9); 3962-2 (1m 5¹/₂); 3966-1 (2m 6-6¹/₂); 3969-4 (1f 6¹/₂); 3969-5 (3f 4¹/₂-5 & 2m 4-5); 3970-2 (1f 7); 3971-2 (1f 5); 3971-3 (1f 6¹/₂ & 1m 6¹/₂); 3975-9 (1f 7 & 1m 7); 3975-10 (1m 6¹/₂); 3981-5 (1f 5¹/₂).

Type locality: Southwestern Pacific, 25°54' S, 172°37' E.

Type material: Holotype ("Dana" St. 3622-1, ZMUC, lost, see Introduction).

Diagnosis: Integument firm; rostrum acute, without small additional dorsal tooth; cornea well pigmented, black, considerably wider than eyestalk; outer A I flagellum in male with segment 3 bearing well developed tubercle overlapping segment 4 of flagellum and segment 4 bearing 0-2 serrated bristles on dorsal surface; scaphocerite with strong distal tooth overlapping blade; PV of petasma absent; LI extremely voluminous; LC undivided; LAC rudimentary; LA curved medially, reaching end of LT; photophores arranged in upper (5-7) and lower (8-14) rows on Cp, 7 on scaphocerite, 2 medial and 1 distal one on Up exopod, 2 basal on Up endopod.

Description: Cp 2.0 times as long as high and 0.32 times as long as abdomen (Fig. 62A). Abdomen with somite VI 1.9 times as long as high and 1.5 times as long as telson; telson 4.5 times as long as wide.

Cornea 1.2 times as long as wide, 0.8 times as long and 1.3 times as wide as eyestalk. A I peduncle 0.8 times as long as Cp, with 2nd and segment 3 0.50 and 0.53 times as long as segment 1, respectively; outer A I flagellum in male with segment 3 bearing tubercle, which extends slightly beyond end of segment 4 of flagellum; segment 4 bearing

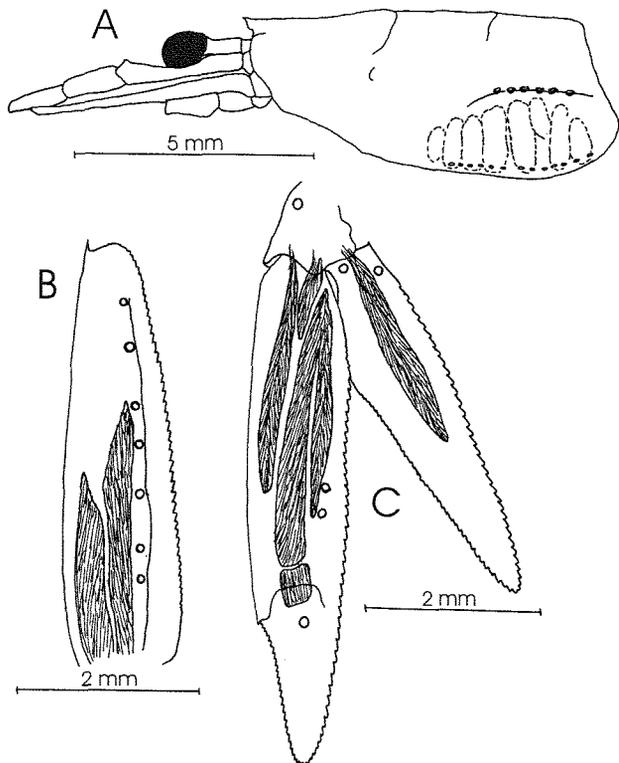


Fig. 62. *Sergia scintillans*, holotype, male, "Dana" St. 3622-1, Cp length 7.0 mm. – A, lateral view of Cp. – B, scaphocerite. – C, Up.

P I 1.0 times as long as Cp, with merus 3.1, carpus 1.8, and propodus 3.1 times as long as ischium; subdivision of propodus uncertain. P II 1.5 times as long as Cp, with merus 2.4, carpus 2.1, propodus 2.4, and dactyl 0.1 times as long as ischium; subdivision of propodus uncertain. P III 1.7 times as long as Cp, with merus 2.9, carpus 2.5, propodus 2.7, and dactyl 0.2 times as long as ischium; subdivision of propodus uncertain. P IV 1.2 times as long as Cp, with merus 1.6, carpus 1.0, and propodus 1.1 times as long as ischium. P V 0.6 times as long as Cp, with merus 1.4, carpus 0.9, and propodus 0.8 times as long as ischium.

Somite VIII with arthrobranch 0.11 times as long as Cp and 2.3 times as long as epipod. Somite IX with anterior pleurobranch 0.17 times as long as Cp and 3.4 times as long as posterior pleurobranch. Somite X with anterior pleurobranch 0.24 times as long as Cp and 4.2 times as long as posterior pleurobranch. Somite XI with anterior pleurobranch 0.25 times as long as Cp and 3.6 times as long as

0-2 serrated bristles and few setae on dorsal surface and few setae on ventral surface (Fig. 63C). A II peduncle 0.4 times as long as scaphocerite; latter with strong distal tooth overreaching blade (Fig. 62B), 3.9 times as long as wide, 0.91 times as long as A I peduncle.

Md palp 0.36 times as long as Cp, with proximal segment 2.0 times as long as distal one. Mx I with palp 2.0 times as long as wide and 0.07 times as long as Cp; endopod 1.7 times as long as wide and 1.5 times as long as palp; endite 1.6 times as long as wide and 0.9 times as long as palp. Mx II with exopod 3.3 times as long as wide and 0.33 times as long as Cp; palp 3.7 times as long as wide and 0.14 times as long as Cp; endopod 1.4 times as long as wide and 0.7 times as long as palp; endites subequal, 1.3 times as long as wide and 0.2 times as long as palp.

Mxp I with exopod 3.0 times as long as wide and 0.17 times as long as Cp; endopod 1.5 times as long as exopod, segments 2 and 3 1.0 and 1.3 times as long as segment 1, respectively. Mxp II 0.9 times as long as Cp, with merus 1.0, carpus and propodus 0.9, and dactyl 0.5 times as long as ischium. Mxp III 1.4 times as long as Cp, with merus 0.8, carpus 0.8, propodus 0.7, and dactyl 0.6 times as long as ischium; subdivision of propodus and dactyl uncertain.

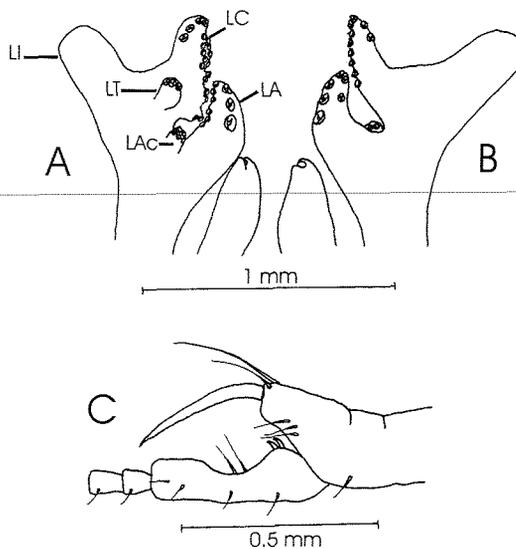


Fig. 63. *Sergia scintillans*, holotype, male, "Dana" St. 3622-1, Cp length 7.0 mm. – A, oral view of petasma. – B, caudal view of petasma. – C, male outer A I flagellum.

posterior pleurobranch. Somite XII with anterior pleurobranch 0.26 times as long as Cp and 2.1 times as long as posterior pleurobranch. Somite XIII with anterior pleurobranch 0.21 times as long as Cp and 1.7 times as long as posterior pleurobranch.

Pl I with basipod 0.33 times as long as Cp and exopod 2.0 times as long as basipod. Pl II with basipod 0.33 times as long as Cp; exopod 2.3 and endopod 1.3 times as long as basipod, respectively. Pl III with basipod 0.34 times as long as Cp; exopod 2.1 and endopod 1.1 times as long as basipod, respectively. Pl IV with basipod 0.33 times as long as Cp; exopod 1.9 and endopod 1.1 times as long as basipod, respectively. Pl V with basipod 0.30 times as long as Cp; exopod 1.9 and endopod 1.0 times as long as basipod, respectively.

Up with exopod 5.3 times as long as wide, 6.5 times as long as basipod and 0.8 times as long as Cp; endopod 4.3 times as long as wide and 0.8 times as long as exopod (Fig. 62C).

Petasma (Fig. 63A-B). LI 1.5 times as long as wide. LT reduced, as papilla at base of LC, not reaching end of LI and LC, 1.5 times as long as wide, 0.3 times as long as LI, armed with few terminal hooks. LC reaching end of LI, 2.0 times as long as wide and 0.9 times as long as LI, armed with numerous hooks along distal margin. LAc 1.4 times as long as wide and 0.2 times as long as PV, armed with few distal hooks. LA 1.8 times as long as wide and 0.7 times as long as LI, armed with row of smaller hooks along medial margin and several stronger hooks on distolateral side.

Photophores. Cp: 5-7 and 8-14 organs in upper and lower rows, respectively. Scaphocerite: 7 organs medial to inner strip of muscle from 0.2 to 0.9 blade length. Up exopod: 2 proximal to suture and medial to inner strips of muscle at 0.4-0.5 exopod length, and 1 organ distal to apical muscle strip, at 0.7 exopod length. Up endopod: 2 organs near base.

Other body photophores, all ventral, found on the following somites (al = anterolateral, l = lateral, m = medial): II (1m), III (4l), labrum (1m+2l), IV (2m+2l), V (2m+2l), VI (2l), VII (2m+2l), VIII (1m+2l), IX (3m), X (3m), XI (3m), XII (3m), XIII (3m+2l), XIV (8m (male)/6m (female)+2l), XV (6m+2l), XVI (6m+2l), XVII (6m+2l), XVIII (4m+2l), XIX (4m+2l), XX (5m+2al). Total (with those in Cp rows): 117-135.

Other photophores found on the following

appendages (d = distal, m = medial, p = proximal, Roman numerals indicate segments): eyestalk (1p+1d), A I (peduncle III - 1d), A II (peduncle V - 1p), Md (proper - 1d, palp I - 1d), Mx II (Exp - 2p), Mxp I (II - 1d, III - 1d), Mxp II (III - 1d, IV - 1p, V - 1p+1d, VI - 1d), Mxp III (III - 1m+1d, IV - 1d, V - 1d, VI - 1d.), P I (IV - 1p+1d, V - 1d), P II (III - 1p+1d, IV - 1d, V - 1d), P III (III - 1p+1d, IV - 1d, V - 1d), P IV (III - 1p+1d, IV - 1d, V - 1d), P V (III - 1d), Pl I - Pl V (I - 1p). Total (with those on scaphocerite and Up): 108.

Thus, the total number of observed photophores in all observed specimens ranges from 225 to 243 organs.

Remarks: The extraordinary form of the petasma (PV absent and LI enormous) as well as the very characteristic number of photophores on the scaphocerite and Up exopod make this common species easily identifiable, and no junior synonyms appeared since Burkenroad's (1940) description. The "Dana" specimens agree with the original description, varying in the form of the rostrum, petasma, and number of photophores in Cp rows. *Sergia scintillans* links *S. prehensilis* and the other lens-bearing species: the number of photophores remains greatly high and variable on Cp; yet, *S. scintillans* has many fewer photophores (1.3-1.6 times) than *S. prehensilis*, and their position becomes less variable on Cp and fixed on Up exopod. Kensley (1971) found in *S. scintillans* a PV in the form of a small protrusion near base of LA; my examination of the "Dana" specimens revealed the existence of proper (although not always conspicuous) hooks on these protrusions; this fact as well as the position of the rudimentary organ suggests that the structure is rather the LAc.

Sergia scintillans is close to *S. prehensilis* (see affinities and differences in remarks to *S. prehensilis*).

Geographical distribution (Fig. 64): Atlantic, Indian, and Pacific Oceans.

Atlantic: Southeastern part, south of 15°S ("Dana"), off South Africa ("Dana"; Kensley 1971).

Indian Ocean: Western Equatorial part, off Comores and Madagascar ("Dana"), off South Africa ("Dana"; Kensley 1971).

Central and Southwestern Pacific Ocean: off Australia ("Dana"), off Hawaii (Walters 1976), over

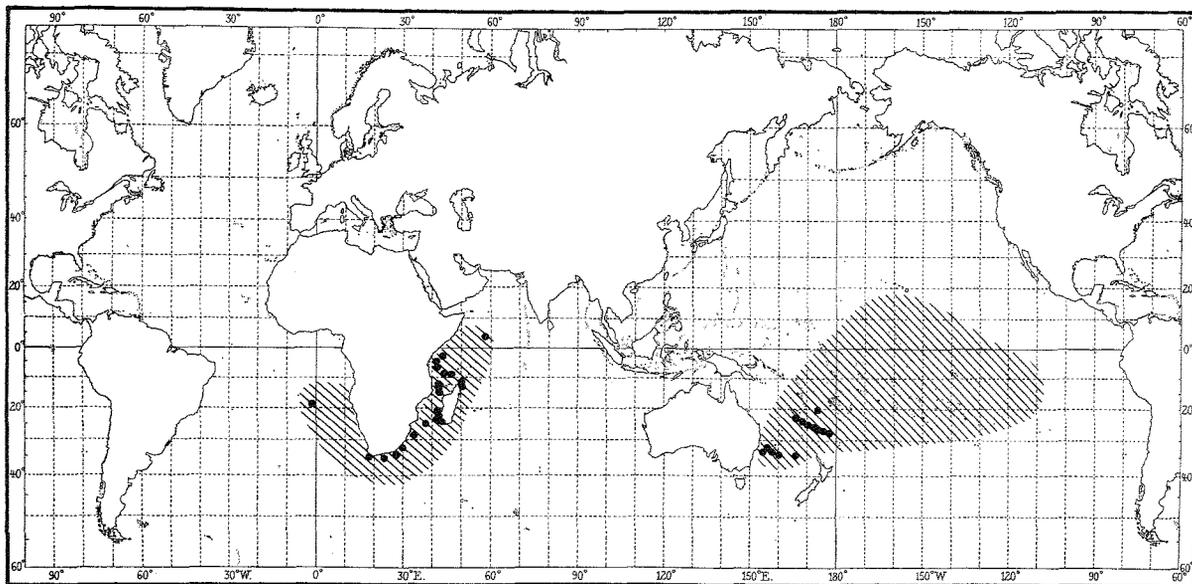


Fig. 64. Probable geographical distribution of *Sergia scintillans*. Small circles and hatching indicate "Dana" stations. Shaded areas without symbols are supported by literature data.

Nazca and Sala-y-Gomez Ridges (Vereshchaka 1990b).

Sergia scintillans occurs in at least two isolated areas; a few samples were taken within a rather vast pelagic area, while the richest samples were taken near the shore, over the continental slope, or over the. Thus, this species is benthopelagic (Vereshchaka 1995a) rather than pelagic. The hatched area in the Central Pacific indicates that there may be independent populations near islands or over seamounts within the triangle Hawaii - Nazca and Sala-y-Gomez Ridges - Australia, where it may also extend into the pelagic zone. *S. scintillans* and its sister species, *S. prehensilis*, are sympatric.

Vertical range: Probably a benthopelagic species, migrating daily between the upper continental slope-contact zone (Vereshchaka 1995a) and the epipelagic zone. "Dana" specimens were taken within the depth range 20-1700 m. Most specimen occur at 30-200 m at night and at 700-1000 m during the day. This species is much less numerous during the day samples, which may indicate aggregations within a narrow near-bottom layer, which is usually not sampled.

Sergia challengerii species group

Diagnosis: Lens-bearing photophores (total of 193-209 organs) present: 4-6 on scaphocerite, 2-3 on Up exopod, 4-6 in single lateral Cp row; hepatic spine prominent; postdorsal spine on VI abdominal somite present; clasping organ, if not rudimentary, with 8-12 serrated bristles; ocular papilla absent; endopod of Mxp I with 3 segments; posterior branchial lobe above P III reduced but not lamellar; petasma with LT usually bilobed and LA rudimentary.

Species included: *Sergia challengerii* (Hansen, 1903), *S. fulgens* (Hansen, 1919), *S. hansjacobi* Vereshchaka, 1994, *S. jeppeseni* n. sp., *S. oksanae* n. sp., *S. stellata* (Burkenroad, 1940), *S. talismani* (Barnard, 1946), *S. umitakae* Hashizume & Omori, 1995.

Key to species of the *Sergia challengerii* species group

1. Scaphocerite with 5-6 photophores, Up exopod with 3 photophores (2 medial and 1 distal). Tubercle of segment 3 in male outer A I flagellum rudimentary and overlapped by single terminal seta. PV of petasma not curved conspicuously at tip in lateral direc-

- tion; LI very voluminous, semicircular or circular 2
- Scaphocerite with 4 photophores, Up exopod with 2 photophores (1 medial and 1 distal). Tubercle of segment 3 in male outer A I flagellum, if present, not rudimentary and not overlapped by terminal setae. PV of petasma curved conspicuously at tip in lateral direction; LI not very voluminous, not semicircular or circular 3
2. Rostrum usually unidentate. Scaphocerite with 5 photophores, Up endopod with 1 basal photophore. Male outer A I flagellum with segment 3 bearing tubercle not reaching end of segment 4 of flagellum and with segment 4 bearing 12-13 serrated bristles on dorsal side. LI of petasma semicircular, LA not overlapping LAc *Sergia hansjacobi*
- Rostrum bidentate. Scaphocerite with 6 photophores, Up endopod with 2 basal photophores. Male outer A I flagellum with segment 3 bearing tubercle reaching end of segment 4 of flagellum and with segment 4 bearing 8 serrated bristles on dorsal side. LI of petasma circular, LA overlapping LAc ...
.....*Sergia jeppeseni* n. sp.
3. Male A I either with peduncle bearing distoventral process and 1-2 very strong, stout setae on terminal segment, with clasping organ rudimentary; tubercle on segment 3 of male outer A I flagellum not overlapping segment 4 of flagellum. LI of petasma not strongly curved at about 1/2 length, tip not directed laterally, LT bilobed 4
- Male A I with peduncle not bearing distoventral process or strong, stout setae on terminal segment, with well developed clasping organ; tubercle on segment 3 of male outer A I flagellum overlapping segment 4 of flagellum. LI of petasma strongly curved at about 1/2 length, tip directed laterally, LT not bilobed *Sergia umitakae*
4. Hepatic spine acute. Male A I with 3rd peduncular segment bearing 0-1 very strong, distoventral stout setae; male outer A I flagellum with segment 3, if bearing tubercle, not reaching end of segment 4 of flagellum and with segment 4, if armed, with 11-12 serrated bristles. LI of petasma well developed, LC overlapping other lobes and processes, LA overlapping LAc 5
- Hepatic spine blunt. Male A I with 3rd peduncular segment bearing 2 very strong, distoventral stout setae; male outer A I flagellum with segment 3 bearing tubercle reaching end of segment 4 of flagellum and with segment 4 armed with 8-9 serrated bristles. LI of petasma rudimentary, as small tubercle; LC not overlapping other lobes and processes, LA not overlapping LAc *Sergia stellata*, n. comb.
5. Male A I with peduncle bearing very strong, distoventral stout seta on terminal segment and with clasping organ well developed; male outer A I flagellum with segment 3 bearing well-developed tubercle and segment 4 armed with serrated bristles setae on dorsal side 6
- Male A I with peduncle lacking very strong, distoventral stout seta on terminal segment and with clasping organ rudimentary; male outer A I flagellum with segment 3 lacking tubercle and segment 4 not armed with serrated bristles on dorsal side 7
6. Lateral Cp row with 4 photophores. Process on terminal segment of male A I subtriangular, not bidentate. Distal tooth on scaphocerite not overlapping blade.....
..... *Sergia challengerii*, n. comb.
- Lateral Cp row with 5 photophores. Process on terminal segment of male A I peduncle elongated, bidentate. Distal tooth on scaphocerite overlapping blade *Sergia fulgens*
7. Lateral Cp row with 6 photophores. Terminal segment of male A I peduncle without distoventral process. LI of petasma with tip directed ventrolaterally, LT not greatly overlapping PV considerably.....
..... *Sergia talismani*
- Lateral Cp row with 5 photophores. Terminal segment of male A I peduncle with very long and narrow distoventral process. LI of petasma with tip directed distolaterally, LT considerably overlapping PV *Sergia oksanae* n. sp.

Like the two former species, all known species of this group are much more abundant above the continental shelves and slopes or seamounts than over the deep sea, indicating a benthopelagic mode of life (Vereshchaka 1995a); the species are scarce in the day samples, suggesting that they aggregate in a

Table 7. Affinities and differences between species of the *Sergia challengerii* species group. a = acute, b = blunt, d = divided, ph = photophore(s), r = rudimentary, Sc = scaphocerite, ss = subsegments, u = undivided, w = well developed, + = present, - = absent.

Characters	<i>S. challengerii</i>	<i>S. fulgens</i>	<i>S. hansjacobi</i>	<i>S. jeppesenii</i> n. sp.	<i>S. oksanae</i> n. sp.	<i>S. stellata</i>	<i>S. talismani</i>	<i>S. umitakae</i>
Additional tooth on rostrum	-	-	-	+	-	-	-	1-2
Hepatic spine	a	a	b	b	a	b	a	b
Length of distoventral process on male A I flagellum	short	d, long	-	-	long	short	-	-
Clasping organ	w	w	w	w	r	w	r	w
Tubercle overlapping segment 4 of flagellum	-	-	-	+	-	+	-	+
No of stout setae on segment 3 of A I flagellum	1	1	0	0	0	2	0	0
No of serrated bristles in clasping organ	11-12	11-12	12-13	8	0	8-9	0	8
Distal tooth of Sc overreaching blade	-	+	-	-	+	-	+	-
PV of petasma curved	+	+	-	-	+	+	+	+
LI strongly curved	-	-	+	+	-	r	-	+
LT of petasma	d	d	d	d	d	d	d	u
LT much overlapping PV	-	-	+	+	+	+	-	-
LC overlapping other lobes and processes	+	+	-	-	+	-	+	-
LA overlapping LAc	+	+	-	+	+	-	+	+
No of ph in lateral Cp row	4	5	5-6	6	5	4	6	4-5
No of ph on Sc	4	4	5	6	4	4	4	4
No of medial ph on Up exopod	1	1	2	2	1	1	1	1
No of distal ph on Up exopod	1	1	1	1	1	1	1	1
No of ph on Up endopod	1	1	1	2	1	1	1	1

very narrow near-bottom layer, which is usually not sampled. The hatched areas in the distribution maps indicate that the specimens may occur offshore throughout the region shown.

***Sergia challengerii* (Hansen, 1903), n. comb.**

Figs. 65-67, Pl. 5A

Sergestes challengerii Hansen, 1903: 61, pl. XII, fig. 2a-n. - Kemp 1910b: 640, pl. 53, figs. 2-5; 1913, pl. 7, fig. 1; 1919: 13, pl. 1, fig. 4a-k. - Illig 1927: 197, figs. 34-40.

Sergestes (Sergia) challengerii. - Yaldwyn 1957: 9.

Material examined: "Dana" stations: 3567-1 (1m 8¹/₂); 3585-2 (1f 6¹/₂); 3585-3 (1m 7); 3677-2 (1m 5¹/₂); 3680-1 (2f 8-9); 3680-4 (12f 4¹/₂-8 & 9m 4-7); 3680-6 (2f 8-9); 3684-2 (1f 7¹/₂); 3684-8 (18f 4¹/₂-8 & 17m 5¹/₂-7¹/₂); 3689-7 (1f 8); 3731-14 (1f 5¹/₂); 3736-3 (1f 6¹/₂ & 1m 8¹/₂); 3736-5 (1f 6¹/₂); 3737-2 (1f 5 & 1m 4¹/₂); 3744-4 (15f 4-6 & 5m 4¹/₂-6); 3751-2 (3f 5-6); 3752-1 (1m 8¹/₂); 3752-3 (2f 4-6¹/₂); 3753-3 (5f 6-7¹/₂); 3764-2 (3f 5-6 & 3m 6¹/₂-

7); 3768-3 (1m 8¹/₂); 3768-6 (10f 6-9 & 4m 5¹/₂-7); 3768-14 (1m 6); 3773-2 (5f 5-6 & 1m 5¹/₂); 3773-3 (7f 4¹/₂-6¹/₂ & 3m 5¹/₂); 3788-2 (1f 6¹/₂ & 2m 6); 3789-2 (1m 6); 3792-2 (4f 5 & 5m 3¹/₂-7); 3793-1 (1m 6); 3793-2 (1m 5); 3793-3 (2m 5-5¹/₂); 3793-4 (1m 6¹/₂); 3796-1 (1m 6); 3804-2 (1f 5 & 1m 6¹/₂); 3804-3 (9f 5¹/₂-7); 3805b (2f 6¹/₂ & 3m 5¹/₂-6¹/₂); 3812-3 (4f 4-8 & 1m 5¹/₂); 3840-5 (1m 6); 3874-2 (1m 7); 3874-4 (1f 7¹/₂).

"Galathea" stations: 441 (1f 12¹/₂); 448 (1f 8); 456 (2f 7-8); 464 (1f 7).

Holotype of *Sergestes challengerii* (BMNH 1903.6.6.14).

Type locality: Western Pacific off Matuku, Fiji Islands, 19°9'35" S, 179°41'50" E.

Type material: Holotype of *Sergestes challengerii* (NHM, see above, examined).

Diagnosis: Integument firm; rostrum acute and unidentate; cornea well pigmented, black, considerably wider than eyestalk; terminal segment of male A I peduncle bearing single strong stout seta and

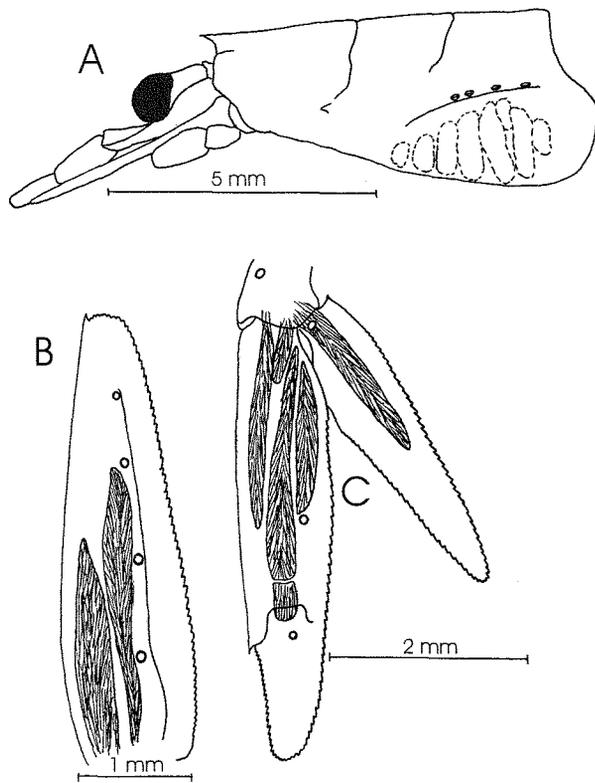


Fig. 65. *Sergia challengerii*, male, "Dana" St. 3684-8, Cp length 6.5 mm. - A, lateral view of Cp. - B, scaphocerite. - C, Up.

triangular unidentate process near distoventral end; A I flagellum in male with segment 3 bearing well developed tubercle not reaching end of segment 4 of flagellum and segment 4 bearing 11-12 serrated bristles on dorsal surface; scaphocerite with distal tooth reaching end of blade; PV of petasma curved laterally at tip; LI well developed, not strongly curved, with tip directed distolaterally; LT bilobed, not overlapping PV considerably; LC overlapping other lobes and processes; LA overlapping LAC; photophores arranged in lateral row of 4 on Cp, row of 4 on scaphocerite, 1 medial photophore and 1 distal photophore on Up exopod, 1 basal photophore on Up endopod.

Description: Cp 1.9 times as long as high and 0.34 times as long as abdomen; hepatic spine acute (Fig. 65A). Abdomen with somite VI 1.7 times as long as high and 1.4 times as long as telson; telson 3.8 times as long as wide.

Cornea well pigmented, black, 1.4 times as long as wide, 1.1 times as long and 1.5 times as wide as eyestalk. A I peduncle 0.8 times as long as Cp, with segments 2 and 3 0.50 and 0.56 times as long as

segment 1, respectively; terminal segment of A I peduncle with single very strong stout seta and prominent triangular process on distoventral side (Fig. 66C); outer A I flagellum in male with segment 3 bearing tubercle not reaching end of segment 4 of flagellum and with segment 4 subdivided and bearing 11-12 serrated bristles on dorsal surface and several setae on ventral surface (Fig. 66D). A II peduncle 0.4 times as long as scaphocerite; latter with strong distal tooth reaching end of blade (Fig. 65B), 3.5 times as long as wide, 0.83 times as long as A I peduncle.

Md palp 0.36 times as long as Cp, with proximal segment 2.1 times as long as distal one. Mx I with palp 2.0 times as long as wide and 0.08 times as long as Cp; endopod 1.6 times as long as wide and 1.2 times as long as palp; endite 1.4 times as long as wide and 0.7 times as long as palp. Mx II with exopod 3.2 times as long as wide and 0.31 times as long as Cp; palp 3.6 times as long as wide and 0.13 times as long as Cp; endopod 1.4 times as long as wide and 0.7 times as long as palp; endites subequal, 1.7 times as long as wide and 0.3 times as long as palp.

Mxp I with exopod 2.4 times as long as wide and 0.16 times as long as Cp; endopod 1.7 times as long as exopod; segments 2 and 3 1.1 and 1.9 times as long as segment 1, respectively. Mxp II 0.8 times as long as Cp, with merus 1.0, carpus and propodus 0.9, and dactyl 0.4 times as long as ischium. Mxp III 1.4 times as long as Cp, with merus 0.8, carpus, propodus and dactyl 0.7 times as long as ischium; subdivision of propodus and dactyl uncertain.

P I 1.0 times as long as Cp, with merus 2.8, carpus 1.5, and propodus 2.8 times as long as ischium, subdivision of propodus uncertain. P II 1.5 times as long as Cp, with merus 2.8, carpus 2.3, propodus 2.8, and dactyl 0.2 times as long as ischium; subdivision of propodus uncertain. P III 1.8 times as long as Cp, with merus 2.9, carpus 2.3, propodus 2.6, and dactyl 0.2 times as long as ischium; subdivision of propodus uncertain. P IV 1.1 times as long as Cp, with merus 1.5, carpus 0.9, and propodus 1.0 times as long as ischium. P V 0.6 times as long as Cp, with merus 1.1, carpus 0.8, and propodus 0.6 times as long as ischium.

Somite VIII with arthrobranch 0.10 times as long as Cp and 2.3 times as long as epipod. Somite IX with anterior pleurobranch 0.17 times as long as Cp and 4.0 times as long as posterior pleurobranch. Somite X with anterior pleurobranch 0.24 times as

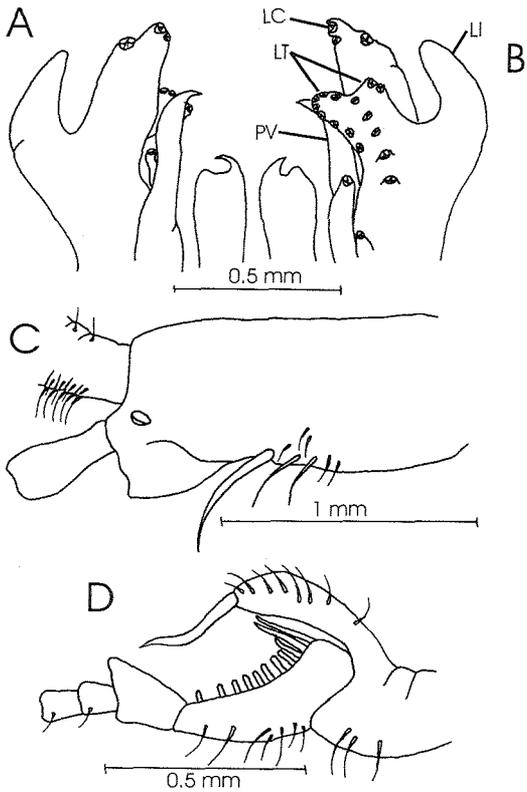


Fig. 66. *Sergia challengerii*, male, "Dana" St. 3684-8, Cp length 6.5 mm. - A, caudal view of petasma. - B, oral view of petasma. - C, terminal segment of male A I. - D, male outer A I flagellum.

long as Cp and 4.9 times as long as posterior pleurobranch. Somite XI with anterior pleurobranch 0.26 times as long as Cp and 5.3 times as long as posterior pleurobranch. Somite XII with anterior pleurobranch 0.26 times as long as Cp and 2.5 times as long as posterior pleurobranch. Somite XIII with anterior pleurobranch 0.20 times as long as Cp and 1.5 times as long as posterior pleurobranch.

Pl I with basipod 0.31 times as long as Cp and exopod 2.0 times as long as basipod. Pl II with basipod 0.31 times as long as Cp; exopod 2.2 and endopod 1.4 times as long as basipod, respectively. Pl III with basipod 0.31 times as long as Cp; exopod 2.1 and endopod 1.3 times as long as basipod, respectively. Pl IV with basipod 0.30 times as long as Cp; exopod 1.9 and endopod 1.2 times as long as basipod, respectively. Pl V with basipod 0.26 times as long as Cp; exopod 1.7 and endopod 1.0 times as long as basipod, respectively.

Up with exopod 5.0 times as long as wide, 6.0 times as long as basipod and 0.8 times as long as

Cp; endopod 4.1 times as long as wide and 0.7 times as long as exopod (Fig. 65C).

Petasma (Fig. 66A-B, Pl. 5A). PV tapering into sharp point, reaching end of LT, 4.5 times as long as wide, tip curved and directed laterally. LI overlapping LT, 1.7 times as long as wide and 0.6 times as long as PV, directed distolaterally. LT thick, bilobed at end, 1.6 times as long as wide, 0.6 times as long as PV, armed with 2 rows of hooks, along dorsal margin and on distolateral side, and with few apical hooks on each of terminal lobules. LC 2.3 times as long as wide and 0.9 times as long as PV, armed with few apical hooks. LAc small, 1.5 as long as wide and 0.2 times as long as PV, armed with single apical hook. LA straight and slender, 3.5 times as long as wide and 0.5 times as long as PV, armed with single apical hook.

Photophores. Cp: 4 in lateral row. Scaphocerite: 4 organs medial to inner strip of muscle from 0.2-0.3 to 0.8-0.9 blade length. Up exopod: 1 organ at middle near tip of inner muscle strip, at 0.4-0.5 exopod length, and 1 distal organ near end of apical muscle strip, at 0.7-0.8 exopod length. Up endopod: 1 organ near base.

Other body photophores, all ventral, found on the following somites (al = anterolateral, l = lateral, m = medial, pm = posteromedial): II (1m), III (4l), labrum (1m+2l), IV (2m+2l), V (2m+2l), VI (2l), VII (2m+2l) VIII (1m+2l), IX (3m), X (3m), XI (3m), XII (3m), XIII (3m+2al), XIV (4pm+2al), XV (6m+2l); XVI (6m+2l), XVII (4m+2l), XVIII (4m+2l), XIX (4m+2l), XX (5m+2al). Total (with those in Cp rows): 97.

Other photophores found on the following appendages (d = distal, p = proximal, Roman numerals indicate segments): eyestalk (1p+1d) A I (peduncle III - 1d), A II (peduncle I - 1p), Md (proper - 1d, palp I - 1d), Mx II (Exp - 1p), Mxp I (II - 1d, III - 1d), Mxp II (II - 1d, III - 1d, IV - 1p, V - 1d, VI - 1d), Mxp III (II - 1d, III - 1d, IV - 1d, V - 1d, VI - 1d), P I (IV - 1p+1d, V - 1d), P II (III - 1p+1d, IV - 1d, V - 1d), P III (III - 1p+1d, IV - 1d, V - 1d), P IV (III - 1p+1d, IV - 1d), P V (II - 0 (male)/1 (female), III - 1d, IV - 1d), Pl I - Pl V (I - 1p). Total (with those on scaphocerite and Up): 96 in male or 98 in female.

Thus, the total number of observed photophores in all examined specimens ranges from 193 in males to 195 in females.

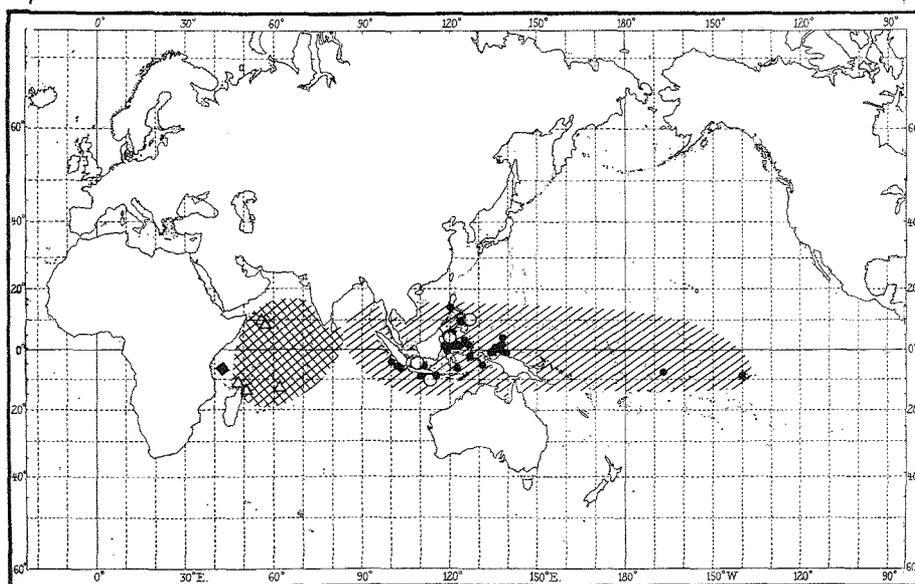


Fig. 67. Probable geographical distribution of *Sergia challengerii* (circles, hatching), *S. jeppeseni* n. sp. (diamond, cross hatching), and *S. umitakae* (triangles, cross hatching). Black symbols indicate "Dana" stations, white circles "Galathea" stations and white triangles "Vityaz" stations. Shaded areas without symbols are supported by literature data.

Remarks: The "Dana" specimens vary in minor proportions of the appendages, development of the branches, relative size of the cornea, number of serrated bristles in the clasping organ (11-12), fine shape of the distoventral process of A I male peduncle (which may be more or less prominent), curvature of LI, and degree of depression in the apical part of LT. The photophore pattern agrees with Hansen's original descriptions (1903), although number of organs exceeds that reported by him, finding a total of 117 photophores in male, while "Dana" specimens have 193 organs. This difference is probably accounted for by the extreme difficulty in observing these organs in specimens preserved in alcohol for a long period: Hansen (1903) described "Challenger" specimen that had already been kept for several decades.

This species is closest to *S. fulgens*, *S. talismani*, *S. oksanae* n. sp., and *S. stellata* in the shape of petasma. In most of these species, a distoventral process or setae on the terminal segment of male A I flagellum is present. These organs are lost in *S. talismani* and, partially, in *S. oksanae*. This loss is merely secondary and related to the reduction of clasping function of male A I; the petasma of these species is almost identical to that of *S. challengerii* and *S. fulgens*, which gives a final argument for their very close relationship. Other affinities and differences between *S. challengerii* and all other known species of the species group are shown in Table 7.

Geographical distribution (Fig. 67): Indian and Pacific Oceans.

Indo-West Pacific: ("Dana" and "Galathea"; Hansen 1919), Bay of Bengal and off Sri Lanka (Illig 1927).

Central Equatorial Pacific: ("Dana" and "Galathea"), off Fiji Islands (Hansen 1919).

The occurrence of *S. challengerii* is like that of the whole group (see remarks to the species group). *S. challengerii* and *S. umitakae* are parapatric, the former occurring in the Eastern Indian Ocean and in the Western and Central Pacific, the latter in the Western and Central Indian Ocean. *S. challengerii* is sympatric with *S. fulgens*, *S. talismani*, *S. stellata* and *S. oksanae* n. sp. and allopatric to *S. hansjacobii* and *S. jeppeseni* n. sp.

Vertical range: A benthopelagic species, migrating daily between the lateral continental-slope contact zone (Vereshchaka 1995a) and the epi-/mesopelagic zone. "Dana" specimens were taken within the depth range 50-1700 m. Most specimens occur at 100-300 m at night and at about 700 m during the day.

Sergia fulgens (Hansen, 1919)

Figs. 68-70, Pl. 5B

Sergestes fulgens Hansen, 1919: 17, pl. 1, fig. 6a-g.
Sergestes (Sergia) fulgens. – Yaldwyn 1957: 9.

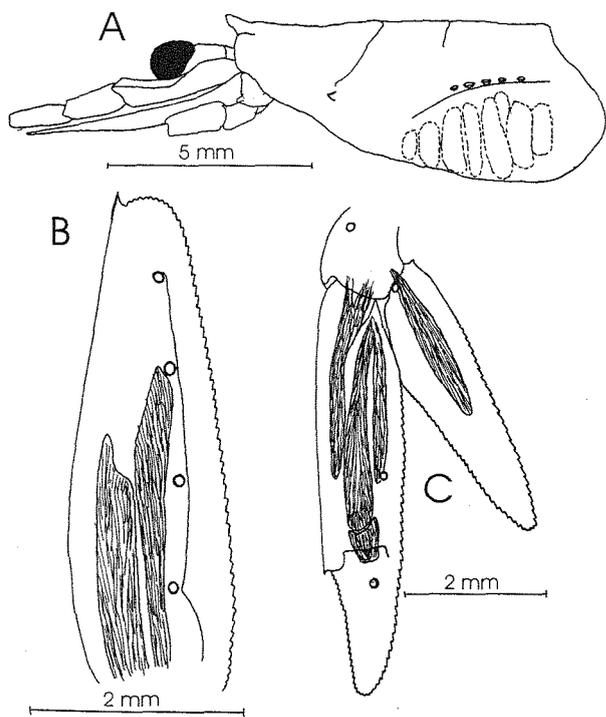


Fig. 68. *Sergia fulgens*, male, "Dana" St. 3733-1, Cp length 8.2 mm. - A, lateral view of Cp. - B, scaphocerite. - C, Up.

Sergia fulgens. - Walters 1976: 816. - Krygier & Wasmer 1988: 50.

Material examined (? = identification is uncertain): "Dana" stations: 3733-1 (16f 8¹/₂-13 & 9m 7-10); 3733-2 (11f 5-10¹/₂ & 6m 5¹/₂-9); 3773-1 (10f 5-7¹/₂ & 2m 5-6¹/₂); ? 3800-2 (43f 4-6¹/₂ & 20m 4-5¹/₂); 3809-2 (27f 5-9¹/₂ & 18m 4¹/₂-7); 3809-3 (2f 5-7 & 3m 5-7); 3809-4 (4f 5-8 & 2m 5¹/₂); 3860-20 (1m 6¹/₂); 3873-1 (4f 6¹/₂-7¹/₂); 3873-2 (1f 7¹/₂ & 2m 6¹/₂); 3874-1 (1f 7¹/₂ & 3m 6¹/₂-7); 3876-1 (3f 7-7¹/₂ & 5m 7-7¹/₂); 3880-3 (1f 5¹/₂ & 1m 6); 3881-3 (32f 4¹/₂-9 & 11m 4¹/₂-7 & 56j 3¹/₂-4); 3882-1 (4f 4¹/₂-7 & 2m 5¹/₂-6); 3882-4 (2f 4-7¹/₂ & 3m 5-5¹/₂); 3893-6 (1f 7); 3897-3 (1m 6); 3902-2 (4f 7-8); 3903-1 (2f 8¹/₂-9); 3904-5 (1m 6); 3913-4 (1m 7¹/₂); 3913-5 (1f 9); 3915-3 (4f 5¹/₂-6¹/₂ & 7m 5¹/₂-7); 3922-1 (2f 7-8).

"Galathea" stations: 436 (1m 10¹/₂ & 1j 5¹/₂); 443 (1m 10 & 1j 4¹/₂).

Type locality: Indonesia, north coast of Sumbawa, "Siboga" Exped. St. 312, 8°19'S, 117°41'E, 274 m.

Type material: Syntypes: "22 specimens, 16 of

which are adult males" (Hansen 1919: 17). Jars with *Sergia fulgens* are in MNHN, but type specimens are not indicated (pers. comm. Drs. Ho and A. Crosnier; types not examined).

Diagnosis: Integument firm; rostrum usually acute and unidentate; cornea well pigmented, black, considerably wider than eyestalk; terminal segment of male A I peduncle bearing single strong stout seta and long bifid process near distoventral end; A I flagellum in male with segment 3 bearing well developed tubercle not reaching end of segment 4 of flagellum and segment 4 bearing 11-12 serrated bristles on dorsal surface; scaphocerite with strong distal tooth overlapping blade; PV of petasma laterally curved at tip; LI well developed, not strongly curved, with tip directed distolaterally; LT bilobed, not greatly overlapping PV; LC overlapping other lobes and processes; LA overlapping LAc; photophores arranged in lateral row of 5 on Cp, row of 4 on scaphocerite, 1 medial and 1 distal organ on Up exopod, 1 basal organ on Up endopod.

Description: Cp 1.8 times as long as high and 0.32 times as long as abdomen, hepatic spine acute (Fig. 68A). Abdomen with somite VI 1.7 times as long as high and 1.5 times as long as telson; telson 3.9 times as long as wide.

Cornea well pigmented, black, 1.2 times as long as wide, 0.9 times as long and 1.6 times as wide as eyestalk. A I peduncle 0.7 times as long as Cp, with segments 2 and 3 0.56 and 0.53 times as long as segment 1, respectively; terminal segment of A I peduncle with single very strong curved stout seta and long prominent bifid process in distoventral side (Fig. 69C); outer A I flagellum in male with segment 3 bearing tubercle curved and not reaching end of segment 4 of flagellum and with segment 4 subdivided and bearing 11-12 serrated bristles on dorsal surface and several setae on ventral surface (Fig. 69D). A II peduncle 0.4 times as long as scaphocerite; latter with strong distal tooth overlapping blade (Fig. 68B), 3.3 times as long as wide, 0.83 times as long as A I peduncle.

Md palp 0.34 times as long as Cp, with proximal segment 2.2 times as long as distal one. Mx I with palp 1.7 times as long as wide and 0.06 times as long as Cp; endopod 1.5 times as long as wide and 1.5 times as long as palp; endite 1.7 times as long as wide and 1.1 times as long as palp. Mx II with exopod 3.2 times as long as wide and 0.34 times as long as Cp; palp 3.5 times as long as wide and 0.11

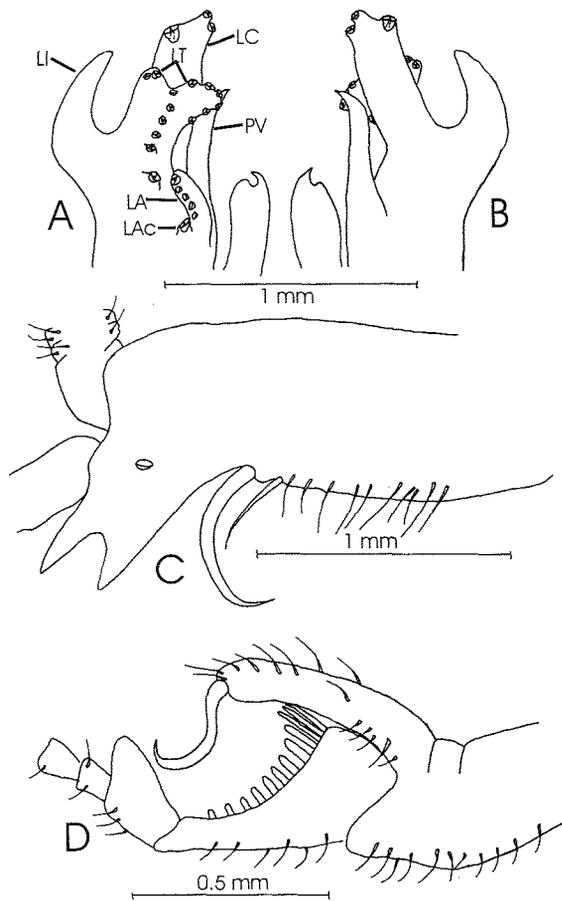


Fig. 69. *Sergia fulgens*, male, "Dana" St. 3733-1, Cp length 8.2 mm. - A, oral view of petasma. - B, caudal view of petasma. - C, terminal segment of male A I. - D, male outer A I flagellum.

times as long as Cp; endopod 1.4 times as long as wide and 0.8 times as long as palp; endites subequal, 1.4 times as long as wide and 0.4 times as long as palp.

Mxp I with exopod 2.6 times as long as wide and 0.18 times as long as Cp; endopod 1.5 times as long as exopod; segments 2 and 3 1.1 and 1.9 times as long as segment 1, respectively. Mxp II 0.9 times as long as Cp, with merus 0.8, carpus and propodus 0.9, and dactyl 0.4 times as long as ischium. Mxp III 1.3 times as long as Cp, with merus, carpus and propodus 0.8, and dactyl 0.7 times as long as ischium; subdivision of propodus and dactyl uncertain.

P I 1.0 times as long as Cp, with merus 2.9, carpus 1.7, and propodus 2.7 times as long as ischium; subdivision of propodus uncertain. P II 1.5 times as long as Cp, with merus 2.9, carpus 2.3, propodus 2.7, and dactyl 0.1 times as long as ischium; subdivision of propodus uncertain. P III 2.0 times as long as Cp, with merus 3.5, carpus 2.7, propodus 3.1,

and dactyl 0.2 times as long as ischium; subdivision of propodus uncertain. P IV 1.3 times as long as Cp, with merus 1.6, carpus 1.0, and propodus 1.1 times as long as ischium. P V 0.7 times as long as Cp, with merus 1.2, carpus 0.9, and propodus 0.8 times as long as ischium.

Somite VIII with arthrobranch 0.14 times as long as Cp and 2.9 times as long as epipod. Somite IX with anterior pleurobranch 0.21 times as long as Cp and 4.4 times as long as posterior pleurobranch. Somite X with anterior pleurobranch 0.25 times as long as Cp and 5.1 times as long as posterior pleurobranch. Somite XI with anterior pleurobranch 0.27 times as long as Cp and 6.4 times as long as posterior pleurobranch. Somite XII with anterior pleurobranch 0.29 times as long as Cp and 2.4 times as long as posterior pleurobranch. Somite XIII with anterior pleurobranch 0.23 times as long as Cp and 1.3 times as long as posterior pleurobranch.

Pl I with basipod 0.31 times as long as Cp and exopod 2.2 times as long as basipod. Pl II with basipod 0.30 times as long as Cp; exopod 2.2 and endopod 1.4 times as long as basipod, respectively. Pl III with basipod 0.31 times as long as Cp; exopod 2.1 and endopod 1.3 times as long as basipod, respectively. Pl IV with basipod 0.31 times as long as Cp; exopod 1.9 and endopod 1.2 times as long as basipod, respectively. Pl V with basipod 0.27 times as long as Cp; exopod 1.7 and endopod 1.0 times as long as basipod, respectively.

Up with exopod 5.0 times as long as wide, 5.5 times as long as basipod and 0.8 times as long as Cp; endopod 3.8 times as long as wide and 0.7 times as long as exopod (Fig. 68C).

Petasma (Fig. 69A-B, Pl. 5B). PV tapering into sharp point, almost reaching end of LT, 3.6 times as long as wide. LI slightly overlapping LT, 2.1 times as long as wide and 0.8 times as long as PV. LT thick, bilobed at end, 1.2 times as long as wide, 0.6 times as long as PV, armed with 2 rows of hooks, along dorsal margin and on distolateral side, and with few apical hooks on each of terminal lobules. LC 2.8 times as long as wide and 1.1 times as long as PV, armed with few apical hooks. LAc rudimentary, as tubercle armed with single hook at base of LA. LA slender, 3.7 times as long as wide and 0.5 times as long as PV, armed with row of hooks on mesiodorsal side.

Photophores. Cp: 5 in lateral row. Scaphocerite: 4 organs medial to inner strip of muscle from 0.2 to

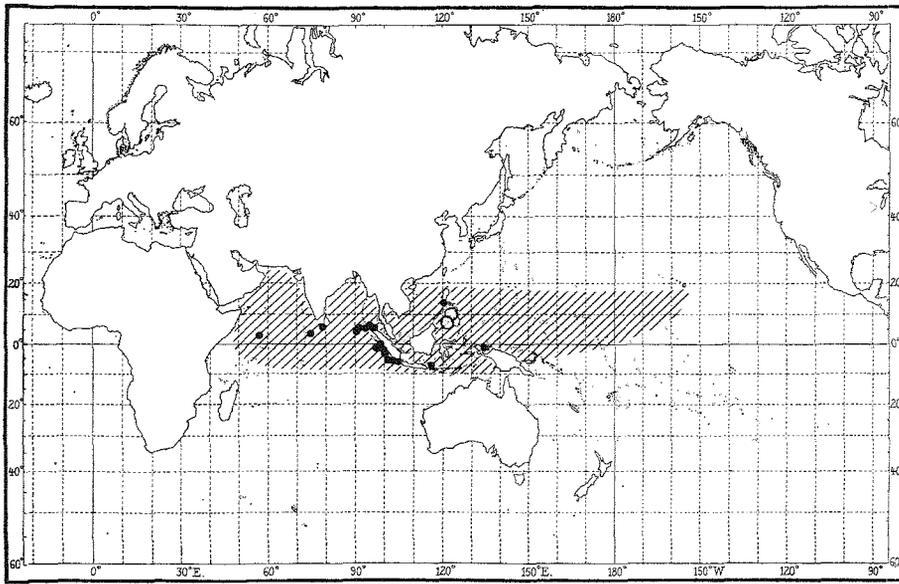


Fig. 70. Probable geographical distribution of *Sergia fulgens*. Black symbols indicate "Dana" stations, white symbols "Galathea" stations. Shaded areas without symbols are supported by literature data.

0.8-0.9 blade length. Up exopod: 1 organ at middle near tip of inner muscle strip, at 0.4-0.5 exopod length, and 1 distal organ near end of apical muscle strip, at 0.7-0.8 exopod length. Up endopod: 1 organ near base.

Other body photophores, all ventral, found on the following somites (al = anterolateral, l = lateral, m = medial, pl = posterolateral): II (1m), III (4l), labrum (1m+2l), IV (2m+2l), V (2m+2l), VI (2l), VII (2m+2l), VIII (1m+2l), IX (3m), X (3m), XI (3m), XII (3m), XIII (3m+2al), XIV (4al+2pl), XV (6m+2l); XVI (6m+2l), XVII (6m+2l), XVIII (4m+2l), XIX (4m+2l), XX (6m+2al). Total (with those in Cp rows): 102.

Other photophores found on the following appendages (d = distal, p = proximal, Roman numerals indicate segments): eyestalk (1p+1d) A I (peduncle III - 1d), A II (peduncle I - 1p), Md (proper - 1d, palp I - 1d), Mx II (Exp - 1p), Mxp I (II - 1p, III - 1d), Mxp II (II - 1d, III - 1d, IV - 1p, V - 1d, VI - 1d), Mxp III (III - 1d, IV - 1d, V - 1d, VI - 1d), P I (III - 1p, IV - 1p+1d, V - 1d), P II (III - 1p+1d, IV - 1d), P III (III - 1p+1d, IV - 1d, V - 1d), P IV (III - 1p+1d, IV - 1d), P V (III - 1 (male)/2 (female), IV - 1d), Pl I - Pl V (I - 1p). Total (with those on scaphocerite and Up): 94 in male or 96 in female.

Thus, the total number of observed photophores in all examined specimens ranges from 196 in males to 198 in females.

Remarks: "Dana" specimens of *S. fulgens* agree with Hansen's original description (1919), varying

only slightly in the form of the rostrum (which is sometimes blunt) and the distoventral process on male A I peduncle (which always remains bifid, but varies in the relative length of the distal lobules), in proportions and armature of LT (that is always bilobed) and LA. The number of photophores remains constant in adults, although in younger specimens there may be 4 instead of 5 organs in the lateral Cp row. *S. fulgens* is very similar to *S. challengeri* in the photophore adornment and exceeds the latter in total number by only 3 organs (1.5%) due to a greater number in the lateral Cp row and few minor differences in the arrangement of photophores on thoracic sternites and appendages.

Sergia fulgens is related to *S. challengeri*, *S. talismani*, *S. oksanae* n. sp. and *S. stellata* (see affinities and differences in remarks to *S. challengeri*). It differs from all other species of the species group in having an elongated bidentate distoventral process on the terminal segment of the male A I peduncle. Other differences and affinities between *S. fulgens* and all other species of the species group are shown in Table 7.

Geographical distribution (Fig. 70): Indian and Pacific Oceans.

Indian Ocean: Western part, off Sri Lanka ("Dana"), off Indonesian islands ("Dana"; Hansen 1919).

Pacific: Off the Philippines and New Guinea ("Dana" and "Galathea"), off Hawaii (Walters 1976).

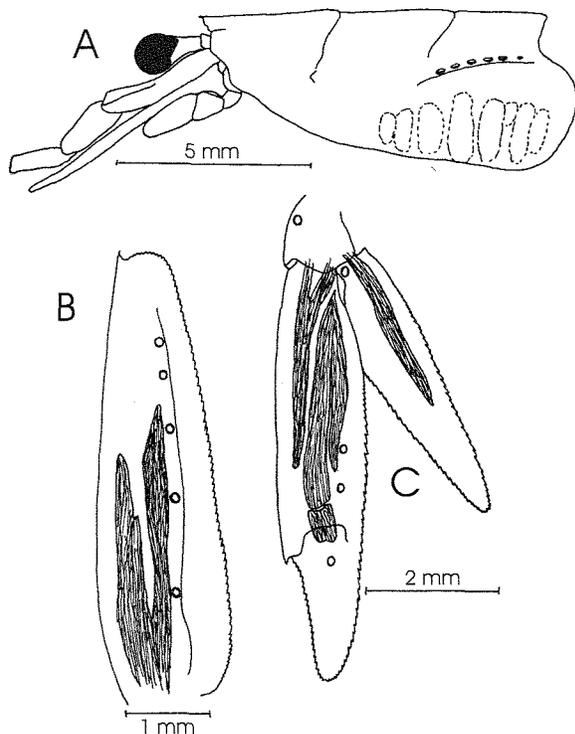


Fig. 71. *Sergia hansjacobi*, holotype, male, "Dana" St. 1198-2, Cp length 8.5 mm. – A, lateral view of Cp. – B, scaphocerite. – C, Up.

The occurrence of *S. fulgens* is like that of the whole group (see remarks to the species group). *S. fulgens* and *S. jeppeseni* are parapatric, the former occurring east of 50°E in the Indian and Pacific Oceans, the latter living west of 50°E in the Indian Ocean. *S. fulgens* is sympatric with *S. challengerii*, *S. talismani*, *S. stellata*, *S. umitakae* and *S. oksanae*, and allopatric to *S. hansjacobi* and *S. challengerii*.

Vertical range: A benthopelagic species, migrating daily between the lateral continental-slope contact zone (Vereshchaka 1995a) and the epi-/mesopelagic zone. "Dana" specimens were taken within the depth range 20-500 m. Most specimens occur at 100-300 m at night and at about 700 m during the day.

Sergia hansjacobi Vereshchaka, 1994

Figs. 71-73, Pl. 2C

Sergia hansjacobi Vereshchaka, 1994a: 91, fig. 23.

Material examined: "Dana" stations: 1174-1 (4m 8^{1/2}-10); 1189-1 (1f 9 & 1m 9); 1192-5 (1m 9);

1196-1 (4f 8-10); 1198-1 (5f 4^{1/2}-9^{1/2} & 8m 6^{1/2}-9^{1/2}); 1198-2 (13f 4^{1/2}-10 & 6m 6^{1/2}-10); 1198-3 (21f 5-9 & 16m 5-8); 1223-2 (1m 8); 1223-6 (1f 7^{1/2} & 1m 8^{1/2}); 1230-5 (1f 5^{1/2}); 1250-1 (5m 9-10); 1250-2 (7f 4^{1/2}-8^{1/2}); 1250-3 (1m 8); 1253-1 (4f 5-9^{1/2} & 11m 6^{1/2}-9^{1/2}); 1256-1 (4f 7-10 & 5m 6^{1/2}-9^{1/2}); 1256-2 (4f 6^{1/2}-9 & 1m 7^{1/2}); 1256-3 (2m 7-8); 1256-4 (1m 8); 1257-1 (1f 9^{1/2}); 1260-2 (2f 5-6^{1/2}); 1260-3 (5f 5-6 & 1m 6^{1/2}); 1261-3 (1f 6); 1261-4 (8f 3-4^{1/2} & 4m 4^{1/2}-8); 1266-1 (1f 8 & 3m 7^{1/2}-9^{1/2}); 1266-2 (1m 8^{1/2}); 1268-1 (2f 9-10); 1269-5 (1f 8); 1270-1 (2f 6-10^{1/2} & 2m 9); 1270-7 (2f 7-7^{1/2}); 1272-1 (2f 8); 1273-1 (1f 7 & 1m 6^{1/2}); 1273-11 (1m 7); 1274-1 (3f 8-9 & 5m 7-8^{1/2}); 1276-1 (10f 6-11 & 6m 7-8^{1/2}); 1278-1 (15f 7-10 & 10m 7-9^{1/2}); 1278-2 (4f 7-9^{1/2} & 2m 8^{1/2}-9 & 9j 3-4^{1/2}); 1278-3 (1f 3^{1/2} & 1m 6^{1/2}); 1278-4 (3m 4^{1/2}-8); 1279-1 (2f 9-9^{1/2} & 1m 7); 1280-2 (1m 8^{1/2}); 1281-1 (1f 7); 1281-2 (1m 7^{1/2}); 1281-4 (5f 5^{1/2}-10 & 5m 6-9); 1281-6 (1f 10); 1281-9 (3f 4-10 & 1m 8^{1/2}); 1286-2 (1f 6); 1287-1 (1f 9^{1/2}); 1287-2 (1f 8 & 1m 8^{1/2}); 1288-4 (1f 8); 1289-1 (2m 8^{1/2}-10); 1289-2 (6m 5-8^{1/2}); 1289-3 (1f 7^{1/2} & 10m 4^{1/2}-8^{1/2}); 1289-7 (2f 7^{1/2}-9 & 4m 5^{1/2}-9^{1/2}); 1289-8 (3m 5-9^{1/2}); 1289-9 (3f 4-5 & 1m 5); 1291-1 (2m 9); 1292-3 (1m 9); 1292-5 (1f 6 & 1m 5); 1293-1 (3m 7-9^{1/2}); 1293-2 (1f 5); 1293-3 (6f 5-6 & 2m 5^{1/2}-6); 1293-4 (4f 4-5 & 2m 5-8); 1294-1 (1m 9^{1/2}); 1294-3 (7f 5-9 & 4m 6-7^{1/2}); 1294-4 (2f 2^{1/2}-8^{1/2}); 1296-1 (1m 8^{1/2}); 1314-1 (1f 9^{1/2}); 1314-2 (2f 7-8^{1/2}); 1314-3 (1f 6 & 4m 5^{1/2}-8); 1314-4 (2f 8-9^{1/2}).

Holotype (ZMUC CRU 3613, "Dana" St. 1198-2, 800 mw).

Type locality: Caribbean Sea, 17°43'N, 64°56'W.

Type material: Holotype of *Sergia hansjacobi* (ZMUC, see above, examined).

Diagnosis: Integument firm; rostrum acute and unidentate; cornea well pigmented, black, considerably wider than eyestalk; terminal segment of male A I peduncle without strong stout seta or process near distoventral end; A I flagellum in male with segment 3 bearing rudimentary tubercle overlapped by strong terminal seta, not reaching end of segment 4 of flagellum and with segment 4 bearing 12-13 serrated bristles on dorsal surface; scaphocerite 3.5 times as long as wide, with distal tooth reaching end of blade; PV of petasma not curved at tip; LI

voluminous, strongly curved in semicircle, with tip directed laterally; LT divided, considerably overlapping PV; LC not overlapping other lobes and processes; LA rudimentary, not overlapping LAC; photophores arranged in lateral row of 5-6 on Cp, row of 5 on scaphocerite, 2 medial and 1 distal organ on Up exopod, 1 basal organ on Up endopod.

Description: Cp 1.9 times as long as high and 0.36 times as long as abdomen; hepatic spine blunt (Fig. 71A). Abdomen with somite VI 1.6 times as long as high and 1.3 times as long as telson; telson 4.2 times as long as wide.

Cornea 1.0 times as long as wide, 0.7 times as long and 1.3 times as wide as eyestalk. A I peduncle 0.8 times as long as Cp, with segments 2 and 3 0.48 and 0.45 times as long as segment 1, respectively; terminal segment of A I peduncle without strong stout seta or prominent process on distoventral side; outer A I flagellum in male with segment 3 bearing rudimentary tubercle overlapped by single long stout seta, not reaching end of segment 4 of flagellum and with segment 4 not subdivided and bearing 12-13 serrated bristles on dorsal surface and numerous setae on ventral surface (Fig. 72C). A II peduncle 0.4 times as long as scaphocerite; latter with strong distal tooth reaching end of blade (Fig. 71B), 3.6 times as long as wide, 0.91 times as long as A I peduncle.

Md palp 0.37 times as long as Cp, with proximal segment 1.9 times as long as distal one. Mx I with palp 1.7 times as long as wide and 0.05 times as long as Cp; endopod 1.7 times as long as wide and 1.7 times as long as palp; endite 1.7 times as long as wide and 1.3 times as long as palp. Mx II with exopod 3.1 times as long as wide and 0.29 times as long as Cp; palp 4.0 times as long as wide and 0.13 times as long as Cp; endopod 2.0 times as long as wide and 0.9 times as long as palp; endites subequal, 2.0 times as long as wide and 0.4 times as long as palp.

Mxp I with exopod 3.2 times as long as wide and 0.18 times as long as Cp; endopod 1.3 times as long as exopod; segments 2 and 3 1.2 and 1.5 times as long as segment 1, respectively. Mxp II 0.9 times as long as Cp, with merus 1.0, carpus 0.8, propodus 0.9, and dactyl 0.4 times as long as ischium. Mxp III 1.5 times as long as Cp, with merus, carpus, propodus 0.9, and dactyl 0.8 times as long as ischium; propodus divided into 3 subsegments, subdivision of dactyl uncertain.

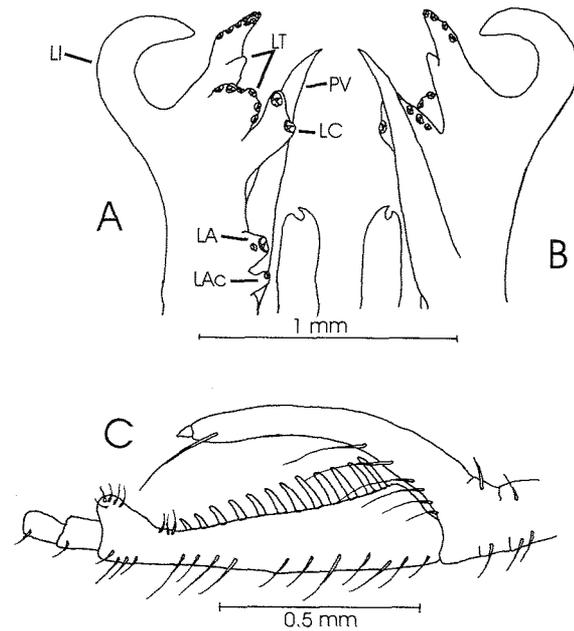


Fig. 72. *Sergia hansjacobi*, holotype, male, "Dana" St. 1198-2, Cp length 8.5 mm. - A, oral view of petasma. - B, caudal view of petasma. - C, male outer A I flagellum.

P I 1.1 times as long as Cp, with merus 3.3, carpus 1.9, and propodus 3.2 times as long as ischium; propodus divided into 7 subsegments. P II 1.6 times as long as Cp, with merus 3.1, carpus 2.6, propodus 3.0, and dactyl 0.1 times as long as ischium; propodus divided into 9 subsegments. P III 1.9 times as long as Cp, with merus 3.4, carpus 2.8, propodus 3.0, and dactyl 0.2 times as long as ischium; propodus divided into 12 subsegments. P IV 1.2 times as long as Cp, with merus 1.6, carpus 1.0, and propodus 1.1 times as long as ischium. P V 0.7 times as long as Cp, with merus 1.2, carpus 0.8, and propodus 0.7 times as long as ischium.

Somite VIII with arthrobranch 0.11 times as long as Cp and 2.4 times as long as epipod. Somite IX with anterior pleurobranch 0.19 times as long as Cp and 4.5 times as long as posterior pleurobranch. Somite X with anterior pleurobranch 0.22 times as long as Cp and 5.4 times as long as posterior pleurobranch. Somite XI with anterior pleurobranch 0.26 times as long as Cp and 6.3 times as long as posterior pleurobranch. Somite XII with anterior pleurobranch 0.26 times as long as Cp and 2.4 times as long as posterior pleurobranch. Somite XIII with anterior pleurobranch 0.21 times as long as Cp and 1.3 times as long as posterior pleurobranch.

PI I with basipod 0.33 times as long as Cp and exopod 2.2 times as long as basipod. PI II with basipod 0.31 times as long as Cp; exopod 2.5 and endopod 1.5 times as long as basipod, respectively. PI III with basipod 0.31 times as long as Cp; exopod 2.4 and endopod 1.4 times as long as basipod, respectively. PI IV with basipod 0.29 times as long as Cp; exopod 2.3 and endopod 1.3 times as long as basipod, respectively. PI V with basipod 0.26 times as long as Cp; exopod 2.1 and endopod 1.1 times as long as basipod, respectively.

Up with exopod 4.8 times as long as wide, 6.2 times as long as basipod and 0.8 times as long as Cp; endopod 3.8 times as long as wide and 0.7 times as long as exopod (Fig. 71C).

Petasma (Fig. 72A-B). PV tapering into sharp point, 5.0 times as long as wide, tip almost straight. LI voluminous, reaching end of LT, 3.7 times as long as wide and 0.6 times as long as PV, if straightened. LT with distal lobule narrow, 2.2 times as long as wide and 0.5 times as long as PV, bearing small tubercle in middle of lateral side and several hooks on distomedial side; proximal lobule robust, 0.8 times as long as wide, 0.3 times as long as PV, covered with several hooks. LC slender, reaching end of proximal lobule of LT and not reaching ends of PV and LI, 1.7 times as long as wide and 0.3 times as long as PV, armed with few stronger apical hooks. LAc small, as papilla near base of PV, 0.7 as long as wide and 0.1 times as long as PV, armed with few hooks. LA rudimentary, as tubercle near base of PV, 1.3 times as long as wide and 0.1 times as long as PV, armed with single small apical hook.

Photophores. Cp: 5-6 in lateral row. Scaphocerite: 5 organs medial to inner strip of muscle from 0.2-0.3 to 0.7-0.8 blade length. Up exopod: 2 organs at middle near tip of inner muscle strip, at 0.4-0.6 exopod length, and 1 distal organ near end of apical muscle strip, at 0.7-0.8 exopod length. Up endopod: 1 organ near base.

Other body photophores, all ventral, found on the following somites (al = anterolateral, l = lateral, m = medial, pm = posteromedial): II (1m), III (4l), labrum (1m+2l), IV (2m+2l), V (2m+2l), VI (2l), VII (2m+2l), VIII (1m+2l), IX (3m), X (3m), XI (3m), XII (3m), XIII (3m+2al), XIV (2pm+4al), XV (6m+2l); XVI (6m+2l), XVII (6m+2l), XVIII (4m+2l), XIX (4m+2l), XX (5m+2al). Total (with those in Cp rows): 101-103 organs.

Other photophores found on the following appendages (d = distal, p = proximal, Roman

numerals indicate segments): eyestalk (lp+1d) A I (peduncle III - 1d), A II (peduncle I - 1p), Md (proper - 1d, palp I - 1d), Mx II (Exp - 1p), Mxp I (II - 1d, III - 1d), Mxp II (II - 1d, III - 1d, IV - 1p, V - 1d, VI - 1d), Mxp III (II - 1d, III - 1d, IV - 1d, V - 1d, VI - 1d), P I (IV - 1p+1d, V - 1d), P II (III - 1p+1d, IV - 1d, V - 1d), P III (III - 1p+1d, IV - 1d, V - 1d), P IV (III - 1p+1d, IV - 1d), P V (III - 1p+1d, IV - 1d), PI I - PI V (I - 1p). Total (with those on scaphocerite and Up): 102 organs.

Thus, the total number of observed photophores in all examined specimens ranges from 203 to 205.

Remarks: Colour in life is shown in Pl. 2C.

In the original description (Vereshchaka 1994a: 92), I wrote about the male A I outer flagellum: "joint III with tubercle widening distally and never reaching end of joint IV." Disagreement with the description above, where I report on the rudimentary tubercle, is accounted for by the different terminology: in my previous paper, the finger-like protrusion on segment 3 (not the tubercle on this protrusion) was called a tubercle. After re-examination of the "Dana" material, I found the number of photophores in the lateral Cp row to range from 5 to 6 (the posterior one is usually small and often hardly visible), usually being 6. Re-examination also revealed the number of dorsal serrated bristles to vary from 12 to 13. The "Dana" specimens also vary slightly in the position of the photophores on the body and appendages (although their number remains constant), the degree of curvature of LI of the petasma (which is usually close to semicircular), and in the armature and relative length of LAc and LA (the former is never overlapped by the latter). In the total photophore number, *S. hansjacobi* exceeds all the species group members mentioned above, from 0.5% (*S. talismani*) to 5.2% (*S. challengerii*), in average.

Sergia hansjacobi is closest to *S. jeppeseni* in having (1) 3 photophores on Up exopod, (2) hepatic spine blunt, (3) male A I with peduncle lacking distoventral process or very strong seta and (4) clasping organ well developed, (5) flagellum with segment 3 bearing rudimentary tubercle, (6) distal tooth on scaphocerite not overlapping blade, (7) PV of petasma not curved laterally, (8) LI voluminous, evenly curved, (9) LT bilobed, (10) LT overlapping PV, and (11) LC not overlapping other lobes and processes. *S. hansjacobi* differs from all other species of the species group in having (1) 5 pho-

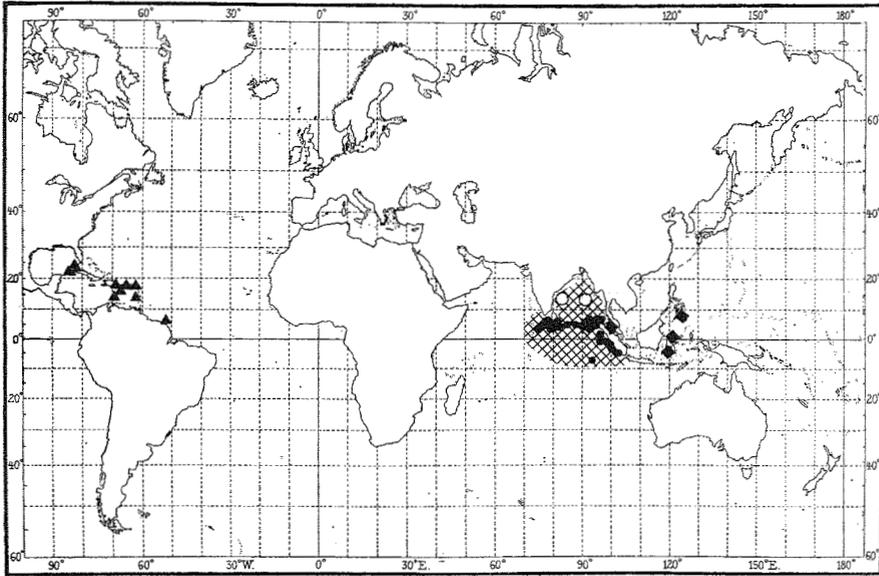


Fig. 73. Probable geographical distribution of *Sergia hansjacobi* (triangles), *S. stellata* (circles, cross hatching) and *S. oksanae* n. sp. (diamonds). Black symbols indicate "Dana" stations, white symbols "Galathea" stations.

tophores on the scaphocerite and (2) LI voluminous and evenly curved in semicircle. Other differences and affinities between *S. hansjacobi* and all other species of the species group are shown in Table 7.

Geographical distribution (Fig. 73): North Atlantic Ocean only: Insular and coastal waters of the Caribbean Sea, in the vicinity of the north coast of South America ("Dana"; Vereshchaka 1994a). The species does not occur in the Indian Ocean, as was supposed before (Vereshchaka 1994a). Further examination of the "Dana II" collections has proved that the species mentioned and figured by Illig (1927) as *S. challengeri* is identical to *S. jeppeseni* n. sp, not to *S. hansjacobi*. The occurrence of *S. hansjacobi* is like that of the whole group (see remarks to the species group). It is sympatric with *S. talismani* and allopatric to *S. challengeri*, *S. fulgens*, *S. stellata*, *S. umitakae*, *S. oksanae* n. sp. and *S. jeppeseni*.

Vertical range: A benthopelagic species, migrating daily between the lateral continental-slope contact zone (Vereshchaka 1995a) and the lateral mesopelagic zone. "Dana" specimens were taken within the depth range 30-1700 m. Most specimens occur at 300-400 m at night; only 2 specimens were sampled during the day, at about 1700 m, which makes estimation of the depth occupied during the day uncertain.

***Sergia jeppeseni* n. sp.**

Figs. 67, 74-75; Pl. 5F

Sergestes challengeri. – Illig 1927 (part): 197, figs. 36, 39.

Material examined: "Dana" station: 3943-1 (1m 10.3).

Holotype: male (Cp length 10.3 mm, ZMUC CRU 3614), "Dana" St. 3943-1, sampled 25 Dec. 1929, 500 mw.

Type locality: Western Indian Ocean off Mombasa, 5°30'S, 40°40'E.

Type material: Holotype (ZMUC, see above).

Diagnosis: Integument firm; rostrum acute and bidentate; cornea well pigmented, black, considerably wider than eyestalk; terminal segment of male A I peduncle without strong stout seta or process near distoventral end; A I flagellum in male with segment 3 bearing rudimentary tubercle overlapped by strong terminal seta, reaching end of segment 4 of flagellum and with segment 4 bearing 8 serrated bristles on dorsal surface; scaphocerite with distal tooth reaching end of blade; PV of petasma not curved at tip; LI voluminous, curved in complete circle, with tip directed proximally; LT divided, considerably overlapping PV; LC not overlapping other lobes and processes; LA small, overlapping LAc; photophores arranged in lateral row of 6 on

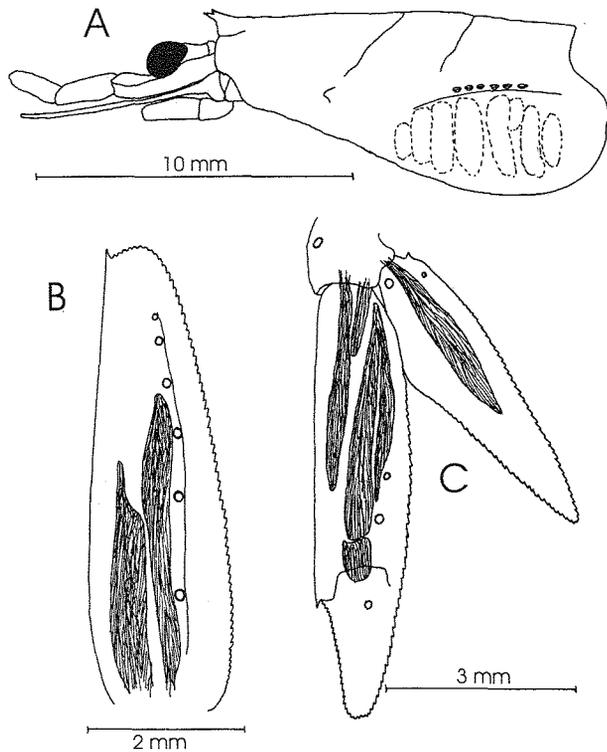


Fig. 74. *Sergia jeppeseni* n. sp., holotype, male, "Dana" St. 3943-1, Cp length 10.3 mm. — A, lateral view of Cp. — B, scaphocerite. — C, Up.

Cp, row of 6 on scaphocerite, 2 medial and 1 distal organ on Up exopod, 2 basal organs on Up endopod.

Description: Cp 2.0 times as long as high and 0.46 times as long as abdomen; hepatic spine acute (Fig. 74A). Abdomen with somite VI 1.8 times as long as high and 1.3 times as long as telson; telson 3.6 times as long as wide.

Eyestalk with cornea well pigmented, black, 1.0 times as long as wide, 0.9 times as long and 1.3 times as wide as eyestalk. A I peduncle 0.6 times as long as Cp, with segments 2 and 3 0.45 and 0.48 times as long as segment 1, respectively; terminal segment of A I peduncle without strong stout seta or prominent process on distoventral side; outer A I flagellum in male with segment 3 bearing rudimentary tubercle overlapped by single long setae, reaching end of segment 4 of flagellum and with segment 4 not subdivided and bearing 8 serrated bristles on dorsal surface and several seta on ventral surface (Fig. 75C). A II peduncle 0.4 times as long as scaphocerite; latter with strong distal tooth reaching end of blade (Fig. 74B), 3.3 times as long as wide, 0.83 times as long as A I peduncle.

Md palp 0.32 times as long as Cp, with proximal segment 2.0 times as long as distal one. Mx I with palp 1.9 times as long as wide and 0.06 times as long as Cp; endopod 1.6 times as long as wide and 1.5 times as long as palp; endite 1.6 times as long as wide and 0.9 times as long as palp. Mx II with exopod 3.1 times as long as wide and 0.30 times as long as Cp; palp 3.6 times as long as wide and 0.11 times as long as Cp; endopod 1.9 times as long as wide and 0.9 times as long as palp; endites subequal, 1.8 times as long as wide and 0.4 times as long as palp.

Mxp I with exopod 3.2 times as long as wide and 0.17 times as long as Cp; endopod 1.3 times as long as exopod; segments 2 and 3 1.1 and 1.5 times as long as segment 1, respectively. Mxp II 0.8 times as long as Cp, with merus 1.1, carpus 1.0, propodus 0.9, and dactyl 0.5 times as long as ischium. Mxp III 1.4 times as long as Cp, with merus 0.8, carpus and propodus 0.9, dactyl 0.8 times as long as ischium; propodus and dactyl divided into 3 and 5 subsegments, respectively.

P I 1.0 times as long as Cp, with merus 2.6, carpus 1.4, and propodus 2.6 times as long as ischium; subdivision of propodus uncertain. P II 1.5 times as long as Cp, with merus 3.5, carpus 2.6, propodus 3.4, and dactyl 0.2 times as long as ischium; propodus divided into 9 subsegments. P III 1.8 times as long as Cp, with merus 3.5, carpus 2.6, propodus 3.1, and dactyl 0.2 times as long as ischium; subdivision of propodus uncertain. P IV 1.1 times as long as Cp, with merus 1.6, carpus and propodus 1.0 times as long as ischium. P V 0.6 times as long as Cp, with merus 1.2, carpus and propodus 0.8 times as long as ischium.

Somite VIII with arthrobranch 0.14 times as long as Cp and 3.7 times as long as epipod. Somite IX with anterior pleurobranch 0.18 times as long as Cp and 4.8 times as long as posterior pleurobranch. Somite X with anterior pleurobranch 0.19 times as long as Cp and 5.2 times as long as posterior pleurobranch. Somite XI with anterior pleurobranch 0.33 times as long as Cp and 6.0 times as long as posterior pleurobranch. Somite XII with anterior pleurobranch 0.26 times as long as Cp and 2.4 times as long as posterior pleurobranch. Somite XIII with anterior pleurobranch 0.23 times as long as Cp and 1.5 times as long as posterior pleurobranch.

PI I with basipod 0.31 times as long as Cp and exopod 2.2 times as long as basipod. PI II with basi-

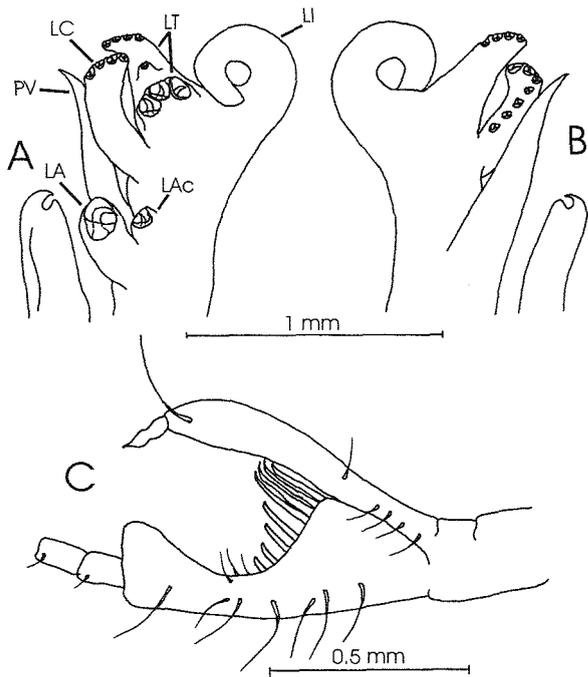


Fig. 75. *Sergia jeppeseni* n. sp., holotype, male, "Dana" St. 3943-1, Cp length 10.3 mm. - A, oral view of petasma. - B, caudal view of petasma. - C, male outer A I flagellum.

pod 0.29 times as long as Cp; exopod 2.5 and endopod 1.5 times as long as basipod, respectively. Pl III with basipod 0.28 times as long as Cp; exopod 2.4 and endopod 1.4 times as long as basipod, respectively. Pl IV with basipod 0.27 times as long as Cp; exopod 2.2 and endopod 1.3 times as long as basipod, respectively. Pl V with basipod 0.25 times as long as Cp; exopod 1.7 and endopod 1.1 times as long as basipod, respectively.

Up with exopod 4.8 times as long as wide, 4.8 times as long as basipod and 0.6 times as long as Cp; endopod 3.7 times as long as wide and 0.7 times as long as exopod (Fig. 74C).

Petasma (Fig. 75A-B; Pl. 5F). PV tapering into sharp point, 3.7 times as long as wide, tip nearly straight. LI reaching end of LT, 3.1 times as long as wide and 0.8 times as long as PV, if straightened. LT with distal lobule slender, 1.5 times as long as wide and 0.5 times as long as PV, bearing small tubercle with in middle of lateral side and few apical hooks; proximal lobule robust, 0.7 times as long as wide, 0.2 times as long as PV, armed with few very strong apical hooks. LC slender, overlapping proximal lobule of LT and PV and not reaching end

of distal lobule of LT, 2.8 times as long as wide and 0.5 times as long as PV, armed with few apical hooks. LAc small, 0.8 as long as wide and 0.1 times as long as PV, armed with single strong apical hook. LA short, 1.7 times as long as wide and 0.3 times as long as PV, armed with single very strong apical hook.

Photophores. Cp: 6 in lateral row. Scaphocerite: 6 organs medial to inner strip of muscle from 0.2-0.3 to 0.8-0.9 blade length. Up exopod: 2 organs at middle near tip of inner muscle strip, at 0.4-0.6 exopod length, and 1 distal organ near end of apical muscle strip, at 3/4 exopod length. Up endopod: 2 organs near base.

Other body photophores, all ventral, found on the following somites (al = anterolateral, l = lateral, m = medial, pm = posteromedial): II (1m), III (4l), labrum (1m+2l), IV (2m+2l), V (2m+2l), VI (2l), VII (2m+2l) VIII (3m+2l), IX (3m), X (3m), XI (3m), XII (3m), XIII (3m+2al), XIV (4pm+2al), XV (6m+2l); XVI (6m+2l), XVII (4m+2l), XVIII (4m+2l), XIX (4m+2l), XX (5m+2al). Total (with those in Cp rows): 103 organs.

Other photophores found on the following appendages (d = distal, p = proximal, Roman numerals indicate segments): eyestalk (lp+1d) A I (peduncle III - 1d), A II (peduncle I - 1p), Md (proper - 1d, palp I - 1d), Mx II (Exp - 1p), Mxp I (II - 1d, III - 1d), Mxp II (II - 1d, III - 1d, IV - 1p, V - 1d, VI - 1d), Mxp III (III - 1d, IV - 1d, V - 1d, VI - 1d), P I (IV - 1p+2d, V - 1d), P II (III - 1p+1d, IV - 1d, V - 1d), P III (III - 1p+1d, IV - 1d, V - 1d), P IV (III - 1p+1d, IV - 1d), P V (III - 1p+1d, IV - 1d), Pl I - Pl V (I - 1p). Total (with those on scaphocerite and Up): 106 organs.

Thus, the total number of observed photophores in the holotype is 209 (male).

Remarks: It is usually not recommendable to establish a new species on the single known specimen, even if the distinguishing characters are as clear and certain as in this species. However, Illig (1927) described and figured (figs. 36, 39) some specimens referred to *S. challengerii* that undoubtedly belong to the present new species, due at least to the very characteristic form of the petasma with a circular LI. Illig's specimens were taken very close to the single "Dana" locality of *S. jeppeseni*. Thus, the presence of very similar specimens within the restricted area gives additional support for establishing a new species. In the total photophore

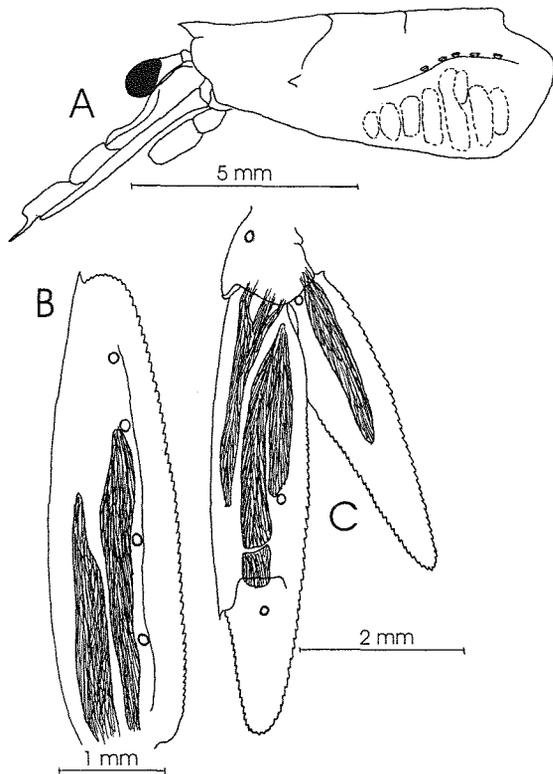


Fig. 76. *Sergia oksanae* n. sp., holotype, male, "Dana" St. 3736-3, Cp length 6.8 mm. — A, lateral view of Cp. — B, scaphocerite. — C, Up.

number, *S. jeppeseni* exceeds all the members of the species group, from 2.5% (*S. hansjacobi*) to 5.6% (*S. challengeri*), in average.

Sergia jeppeseni is closest to *S. hansjacobi* (see affinities and differences between these species in remarks to *S. hansjacobi*). It differs from all other species of the species group in having (1) 6 photophores on the scaphocerite, (2) 2 photophores on the Up endopod, and (3) LI voluminous, curved in a complete circle. Other differences and affinities between *S. jeppeseni* and all other known species of the species group are shown in Table 7.

Etymology: This species is named after Mr. Poul Jeppesen, who for many years has been taking care of the ZMUC crustacean collection.

Geographical distribution (Fig. 67): Indian Ocean only: Western part only, off Mombasa ("Dana"), "northeast from Dar-es-Salam" (Illig 1927).

The occurrence of *S. jeppeseni* is like that of the whole group (see remarks to the species group). It

is parapatric to *S. umitakae* and *S. fulgens*, which occur east of 45°E in the Indian Ocean, while *S. jeppeseni* lives west of 45°E, sympatric with *S. talismani*, and allopatric to *S. challengeri*, *S. stellata*, *S. hansjacobi*, and *S. oksanae*.

Vertical range: Probably a benthopelagic species, migrating daily between the lateral continental-slope contact zone (Vereshchaka 1995a) and the epipelagic zone. The "Dana" specimen was taken at night at a depth of about 200 m.

Sergia oksanae n. sp.

Figs. 73, 76-77; Pl. 5E

Sergestes sp. — Hansen 1919: 16, pl. 1, fig. 5a.

Material examined: "Dana" stations: 3736-3 (2f 7 & 3m 6¹/₂-7); 3793-1 (69f 3¹/₂-6¹/₂); 3793-2 (29f 3¹/₂-7 & 19m 3¹/₂-6¹/₂); 3793-3 (30f 4-6¹/₂ & 18m 4-6); 3793-4 (36f 3¹/₂-6¹/₂ & 8m 4¹/₂-6); 3797-1 (1f 5 & 1m 6¹/₂); 3830-6 (1m 6¹/₂).

Holotype: male (Cp length 6.8 mm, ZMUC CRU 3615), "Dana" St. 3736-3, sampled 28 Jun. 1929.

Paratype: 1 female (Cp length 7.0 mm, ZMUC CRU 3616), same sample as holotype.

Type locality: Mindanao Sea, 9°17'N, 123°58'E.

Type material: Holotype + 1 paratype (ZMUC, see above).

Diagnosis: Integument firm; rostrum acute and unidentate; cornea well pigmented, black, wider than eyestalk; terminal segment of male A I peduncle without strong stout seta, with single very long and narrow process near distoventral end; clasping organ rudimentary; A I flagellum in male with segment 3 lacking tubercle and segment 4 lacking serrated bristles; scaphocerite with strong distal tooth overlapping blade; PV of petasma curved laterally at tip, LI well developed, not strongly curved, with tip directed distolaterally; LT bilobed, considerably overlapping PV; LC overlapping other lobes and processes; LA overlapping LAc; photophores arranged in lateral row of 5 on Cp, of 4 on scaphocerite, 1 medial and 1 distal organ on Up exopod, 1 basal organ on Up endopod.

Description: Cp 2.0 times as long as high and 0.34 times as long as abdomen; hepatic spine acute

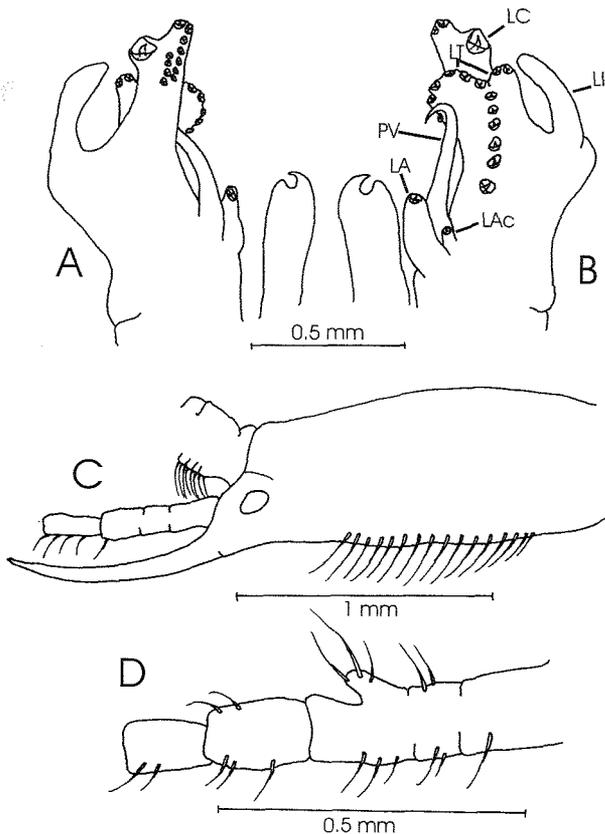


Fig. 77. *Sergia oksanae* n. sp., holotype, male, "Dana" St. 3736-3, Cp length 6.8 mm. — A, caudal view of petasma. — B, oral view of petasma. — C, terminal segment of male A I. — D, male outer A I flagellum.

(Fig. 76A). Abdomen with somite VI 1.9 times as long as high and 1.5 times as long as telson; telson 3.5 times as long as wide.

Cornea 1.1 times as long as wide, 0.7 times as long and 1.2 times as wide as eyestalk. A I peduncle 0.7 times as long as Cp, with segments 2 and 3 0.43 and 0.50 times as long as segment 1, respectively; terminal segment of A I peduncle without strong stout seta, bearing very long and narrow process on distoventral side (Fig. 77C); clasping organ rudimentary; outer A I flagellum in male with segment 3 bearing very short fingerlike protrusion and no tubercle and with segment 4 of flagellum not thickened, lacking dorsal serrated bristles, covered with few setae (Fig. 77D). A II peduncle 0.4 times as long as scaphocerite; latter with strong distal tooth overlapping blade (Fig. 76B), 3.8 times as long as wide, 0.91 times as long as A I peduncle.

Md palp 0.34 times as long as Cp, with proximal segment 1.9 times as long as distal one. Mx I with

palp 2.0 times as long as wide and 0.07 times as long as Cp; endopod 1.4 times as long as wide and 1.3 times as long as palp; endite 1.5 times as long as wide and 0.9 times as long as palp. Mx II with exopod 3.1 times as long as wide and 0.34 times as long as Cp; palp 3.5 times as long as wide and 0.12 times as long as Cp; endopod 1.5 times as long as wide and 0.9 times as long as palp; endites subequal, 1.8 times as long as wide and 0.5 times as long as palp.

Mxp I with exopod 2.9 times as long as wide and 0.18 times as long as Cp; endopod 1.5 times as long as exopod; segments 2 and 3 1.1 and 1.8 times as long as segment 1, respectively. Mxp II 0.9 times as long as Cp, with merus 1.1, carpus and propodus 0.9, and dactyl 0.4 times as long as ischium. Mxp III 1.3 times as long as Cp, with merus, carpus and propodus 0.8, and dactyl 0.6 times as long as ischium; subsegmentation of propodus and dactyl uncertain.

P I 1.0 times as long as Cp, with merus 2.6, carpus 1.6, and propodus 2.5 times as long as ischium; propodus divided into 7 subsegments. P II 1.5 times as long as Cp, with merus 3.5, carpus 2.7, propodus 3.2, and dactyl 0.2 times as long as ischium; propodus incompletely divided into 8 subsegments. P III 1.8 times as long as Cp, with merus 3.5, carpus 2.7, propodus 3.4, and dactyl 0.2 times as long as ischium; propodus incompletely divided into 12 subsegments. P IV 1.1 times as long as Cp, with merus 1.5, carpus 0.9, and propodus 1.1 times as long as ischium. P V 0.6 times as long as Cp, with merus 1.3, carpus 0.9, and propodus 0.7 times as long as ischium.

Somite VIII with arthrobranch 0.11 times as long as Cp and 2.6 times as long as epipod. Somite IX with anterior pleurobranch 0.18 times as long as Cp and 3.6 times as long as posterior pleurobranch. Somite X with anterior pleurobranch 0.24 times as long as Cp and 3.9 times as long as posterior pleurobranch. Somite XI with anterior pleurobranch 0.24 times as long as Cp and 3.3 times as long as posterior pleurobranch. Somite XII with anterior pleurobranch 0.27 times as long as Cp and 2.8 times as long as posterior pleurobranch. Somite XIII with anterior pleurobranch 0.23 times as long as Cp and 3.4 times as long as posterior pleurobranch.

Pl I with basipod 0.29 times as long as Cp and exopod 2.0 times as long as basipod. Pl II with basipod 0.29 times as long as Cp; exopod 2.2 and endo-

pod 1.4 times as long as basipod, respectively. PI III with basipod 0.28 times as long as Cp; exopod 2.1 and endopod 1.4 times as long as basipod, respectively. PI IV with basipod 0.28 times as long as Cp; exopod 2.1 and endopod 1.2 times as long as basipod, respectively. PI V with basipod 0.24 times as long as Cp; exopod 1.9 and endopod 1.1 times as long as basipod, respectively.

Up with exopod 4.8 times as long as wide, 5.0 times as long as basipod and 0.7 times as long as Cp; endopod 3.8 times as long as wide and 0.7 times as long as exopod (Fig. 76C).

Petasma (Fig. 77A-B, Pl. 5E). PV slender, tapering into sharp point, 6.2 times as long as wide. LI overlapping LT, 3.6 times as long as wide and 0.7 times as long as PV. LT thick, bilobed at end, 1.0 times as long as wide, 0.6 times as long as PV, armed with 2 rows of hooks, along dorsal margin and on distolateral side, and with few apical hooks on each of terminal lobules. LC 2.3 times as long as wide and 0.9 times as long as PV, armed with several subapical hooks and single stronger apical hook. LAc developed, slender, 2.0 times as long as wide and 0.2 times as long as PV, armed with single apical hook. LA slender, 2.4 times as long as wide and 0.5 times as long as PV, armed with single apical hook.

Photophores. Cp: 5 in lateral row. Scaphocerite: 4 organs medial to inner strip of muscle from 0.2-0.3 to 0.8-0.9 blade length. Up exopod: 1 organ at middle near tip of inner muscle strip, at 0.4-0.5 exopod length, and 1 distal organ near end of apical muscle strip, at 0.7-0.8 exopod length. Up endopod: 1 organ near base.

Other body photophores, all ventral, found on the following somites (a = anterolateral, l = lateral, m = medial): II (1m), III (4l), labrum (1m+2l), IV (2m+2l), V (2m+2l), VI (2l), VII (2m+2l) VIII (1m+2l), IX (3m), X (3m), XI (3m), XII (3m), XIII (3m+2al), XIV (4pm+2al), XV (6m+2l); XVI (6m+2l), XVII (6m+2l), XVIII (4m+2l), XIX (4m+2l), XX (5m+2al). Total (with those in Cp rows): 101.

Other photophores found on the following appendages (d-distal, m - medial, p-proximal, Roman numerals indicate segments): eyestalk (1p+1d) A I (peduncle III - 1d), A II (peduncle I - 1p), Md (proper - 1d, palp I - 1d), Mx II (Exp - 1p), Mxp I (II - 1d, III - 1d), Mxp II (II - 1d, III - 1d, IV - 1p, V - 1d, VI - 1d), Mxp III (II - 1d, III - 1d, IV - 1d, V - 1d, VI - 1d), P I (IV - 1p+1d, V - 1d), P II

(III - 1p+1d, IV - 1d, V - 1d), P III (III - 1p+1d, IV - 1d, V - 1d, VI - 1d), P IV (III - 1p+1d, IV - 1d), P V (III - 1p+1d, IV - 1d), P I - P V (I - 1p). Total (with those on scaphocerite and Up): 100.

Thus, the total number of observed photophores in all examined specimens is 201.

Remarks: Hansen (1919: 16) briefly described and figured a specimen of *Sergestes* which was considered to be close to *S. challengerii* in all peculiarities except for a reduced clasping organ and the presence of a very long distoventral process on the terminal segment of the male A I peduncle. Hansen referred this species to *Sergestes* sp., which is definitely identical to *S. oksanae*. All "Dana" specimens vary slightly in the length of the distoventral process on male A I peduncle (which is always present), proportions of the appendages, the branchial lobes, and in the form of rostrum and lobes and processes of the petasma, for instance, in the form of the PV (LT always overlaps PV). Adults of *S. oksanae* seem not to vary in the number and position of photophores, which are not dependent upon sex and are very close to the photophore patterns of *S. challengerii*, *S. fulgens*, and *S. talismani*. In the abundance of the luminescent organs. *S. oksanae* is in an intermediate position between the 2 former and the latter species: *Sergia oksanae* exceeds *S. challengerii* by 3.6% and *S. fulgens* by 2.0% in the total photophore number, while *S. talismani* exceeds *S. oksanae* by 1.0% in the same character. *Sergia oksanae* n. sp. is closely related to *S. challengerii*, *S. fulgens*, *S. talismani*, and *S. stellata* (see affinities and differences in remarks to *S. challengerii*). It differs from all other species of the species group in having a very long and narrow distoventral process on the terminal segment of male A I peduncle. Other differences and affinities between *S. oksanae* and all other known species of the species group are shown in Table 7.

Etymology: This species is named after my wife Oksana, who has supported me during my studies on sergestids.

Geographical distribution (Fig. 73): Indo-West Pacific only: Off Sumatra, Borneo, and Philippines ("Dana"), at location 06°11'N, 120°37'E (Hansen 1919).

The occurrence of *S. oksanae* is like that of the whole group (see remarks to the species group). *S.*

oksanae and *S. stellata* are parapatric, the former occurring east of Sumatra, the latter living west of this island. *S. oksanae* is sympatric with *S. challengeri*, *S. fulgens*, and *S. talismani* and parapatric to *S. hansjacobi*, *S. umitakae*, and *S. jeppeseni* n. sp.

Vertical range: A benthopelagic species, migrating daily between the lateral continental-slope contact zone and the epipelagic zone. "Dana" specimens were taken within the depth range 20-1200 m. Most specimens occur at 30-80 m at night and at about 500 m during the day.

***Sergia stellata* (Burkenroad, 1940), n. comb.**

Figs. 73, 78-79; Pl. 5D

Sergestes stellatus Burkenroad, 1940: 43.

Sergestes (*Sergia*) *stellatus*. – Yaldwyn 1957: 9.

Material examined: "Dana" stations: 3830-6 (7f 4¹/₂-8 & 5m 4¹/₂-7); 3838-1 (1f 6¹/₂ & 2m 6-6¹/₂); 3849-1 (1m 5¹/₂); 3860-20 (2f 6¹/₂-7 & 6m 5¹/₂-7); 3873-1 (4f 5¹/₂-6¹/₂); 3873-2 (2f 6¹/₂); 3873-3 (1m 6); 3874-1 (1f 5 & 4m 5¹/₂-6¹/₂); 3874-2 (2m 4¹/₂-5¹/₂); 3874-3 (2f 6); 3874-4 (1f 7 & 1m 5¹/₂); 3876-1 (2f 6¹/₂ & 6m 6-6¹/₂); 3876-3 (2f 5-6¹/₂); 3880-1 (1m 6¹/₂); 3882-1 (2f 4¹/₂-5¹/₂ & 4m 4-7); 3884-1 (2f 4¹/₂-7¹/₂); 3884-3 (1m 5¹/₂); 3891-1 (13f 4-8 & 9m 5-6¹/₂); 3891-2 (10f 5-6 & 6m 5-5¹/₂); 3891-3 (11f 4-7¹/₂ & 6m 4¹/₂-6¹/₂); 3891-4 (9f 4¹/₂-7¹/₂ & 4m 5); 3892-1 (8f 4¹/₂-6¹/₂ & 12m 4¹/₂-7); 3892-2 (11f 4¹/₂-8¹/₂ & 7m 5-6¹/₂); 3892-3 (1f 8 & 2m 6-6¹/₂); 3893-3 (5f 5-6¹/₂ & 3m 5-5¹/₂); 3893-7 (3f 7¹/₂-9); 3893-8 (38f 4-9 & 7m 4¹/₂-5¹/₂); 3893-9 (3f 4¹/₂-8); 3894-1 (5f 6¹/₂-7¹/₂ & 2m 4¹/₂-6¹/₂); 3894-2 (9f 4¹/₂-6¹/₂ & 2m 4¹/₂-5¹/₂); 3894-3 (3f 7-8¹/₂); 3897-1 (1f 7); 3897-2 (1f 7 & 1m 5¹/₂); 3897-3 (1f 8 & 2m 6-7); 3897-4 (1f 7¹/₂ & 1m 5¹/₂); 3899-2 (2f 4¹/₂-5 & 2m 4¹/₂-5¹/₂); 3902-2 (2f 6 & 5m 6¹/₂-7); 3902-3 (2f 5-6¹/₂); 3903-3 (6f 3¹/₂-6¹/₂ & 4m 5¹/₂-6¹/₂); 3904-1 (2m 6¹/₂-7); 3904-2 (1m 6¹/₂); 3904-4 (3m 4¹/₂-6¹/₂); 3904-5 (2f 5-6¹/₂ & 1m 7); 3905-2 (2f 6¹/₂); 3905-3 (5f 6-8¹/₂ & 2m 6-7); 3905-4 (4f 4¹/₂-7¹/₂ & 6m 4¹/₂-6); 3906-2 (1f 7¹/₂); 3906-4 (1f 8); 3907-1 (1f 7¹/₂); 3907-2 (1f 7 & 1m 6¹/₂); 3907-3 (1f 7¹/₂ & 4m 6¹/₂-7¹/₂); 3907-4 (1f 6¹/₂ & 3m 6-7); 3908-1 (1f 8 & 4m 6-7); 3908-2 (12f 6-8 & 10m 6-8); 3908-3 (18f 6¹/₂-8¹/₂ & 14m 6-7¹/₂); 3909-2 (2m 6¹/₂-7); 3910-1 (11f 7-9 & 1m 8); 3910-2 (41f 4-9¹/₂ & 12m 6-7¹/₂); 3912-3 (2f 6¹/₂-8¹/₂ & 3m 6¹/₂-7¹/₂); 3913-2 (1m 6); 3913-3 (4f 7-9

& 4m 6-7); 3913-4 (2f 6¹/₂-7¹/₂ & 1m 6¹/₂); 3914-3 (11f 6¹/₂-8 & 10m 6¹/₂-7¹/₂); 3914-5 (2m 7¹/₂); 3915-2 (2f 6-6¹/₂ & 1m 7¹/₂); 3915-3 (15f 4¹/₂-8 & 2m 6¹/₂-7).

"Galathea" stations: 298 (1m 8); 316 (1m 7¹/₂).

Holotype (ZMUC CRU 1607, "Dana" St. 3908-1, 1000 mw).

Type locality: Indian Ocean off Sri Lanka, 4°28'N, 82°13'E.

Type material: Holotype (ZMUC, see above, examined).

Diagnosis: Integument firm; rostrum acute and unidentate; cornea well pigmented, black, wider than eyestalk; terminal segment of male A I peduncle bearing 2 strong stout setae and triangular blunt process near distoventral end; A I flagellum in male with segment 3 bearing well developed tubercle reaching end of segment 4 of flagellum and segment 4 bearing 8-9 serrated bristles on dorsal surface; scaphocerite with strong distal tooth reaching end of blade; PV of petasma laterally curved at tip; LI rudimentary; LT bilobed, overlapping other lobes and processes; LC small, not overlapping PV; LA not overlapping LAc; photophores arranged in lateral row of 4 on Cp, row of 4 on scaphocerite, 1 medial and 1 distal organ on Up exopod, 1 basal organ on Up endopod.

Description: Cp 1.8 times as long as high and 0.31 times as long as abdomen; hepatic spine blunt (Fig. 78A). Abdomen with somite VI 1.7 times as long as high and 1.5 times as long as telson; telson 3.7 times as long as wide.

Cornea 1.1 times as long as wide, 1.0 times as long and 1.4 times as wide as eyestalk. A I peduncle 0.7 times as long as Cp, with segments 2 and 3 0.48 and 0.59 times as long as segment 1, respectively; terminal segment of A I peduncle with 2 very strong stout seta and triangular blunt process in distoventral side (Fig. 79C); outer A I flagellum in male with segment 3 bearing tubercle overlapping segment 4 of flagellum and with segment 4 subdivided and bearing 8-9 serrated bristles on dorsal surface and several setae on ventral surface (Fig. 79D). A II peduncle 0.4 times as long as scaphocerite; latter with distal tooth reaching end of blade (Fig. 78B), 3.5 times as long as wide, 1.0 times as long as A I peduncle.

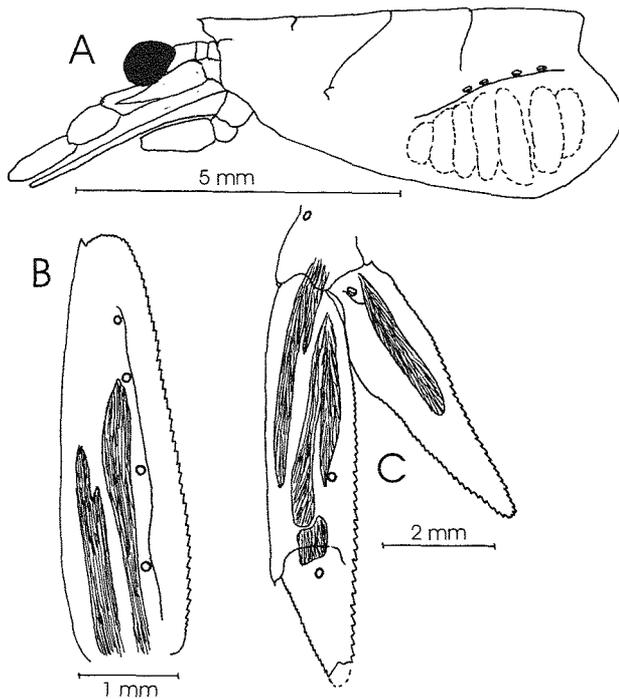


Fig. 78. *Sergia stellata*, holotype, male, "Dana" St. 3908-1, Cp length 6.8 mm. - A, lateral view of Cp. - B, scaphocerite. - C, Up.

Md palp 0.33 times as long as Cp, with proximal segment 1.7 times as long as distal one. Mx I with palp 3.3 times as long as wide and 0.06 times as long as Cp; endopod 1.7 times as long as wide and 1.7 times as long as palp; endite 2.4 times as long as wide and 1.2 times as long as palp. Mx II with exopod 3.1 times as long as wide and 0.32 times as long as Cp; palp 3.8 times as long as wide and 0.12 times as long as Cp; endopod 1.6 times as long as wide and 0.9 times as long as palp; endites subequal, 1.1 times as long as wide and 0.3 times as long as palp.

Mxp I with exopod 2.6 times as long as wide and 0.17 times as long as Cp; endopod 1.4 times as long as exopod; segments 2 and 3 1.0 and 1.7 times as long as segment 1, respectively. Mxp II 0.8 times as long as Cp, with merus 1.0, carpus 0.9, propodus 1.0, and dactyl 0.5 times as long as ischium. Mxp III 1.3 times as long as Cp, with merus, carpus and propodus 0.8, dactyl 0.7 times as long as ischium; subdivision of propodus and dactyl uncertain.

P I 1.0 times as long as Cp, with merus 2.1, carpus 1.4, and propodus 2.1 times as long as ischium; subdivision of propodus uncertain. P II 1.4 times as long as Cp, with merus 3.0, carpus 2.6, propodus

3.0, and dactyl 0.2 times as long as ischium; subdivision of propodus uncertain. P III 1.7 times as long as Cp, with merus 3.1, carpus 2.5, propodus 2.7, and dactyl 0.2 times as long as ischium; subdivision of propodus uncertain. P IV 1.1 times as long as Cp, with merus 1.5, carpus and propodus 1.0 times as long as ischium. P V 0.6 times as long as Cp, with merus 1.2, carpus 0.9, and propodus 0.8 times as long as ischium.

Somite VIII with arthrobranch 0.15 times as long as Cp and 5.8 times as long as epipod. Somite IX with anterior pleurobranch 0.19 times as long as Cp and 5.0 times as long as posterior pleurobranch. Somite X with anterior pleurobranch 0.19 times as long as Cp and 3.3 times as long as posterior pleurobranch. Somite XI with anterior pleurobranch 0.29 times as long as Cp and 5.5 times as long as posterior pleurobranch. Somite XII with anterior pleurobranch 0.31 times as long as Cp and 3.0 times as long as posterior pleurobranch. Somite XIII with anterior pleurobranch 0.26 times as long as Cp and 1.3 times as long as posterior pleurobranch.

PI I with basipod 0.32 times as long as Cp and exopod 1.9 times as long as basipod. PI II with basipod 0.32 times as long as Cp; exopod 2.1 and endopod 1.2 times as long as basipod, respectively. PI III with basipod 0.33 times as long as Cp; exopod 1.8 and endopod 1.2 times as long as basipod, respectively. PI IV with basipod 0.32 times as long as Cp; exopod 1.7 and endopod 1.0 times as long as basipod, respectively. PI V with basipod 0.31 times as long as Cp; exopod 1.5 and endopod 0.9 times as long as basipod, respectively.

Up with exopod 4.7 times as long as wide, 5.0 times as long as basipod and 0.8 times as long as Cp; endopod 3.6 times as long as wide and 0.7 times as long as exopod (Fig. 78B).

Petasma (Fig. 79A-B, Pl. 5D). PV tapering into sharp point, 4.2 times as long as wide. LI as small tubercle, 1.2 times as long as wide and 0.1 times as long as PV. LT very thick and voluminous, bilobed at end, 0.7 times as long as wide, 0.4 times as long as PV, with distolateral lobule bearing few smaller hooks and distomedial lobule bearing single extremely strong apical hook. LC 1.7 times as long as wide and 0.4 times as long as PV, armed with several apical hooks. LAc small, as tubercle at base of PV, 1.5 as long as wide and 0.1 times as long as PV, armed with single small apical hook. LA rudimentary, 1.3 times as long as wide and 0.1 times as

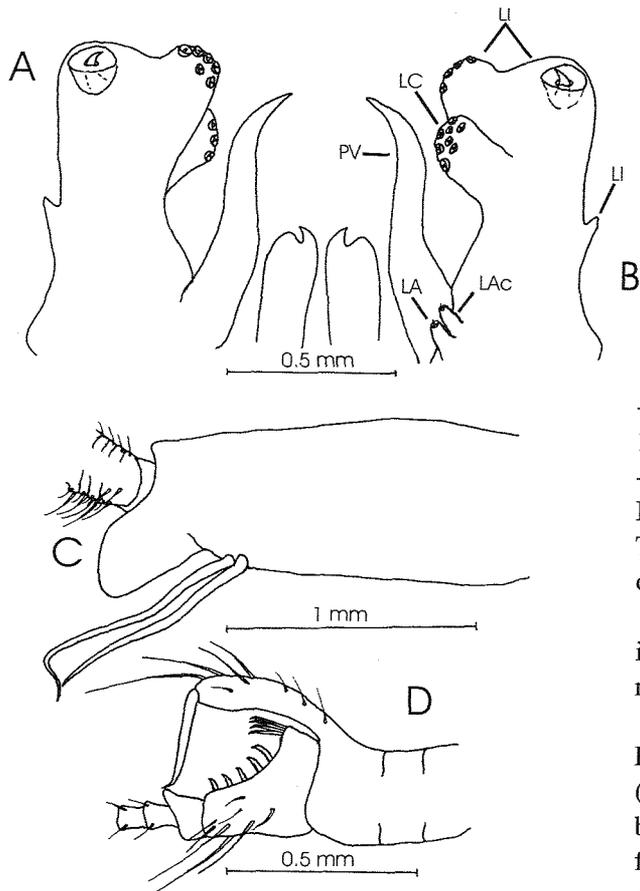


Fig. 79. *Sergia stellata*, holotype, male, "Dana" St. 3908-1, Cp length 6.8 mm. - A, caudal view of petasma. - B, oral view of petasma. - C, terminal segment of male A I. - D, male outer A I flagellum.

- 1d), Mxp III (II - 1d, III - 1d, IV - 1d, V - 1d, VI - 1d), P I (III - 1p, IV - 1p+1d), P II (III - 1p+1d, IV - 1d), P III (III - 1p+1d, IV - 1d), P IV (III - 1p+1d, IV - 1d), P V (III - 2d, IV - 1d), Pl I - Pl V (I - 1p). Total (with those on scaphocerite and Up): 92 organs.

Thus, the total number of observed photophores in all examined specimens ranges from 194 in males to 196 in females.

Remarks: Since this species was described (Burkenroad 1940), there have not been new reports by any author except Yaldwyn (1957), who just fixed the position of this species within the subgenus *Sergestes*. The very characteristic form of the petasma and the presence of two very strong setae make the males of *S. stellata* easily identifiable. The "Dana" specimens agree well with the brief original description, varying in minor body proportions, armature of segment 4 of the male outer A I flagellum (usually 9, but sometimes 8 dorsal serrated bristles), the form of PV of the petasma, and the relative length of LAc and LA (LA never overlaps LAc). The photophore patterns are very close to those of *S. challengeri*, *S. fulgens*, *S. talismani*, and *S. oksanae* n. sp. Among these species, the total photophore number in *S. stellata* exceeds that in *S. challengeri* by 0.5%, while the total number of luminescent organs in *S. fulgens*, *S. oksanae*, and *S. talismani* exceeds that in *S. stellata* by 1.0%, 3.1%, and 4.1%, respectively.

Sergia stellata is closely related to *S. challengeri*, *S. fulgens*, *S. talismani*, and *S. oksanae*, (see affinities and differences in remarks to *S. challengeri*). It differs from all other species of the species group in having (1) 2 very strong distoventral stout setae on the terminal segment of the male A I peduncle and (2) rudimentary LI. Other differences and affinities between *S. stellata* and all other known species of the species group are shown in Table 7.

long as PV, armed with single small apical hook.

Photophores. Cp: 4 in lateral row. Scaphocerite: 4 organs medial to inner strip of muscle from 0.2 to 0.7-0.8 blade length. Up exopod: 1 organ near tip of inner muscle strip, at 0.5 exopod length, and 1 distal organ near end of apical muscle strip, at 0.7-0.8 exopod length. Up endopod: 1 organ near base.

Other body photophores, all ventral, found on the following somites (al = anterolateral, am = antero-medial, l = lateral, m = medial, pm = posteromedial): II (1m), III (4l), labrum (1m+2l), IV (2m+2l), V (2m+2l), VI (2l), VII (2m+2l) VIII (1m), IX (3m), X (3m), XI (3m), XII (3m), XIII (3m+2am (female)/0am (male)+2al), XIV (4pm+2al), XV (6m+2l); XVI (6m+2l), XVII (6m+2l), XVIII (6m+2l), XIX (6m+2l), XX (6m+2al). Total (with those in Cp rows): 102 (in male) or 104 (female).

Other photophores found on the following appendages (d = distal, p = proximal, Roman numerals indicate segments): eyestalk (1p+1d) A I (peduncle III - 1d), A II (peduncle I - 1p), Md (proper - 1d, palp I - 1d), Mx II (Exp - 1p), Mxp I (II - 1d, III - 1d), Mxp II (II - 1d, III - 1d, V - 1d, VI

Geographical distribution (Fig. 73): Indian Ocean only: northeastern part, off Sri Lanka and Sumatra ("Dana"; Burkenroad 1940), Bay of Bengal ("Galathea").

The occurrence of *S. stellata* is like that of the whole group (see remarks to the species group). *S. stellata* is nearly parapatric to *S. umitakae* and *S. oksanae* n. sp., which occur mainly west of Sri Lanka or east of Sumatra, while *S. stellata* generally lives between these areas. It is sympatric with *S. challengerii*, *S. fulgens*, and *S. talismani* and allopatric with *S. hansjacobi* and *S. jeppeseni* n. sp.

Vertical range: A benthopelagic species, migrating daily between the lateral continental-slope contact zone (Vereshchaka 1995a) and the epipelagic zone. "Dana" specimens were taken within the depth range 20-1200 m. Most specimens occur at 100-200 m at night and 500-1200 m during the day.

Sergia talismani (Barnard, 1946)

Figs. 80-82; Pls. 2B, 5C

Sergestes splendens Hansen, 1919: 18 [with remarks but without formal description, usually treated as nomen nudum]; 1920: 480 [formal description, usually considered preoccupied by *Sergestes splendens* Sund, 1920]; 1922: 121, pl. 7, fig. 2; 1927: 5. – Gordon 1935: fig. 2a. – Holthuis 1952b: 88.

Sergestes talismani Barnard, 1946: 384 [new name for *Sergestes splendens* Hansen, not Sund, 1920].

Sergestes (*Sergia*) *talismani*. – Yaldwyn 1957: 9. – Crosnier & Forest 1973: 325, figs. 111, 112. – Kensley 1977: 31.

Sergia talismani. – Omori 1974: 236. – Krygier & Wasmer 1988: 50. – Vereshchaka 1994a: 90; 1995a: 1651.

Material examined (? = identification uncertain): "Dana" stations: 1173-2 (1m 9^{1/2}); 1184-3 (1m 12); 1192-5 (3f 5-9^{1/2}); 1225-5 (1f 10); 1284-1 (1f 12 & 1m 12); 1285-1 (1m 5^{1/2}); 1286-2 (1f 5^{1/2} & 1m 8); 1287-1 (2f 5^{1/2}-6); 1288-2 (2f 5^{1/2}); 3545-4 (1f 8); 3604-1 (1m 13); 3764-1 (4f 5-6 & 1m 5); 3766-10 (1f 5); 3766-14 (1m 5); 3767-1 (14m 6-10 & 25f 4-6^{1/2}); 3767-2 (17f 4^{1/2}-7 & 14m 5^{1/2}-9^{1/2}); 3767-3 (9f 4^{1/2}-7 & 2m 6^{1/2}-7^{1/2}); 3767-4 (7f 5-8 &

8m 5-10^{1/2}); 3767-7 (5j 4^{1/2}-7^{1/2} & 1m 11); 3768-2 (2f 5^{1/2}); 3768-3 (1f 8 & 3m 7^{1/2}-8^{1/2}); 3775-2 (1f 5 & 2m 7^{1/2}-10); 3778-1 (17f 3^{1/2}-7 & 8m 3^{1/2}-6^{1/2}); ? 3805b (3m 7-8^{1/2}); ? 3812-2 (3f 5-7 & 3m 7-7^{1/2}); ? 3876-1 (1f 10 & 1m 10^{1/2}); 3937-1 (1m 9); 3941-1 (1m 7^{1/2}); 3949-1 (4f 5-11^{1/2} & 1m 10); 3949-2 (2m 6-7); 3953-1 (1f 8^{1/2} & 1m 8^{1/2}); ? 3956-1 (4f 5-6^{1/2}); ? 3969-5 (2f 5^{1/2}); ? 3975-9 (1m 9); ? 3975-10 (1f 6^{1/2} & 2m 6); 3994-1 (149f 5-8 & 92m 5-8^{1/2}); 3994-2 (2m 6^{1/2}-7^{1/2}); 3994-3 (1f 6^{1/2}); 3996-3 (2f 6 & 4m 6^{1/2}-7); 3996-5 (1f 6^{1/2} & 2m 5^{1/2}-6); 3996-9 (18f 5^{1/2}-10^{1/2} & 9m 5-8); 3996-10 (13f 5-7^{1/2} & 10m 5-7).

Five syntypes of *Sergestes splendens* Hansen: "Talisman" Exp., 1883, station 113 (1f 13^{1/2} & 4m 13-15) (MNHN Na 351).

"Atlantide" Exp. West Africa 1945-46, stations: 62 (8f 4-9 & 3m 8-8^{1/2}); 82 (3f 10-10^{1/2}); 120 (1f 10 & 3m 11-12); see station list in Bruun (1950) (ZMUC).

Type locality: Eastern North Atlantic, Cape Verde Islands, 16°52'N, 27°30'-27°31'W, 550-760 m [495-618 m on original label], 30 Jul. 1883.

Type material: About 40 [ca. 50 according to Hansen 1919: 480] male and female syntypes of *Sergestes splendens* Hansen [= syntypes of replacement name *Sergestes talismani* Barnard], "Talisman" station 113 (MNHN Na 351, some examined). Additional information: Jar labeled "*Sergestes splendens* Hansen, males and females, types for the description and figures" contains about 40 specimens in poor condition.

Diagnosis: Integument firm; rostrum acute and unidentate; cornea well pigmented, black, considerably wider than eyestalk; terminal segment of male A I peduncle without strong stout seta or process near distoventral end; clasping organ rudimentary; A I flagellum in male with segment 3 lacking tubercle and segment 4 lacking serrated bristles; scaphocerite with strong distal tooth overlapping blade; PV of petasma laterally curved at tip, LI well developed, not strongly curved, with tip directed ventrolaterally; LT bilobed, not greatly overlapping PV; LC overlapping other lobes and processes; LA overlapping LAc; photophores arranged in lateral row of 6 on Cp, row of 4 on scaphocerite, 1 medial organ and 1 distal organ on Up exopod, 1 basal organ on Up endopod.

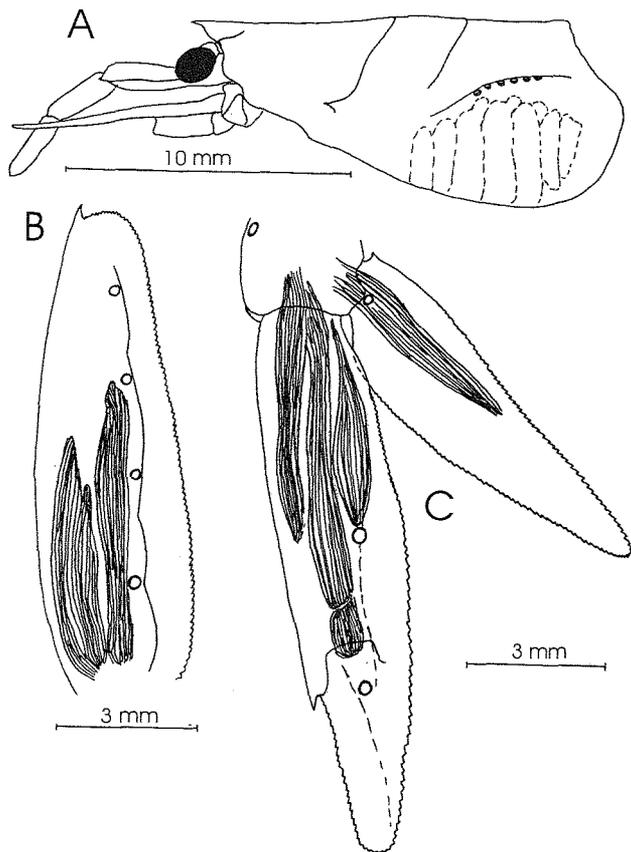


Fig. 80. *Sergia talismani*, male, "Dana" St. 1284-1, Cp length 12.0 mm. - A, lateral view of Cp. - B, scaphocerite. - C, Up.

Description: Cp 1.9 times as long as high and 0.42 times as long as abdomen; hepatic spine acute (Fig. 80A). Abdomen with somite VI 1.7 times as long as high and 1.4 times as long as telson; telson 3.3 times as long as wide.

Cornea well pigmented, black, 1.0 times as long as wide, 0.8 times as long and 2.5 times as wide as eyestalk. A I peduncle 0.7 times as long as Cp, with segments 2 and 3 0.63 and 0.50 times as long as segment 1, respectively; terminal segment of A I peduncle without strong stout seta or process on distoventral side; outer A I flagellum in male with segment 3 bearing very short finger-like protrusion and no tubercle and with segment 4 of flagellum lacking dorsal serrated bristles, covered with few setae (Fig. 81C). A II peduncle 0.4 times as long as scaphocerite; latter with strong distal tooth overlapping blade (Fig. 80B), 3.4 times as long as wide, 0.91 times as long as A I peduncle.

Md palp 0.33 times as long as Cp, with proximal segment 2.0 times as long as distal one. Mx I with palp 1.7 times as long as wide and 0.06 times as long as Cp; endopod 1.4 times as long as wide and 1.5 times as long as palp; endite 1.4 times as long

as wide and 0.9 times as long as palp. Mx II with exopod 5.6 times as long as wide and 0.29 times as long as Cp; palp 4.4 times as long as wide and 0.12 times as long as Cp; endopod 1.3 times as long as wide and 0.7 times as long as palp; endites subequal, 1.3 times as long as wide and 0.4 times as long as palp.

Mxp I with exopod 3.1 times as long as wide and 0.18 times as long as Cp; endopod 1.4 times as long as exopod; segments 2 and 3 1.1 and 2.4 times as long as segment 1, respectively. Mxp II 0.7 times as long as Cp, with merus 1.1, carpus and propodus 1.0, and dactyl 0.5 times as long as ischium. Mxp III 1.4 times as long as Cp, with merus, carpus and propodus 0.8, and dactyl 0.7 times as long as ischium; propodus and dactyl divided into 3 and 7 subsegments, respectively.

P I 1.0 times as long as Cp, with merus 3.0, carpus 1.7, and propodus 2.9 times as long as ischium; propodus divided into 9 subsegments. P II 1.5 times as long as Cp, with merus 3.5, carpus 2.8, propodus 3.1, and dactyl 0.2 times as long as ischium; propodus divided into 9 subsegments. P III 1.7 times as long as Cp, with merus 3.6, carpus 2.9, propodus 3.2, and dactyl 0.2 times as long as ischium; propodus divided into 9 subsegments. P IV 1.1 times as long as Cp, with merus 1.6, carpus 1.0, and propodus 1.2 times as long as ischium. P V 0.6 times as long as Cp, with merus 1.3, carpus 1.1, and propodus 0.8 times as long as ischium.

Somite VIII with arthrobranch 0.12 times as long as Cp and 2.8 times as long as epipod. Somite IX with anterior pleurobranch 0.17 times as long as Cp and 4.1 times as long as posterior pleurobranch.

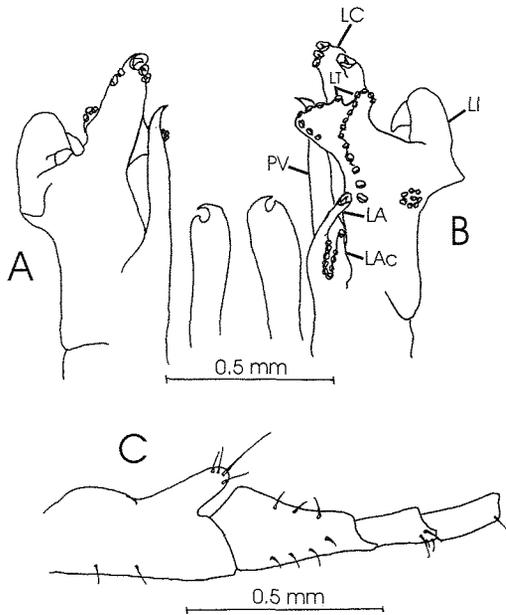


Fig. 81. *Sergia talismani*, male, "Dana" St. 1284-1, Cp length 12.0 mm. – A, caudal view of petasma. – B, oral view of petasma. – C, male outer A I flagellum.

Somite X with anterior pleurobranch 0.23 times as long as Cp and 5.4 times as long as posterior pleurobranch. Somite XI with anterior pleurobranch 0.27 times as long as Cp and 6.5 times as long as posterior pleurobranch. Somite XII with anterior pleurobranch 0.28 times as long as Cp and 6.3 times as long as posterior pleurobranch. Somite XIII with anterior pleurobranch 0.31 times as long as Cp and 1.2 times as long as posterior pleurobranch.

Pl I with basipod 0.28 times as long as Cp and exopod 2.3 times as long as basipod. Pl II with basipod 0.27 times as long as Cp; exopod 2.3 and endopod 1.4 times as long as basipod, respectively. Pl III with basipod 0.27 times as long as Cp; exopod 2.3 and endopod 1.5 times as long as basipod, respectively. Pl IV with basipod 0.27 times as long as Cp; exopod 2.1 and endopod 1.2 times as long as basipod, respectively. Pl V with basipod 0.27 times as long as Cp; exopod 1.7 and endopod 1.0 times as long as basipod, respectively.

Up with exopod 4.7 times as long as wide, 5.4 times as long as basipod and 0.7 times as long as Cp; endopod 3.8 times as long as wide and 0.7 times as long as exopod (Fig. 80C).

Petasma (Fig. 81A-B, Pl. 5C). PV tapering into sharp point, reaching end of LT, 3.7 times as long as wide. LI reaching end of LT, 1.8 times as long as

wide and 0.4 times as long as PV. LT thick, bilobed at end, 1.2 times as long as wide, 0.5 times as long as PV, armed with 2 rows of hooks, along dorsal margin and on distolateral side, and with few apical hooks on each of terminal lobules. LC 1.8 times as long as wide and 0.5 times as long as PV, armed with few apical hooks. LAc well developed, slender, 2.4 times as long as wide and 0.3 times as long as PV, armed with row of smaller hooks along proximoventral margin and single stronger apical hook. LA slender, 5.0 times as long as wide and 0.6 times as long as PV, armed with row of smaller hooks along proximoventral margin and single stronger apical hook.

Photophores. Cp: 6 in lateral row. Scaphocerite: 4 organs medial to inner strip of muscle from 0.2 to 0.8-0.9 blade length. Up exopod: 1 organ at middle near tip of inner muscle strip, at 0.4-0.5 exopod length, and 1 distal organ near end of apical muscle strip, at 0.7 exopod length. Up endopod: 1 organ near base.

Other body photophores, all ventral, found on the following somites (al = anterolateral, l = lateral, m = medial): II (1m), III (4l), labrum (1m+2l), IV (2m+2l), V (2m+2l), VI (2l), VII (2m+2l) VIII (1m+2l), IX (3m), X (3m), XI (3m), XII (3m), XIII (3m+2al (male)/4l (female)), XIV (4m+2al (male)/4l (female)), XV (6m+2l); XVI (6m+2l), XVII (6m+2l), XVIII (4m+2l), XIX (4m+2l), XX (5m+2al). Total (with those in Cp rows): 103 (in male) or 107 (in female).

Other photophores found on the following appendages (d = distal, m = medial, p = proximal, Roman numerals indicate segments): eyestalk (Ip+Id) A I (peduncle III - 1d), A II (peduncle I - 1p), Md (proper - 1d, palp I - 1d), Mx II (Exp - 1p), Mxp I (II - 1d, III - 1d), Mxp II (II - 1d, III - 1d, IV - 1p, V - 1d, VI - 1d), Mxp III (III - 1d, IV - 1d, V - 1d, VI - 1d), P I (II - 1d, IV - 1p+1d, V - 1d, VI - 1m), P II (III - 1p+1d, IV - 1d), P III (III - 1p+1d, IV - 1d, V - 1d), P IV (III - 1p+1d, IV - 1d), P V (III - 1p+1d, IV - 1d), Pl I - Pl V (I - 1p). Total (with those on scaphocerite and Up): 98.

Thus, the total number of observed photophores in all examined specimens ranges from 201 in males to 205 in females.

Remarks: The colour in life is shown in Pl. 2B. This species was first mentioned as *Sergestes splendens* n. sp. by Hansen (1919), but first described in detail in June 1920 by the same author. Just before

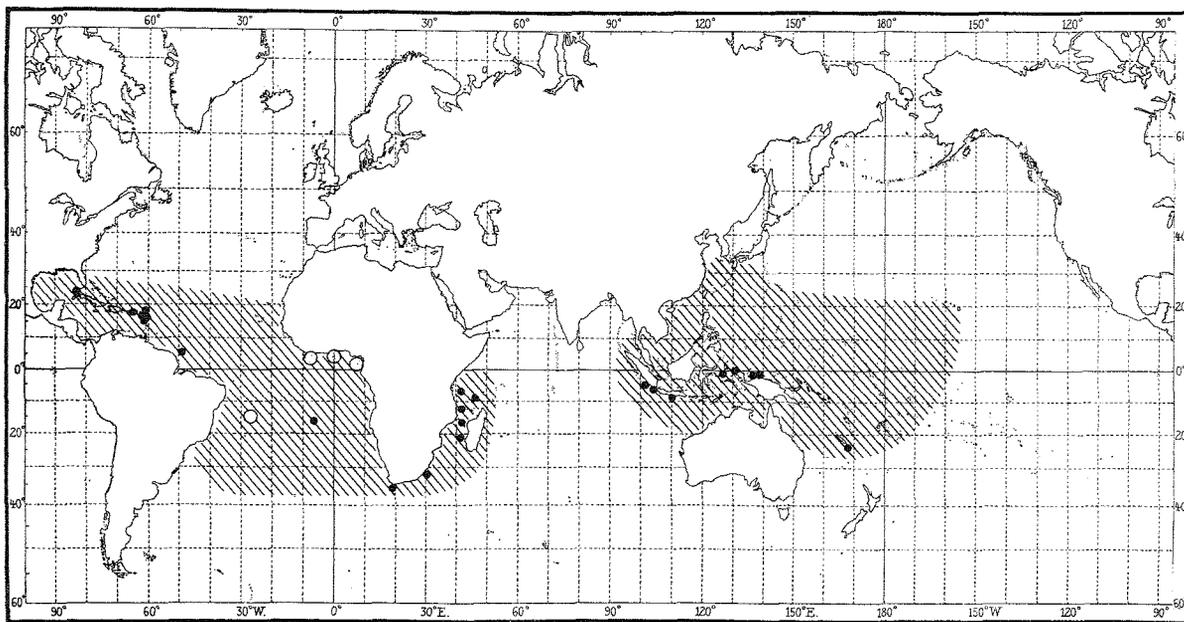


Fig. 82. Probable geographical distribution of *Sergia talismani*. Black symbols indicate "Dana" stations, white symbols "Talisman" and "Atlantide" stations. Shaded areas without symbols are supported by literature data.

Hansen's publication in June 1920, Sund (March 1920) published the description of another species of the genus *Sergestes* and named the new species *S. splendens*. In order to avoid the confusion thus created, Barnard (1946) proposed the new name *S. talismani* for Hansen's species. All the specimens examined agree well with the remarks and description by Hansen (1919, 1920, 1922) and show inconspicuous variability in the body proportions, degree of reduction of the clasp organ, fine structure of the petasma, and curvature of LI. The main peculiarity of *S. talismani*, placing it together with *S. jeppeseni* n. sp. and apart from all other known *Sergia* species, is related to the nearly complete reduction of the male clasp organ: the protrusion on segment 3 of the outer A I flagellum is very short and lacks any trace of a tubercle, while segment 4 has lost all sexual attributes (dorsal depression, serrated bristles) and looks rather like the usual segment. The photophore position is very similar to that in *S. challengerii* and *S. fulgens* and varies only in the minor patterns among which the presence of 6 (not 5) organs in the lateral Cp row is most remarkable. The number of photophores depends upon sex and exceeds that (although very insignificantly) in *S. challengerii* and *S. fulgens*, the former by 4.6%, the latter by 3.0%, in average.

Sergia talismani is closely related to *S. challengerii*,

S. fulgens, *S. oksanae* n. sp., and *S. stellata* (see affinities and differences in remarks to *S. challengerii*). It differs from all other species of the species group in having the end of LI curved and directed ventrolaterally. Other differences and affinities between *S. talismani* and all other species of the species group are shown in Table 7.

Geographical distribution (Fig. 82): Atlantic, Indian, and Pacific Oceans.

Atlantic: Caribbean Sea and near the northeast shore of South America ("Dana"; Vereshchaka 1994a), Cape Verde Islands (Hansen 1922), Gulf of Guinea ("Atlantide"), western part of South Atlantic ("Talisman"), off Guinea Bissau (Holthuis 1952b), Gabon, Congo, Cabinda, Northern Angola (Gordon 1935, Holthuis 1952b, Crosnier & Forest 1973).

Indian Ocean: Along the southern and western coasts of Africa ("Dana"; Kensley 1977), off Madagascar and Comores ("Dana"), Indo-West Pacific ("Dana").

Pacific: Off Tahiti ("Dana"), off Japan and Hawaii (Krygier & Wasmer 1988).

Thus, further examination of the "Dana II" collections has shown that this species is very widely distributed in the tropical zones of all oceans, as was shown earlier: in the Atlantic and Pacific Oceans (Vereshchaka 1994a), in the Indian Ocean

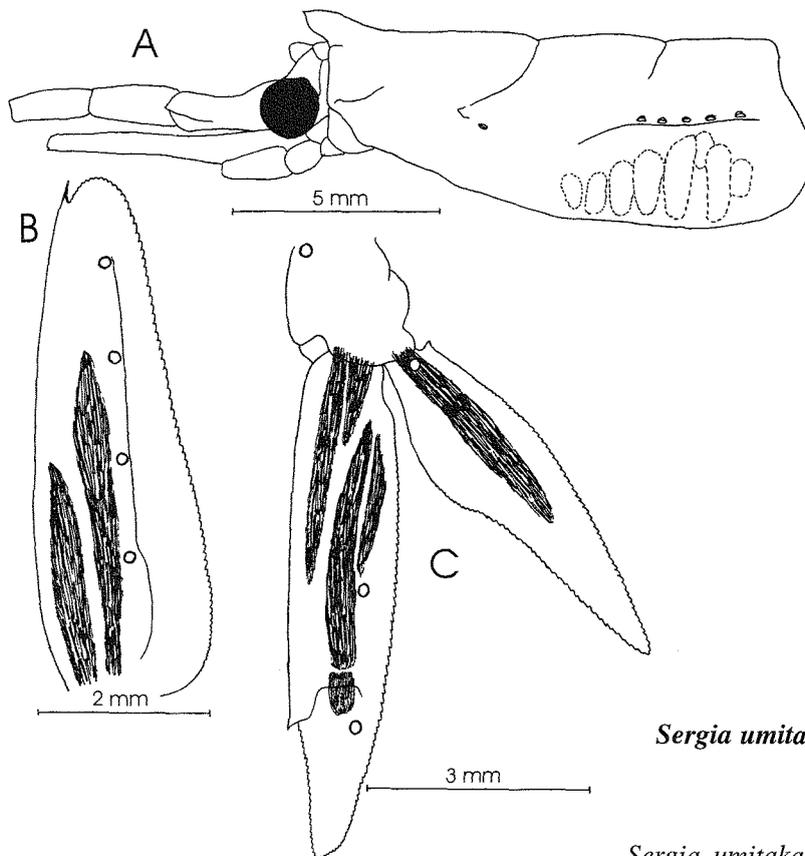


Fig. 83. *Sergia umitakae*, male, "Vityaz" St. 2578, Cp length 10.6 mm. – A, lateral view of Cp. – B, scaphocerite. – C, Up.

***Sergia umitakae* Hashizume & Omori, 1995**

Figs. 67, 83-84

(Vereshchaka 1994b). It occurs in at least two isolated areas; its absence in the Central Indian Ocean is very likely, as "Dana", "Galathea", and several Russian expeditions, working intensively in this area, took no specimens.

The occurrence of *S. talismani* is like that of the whole group (see remarks to the species group). It is nearly parapatric to *S. umitakae* and *S. stellata*, which are found in the Central Indian Ocean, while *S. talismani* lives in the western and eastern parts of this ocean. *S. talismani* is sympatric with *S. challengerii*, *S. fulgens*, *S. hansjacobi*, *S. oksanae* n. sp., and *S. jeppeseni* n. sp.

Vertical range: A benthopelagic species, migrating daily between the lateral continental-slope contact zone (Vereshchaka 1995a) and the epipelagic zone. "Dana" specimens were taken within the depth range 20-1200 m. Most specimens occur at 30-200 m at night and at about 700 m during the day. Vereshchaka (1994a), after examination of the lesser part of the *S. talismani* material from the "Dana I" collection only, reported on the greater depth of this species when taken at night, i.e., 200-500 m.

Sergia umitakae Hashizume & Omori, 1995: 72, figs. 1-4.

Sergia sp. nov. N1. – Vereshchaka 1990a: 41.

Sergia sp. 1. – Vereshchaka 1991: 5; 1994b: 63.

Sergia sp. n. 1. – Vereshchaka 1995a: 1651.

Material examined: "Galathea" St. 298 (1f 9¹/₂ & 2m 10¹/₂-11).

Russian R/V "Vityaz", Cruise 17, St.: 2575 (13f 7-11 & 16m 6¹/₂-11¹/₂), 2578 (23f 5¹/₂-9 & 21m 5-11¹/₂), 2604 (2f 9-10 & 2m 7¹/₂-9), 2605 (7f 7-12 & 6m 8-10¹/₂) 2787 (3f 10-10¹/₂), 2823 (11f 5¹/₂-9 & 13m 6-9¹/₂), 2826 (27f 7¹/₂-12¹/₂ & 21m 7-13), 2827 (21f 8-10 & 13m 9-11¹/₂).

Type locality: Indian Ocean, south off Sri Lanka, ca. 06°31.9'N, 081°56.5'E (coordinates courtesy of Dr. Hashizume).

Type material: Holotype male (NSMT-Cr 11495), allotype female (NSMT-Cr 11496), and 10 paratypes (NSMT, not examined).

Diagnosis: Integument firm; rostrum acute, uni- or bidentate; cornea well pigmented, black, considerably wider than eyestalk; terminal segment of male A I peduncle without stout seta or process near distoventral end; A I flagellum in male with

segment 3 bearing well developed tubercle overlapping segment 4 of flagellum and segment 4 bearing 8 serrated bristles on dorsal surface; scaphocerite with strong distal tooth reaching end of blade; PV of petasma curved laterally at tip; LI well developed, strongly curved, tip directed laterally; LT not bilobed, not overlapping PV; LC not overlapping other lobes and processes; LA overlapping LAc; photophores arranged in lateral row of 4-5 on Cp, row of 4 on scaphocerite, 1 medial and 1 distal organ on Up exopod, 1 basal organ on Up endopod.

Description: Cp 2.1 times as long as high and 0.37 times as long as abdomen; hepatic spine blunt (Fig. 83A). Abdomen with somite VI 1.6 times as long as high and 1.3 times as long as telson; telson 3.7 times as long as wide.

Cornea 1.2 times as long as wide, 0.9 times as long and 1.5 times as wide as eyestalk. A I peduncle 0.7 times as long as Cp, with segments 2 and 3 0.53 and 0.59 times as long as segment 1, respectively; terminal segment of A I peduncle without strong stout seta or prominent process on distoventral side; outer A I flagellum in male with segment 3 bearing well developed tubercle overlapping segment 4 of flagellum and with segment 4 subdivided and bearing 8 serrated bristles on dorsal surface and several setae on ventral surface (Fig. 84C). A II peduncle 0.5 times as long as scaphocerite; latter with strong distal tooth reaching end of blade (Fig. 83B), 3.2 times as long as wide, 0.83 times as long as A I peduncle.

Md palp 0.34 times as long as Cp, with proximal segment 1.8 times as long as distal one. Mx I with palp 1.7 times as long as wide and 0.06 times as long as Cp; endopod 1.6 times as long as wide and 1.6 times as long as palp; endite 1.3 times as long as wide and 0.8 times as long as palp. Mx II with exopod 3.2 times as long as wide and 0.32 times as long as Cp; palp 4.1 times as long as wide and 0.12 times as long as Cp; endopod 1.8 times as long as wide and 0.9 times as long as palp; endites subequal, 1.8 times as long as wide and 0.4 times as long as palp.

Mxp I with exopod 2.5 times as long as wide and 0.16 times as long as Cp; endopod 1.7 times as long as exopod; segments 2 and 3 1.3 and 1.1 times as long as segment 1, respectively. Mxp II 0.8 times as long as Cp, with merus 1.1, carpus 1.2, propodus 1.1, and dactyl 0.6 times as long as ischium. Mxp III 1.3 times as long as Cp, with merus 0.7, carpus

0.8, propodus 0.7, and dactyl 0.6 times as long as ischium; subdivision of propodus and dactyl uncertain.

P I 1.0 times as long as Cp, with merus 2.2, carpus 1.5, and propodus 2.5 times as long as ischium; subdivision of propodus uncertain. P II 1.5 times as long as Cp, with merus 3.0, carpus 2.5, propodus 3.2, and dactyl 0.2 times as long as ischium; subdivision of propodus uncertain. P III 1.8 times as long as Cp, with merus 3.0, carpus 2.1, propodus 2.9, and dactyl 0.2 times as long as ischium; subdivision of propodus uncertain. P IV 1.0 times as long as Cp, with merus 1.4, carpus 1.0, and propodus 1.2 times as long as ischium. P V 0.7 times as long as Cp, with merus 1.2, carpus 1.0, and propodus 0.8 times as long as ischium.

Somite VIII with arthrobranch 0.12 times as long as Cp and 3.2 times as long as epipod. Somite IX with anterior pleurobranch 0.18 times as long as Cp and 4.3 times as long as posterior pleurobranch. Somite X with anterior pleurobranch 0.22 times as long as Cp and 4.7 times as long as posterior pleurobranch. Somite XI with anterior pleurobranch 0.27 times as long as Cp and 5.6 times as long as posterior pleurobranch. Somite XII with anterior pleurobranch 0.38 times as long as Cp and 3.3 times as long as posterior pleurobranch. Somite XIII with anterior pleurobranch 0.21 times as long as Cp and 1.6 times as long as posterior pleurobranch.

Pl I with basipod 0.31 times as long as Cp and exopod 2.1 times as long as basipod. Pl II with basipod 0.29 times as long as Cp; exopod 2.3 and endopod 1.4 times as long as basipod, respectively. Pl III with basipod 0.29 times as long as Cp; exopod 2.2 and endopod 1.4 times as long as basipod, respectively. Pl IV with basipod 0.29 times as long as Cp; exopod 2.0 and endopod 1.2 times as long as basipod, respectively. Pl V with basipod 0.26 times as long as Cp; exopod 1.7 and endopod 1.0 times as long as basipod, respectively.

Up with exopod 4.9 times as long as wide, 5.9 times as long as basipod and 0.7 times as long as Cp; endopod 3.6 times as long as wide and 0.7 times as long as exopod (Fig. 83C).

Petasma (Fig. 84A-B). PV tapering into sharp point, overreaching LT, 4.7 times as long as wide, tip curved and directed laterally. LI overlapping LT, 3.3 times as long as wide and 0.3 times as long as PV if straightened. LT entire at end, not reaching end of PV, 2.2 times as long as wide, 0.4 times as

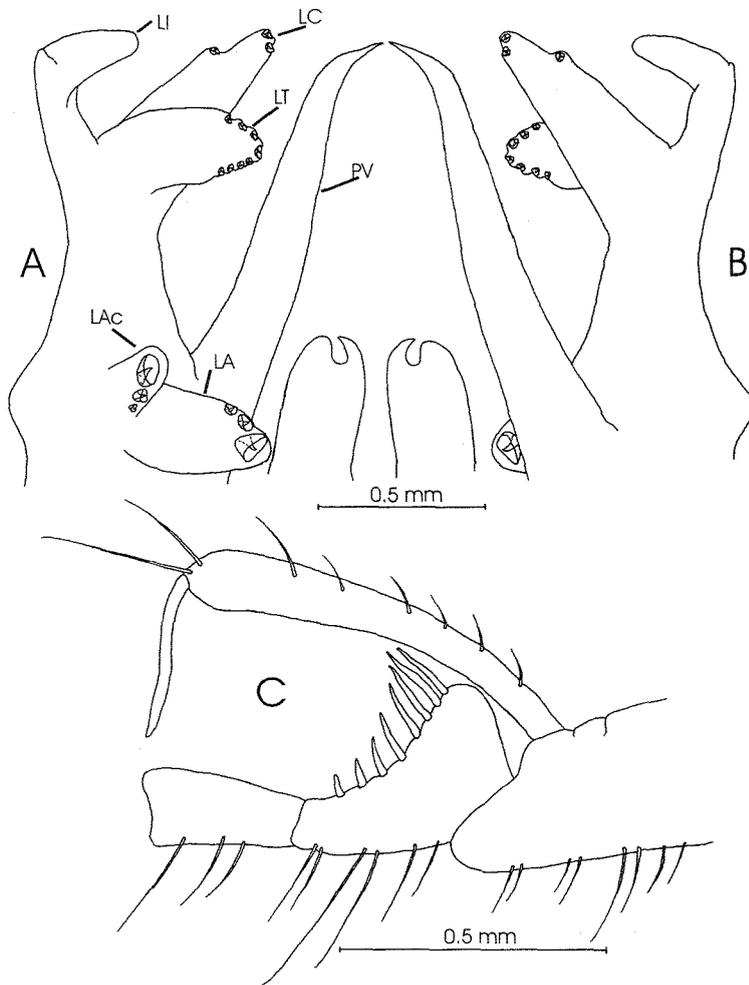


Fig. 84. *Sergia umitakae*, male, "Vityaz" St. 2578, Cp length 10.6 mm. – A, oral view of petasma. – B, caudal view of petasma. – C, male outer A I flagellum.

long as PV, armed with several distal hooks. LC overlapping LT and reaching end of PV and LI, 2.1 times as long as wide and 0.4 times as long as PV, armed with few apical hooks and 1 subapical hook. LAc small, 1.2 as long as wide and 0.1 times as long as PV, armed with few smaller subapical hooks and 1 strong apical hook. LA straight and slender, 1.7 times as long as wide and 0.3 times as long as PV, armed with few smaller subapical hooks and 1 strong apical hook.

Photophores. Cp: 4-5 in lateral row. Scaphocerite: 4 organs medial to inner strip of muscle from 0.2-0.3 to 0.8-0.9 blade length. Up exopod: 1 organ at middle near tip of inner muscle strip, at 0.4-0.5 exopod length and 1 distal organ near end of apical muscle strip, at 0.7-0.8 exopod length. Up endopod: 1 organ near base.

Other body photophores, all ventral, found on the following somites (al = anterolateral, l = lateral, m = medial, pm = posteromedial): II (1m), III (4l), labrum (1m+2l), IV (2m+2l), V (2m+2l), VI (2l),

VII (2m+2l) VIII (1m+2l), IX (3m), X (3m), XI (3m), XII (3m), XIII (3m+2al), XIV (4pm+2al), XV (4m+2l); XVI (6m+2l), XVII (6m+2l), XVIII (4m+2l), XIX (4m+2l), XX (5m+2al). Total (with those in Cp rows): 97-99 organs.

Other photophores found on the following appendages (d = distal, p = proximal, Roman numerals indicate segments): eyestalk (1p+1d) A I (peduncle III - 1d), A II (peduncle I - 1p), Md (proper - 1d, palp I - 1d), Mx II (Exp - 1p), Mxp I (II - 1d, III - 1d), Mxp II (II - 1d, III - 1d, IV - 1p, V - 1d, VI - 1d), Mxp III (II - 1d, III - 1d, IV - 1d, V - 1d, VI - 1d), P I (III - 1p, IV - 1p+1d, V - 1d), P II (III - 1p+1d, IV - 1d), P III (III - 1p+1d, IV - 1d, V - 1d), P IV (III - 1p+1d, IV - 1d), P V (III - 1p+1d, IV - 1d), Pl I - Pl V (I - 1p). Total (with those on scaphocerite and Up): 98 organs.

The total number of observed photophores in all examined specimens ranges from 195 to 197 organs.

Remarks: This species was first found in 1988 during the Russian 17th cruise of the R/V "Vityaz" and has been referred to in several of my papers in Russian (e.g., Vereshchaka 1990a, 1991 and English (Vereshchaka 1994b, 1995a) as a new or unidentified species of *Sergia* (see synonymy). Having plans of preparing a general revision of the genus, I decided to include the original description in this revision instead of publishing a brief description of one more new species of this extensive genus. In 1993, K. Hashizume and M. Omori found the same species in the material of the Japanese 55th cruise of the T/S "Umitaka-Maru". They sent me sketches of the petasma and several other organs, asking whether this species belonged to one of the "Dana" species described by Burkenroad. I replied that this was not the case but that it was identical to mine, sampled in 1988. I proposed a joint publication, but Hashizume and Omori preferred to publish the description in a Japanese journal without delay (Hashizume & Omori 1995).

Hashizume & Omori (1995) report a bidentate rostrum (usually unidentate in my specimens) and 4 photophores in the lateral Cp row (I counted in adults mainly 5 organs, although the medial one is smaller and harder to see). Furthermore, minor proportions of the branchial lobes, appendages, and lobes and processes of the petasma differ (although LT never overlaps PV, LA is always stronger and overlaps LAc).

In the position and total number of photophores, *S. umitakae* is very close to all other species of the species group. It has a greater total number of luminescent organs than *S. challengerii* (1.0% more in average) and *S. stellata* (0.5% more in average); all other species have more photophores than *S. umitakae*, from 0.5% more (*S. fulgens*) to 6.6% more (*S. jeppeseni*), in average.

Sergia umitakae differs from all other species of the species group in (1) undivided LT of petasma, (2) LI strongly curved at about 1/2 length, and (3) segment 3 of male outer A I flagellum with tubercle long, overlapping segment 4 of flagellum. Other differences and affinities between *S. umitakae* and all other known species of the species group are shown in Table 7.

Geographical distribution (Fig. 67): Indian Ocean only: Northwestern part, off Sokotra, Madagascar, over Saya-da-Malya Bank ("Vityaz";

Vereshchaka 1995a); "south off Sri Lanka" (Hashizume & Omori 1995).

The occurrence of *S. umitakae* is like that of the whole group (see remarks to the species group). It is nearly parapatric to *S. challengerii*, *S. talismani*, *S. stellata* and *S. jeppeseni* n. sp., which occur mainly west of 45°E or east of Sri Lanka, while *S. umitakae* lives between these areas. It is sympatric with *S. fulgens* and allopatric to *S. hansjacobi* and *S. oksanae* n. sp.

Vertical range: A benthopelagic species, migrating daily between the lateral continental-slope contact zone (Vereshchaka 1995a) and lateral mesopelagic zone. "Vityaz" specimens were taken within the depth range 100-700 m. Most specimens occur at 300-400 m at night and at 400-700 m during the day.

Sergia lucens species group

Diagnosis: Lens-bearing photophores (total of 138-162 organs) present: 2-3 in single lateral Cp row, 2-3 on scaphocerite, 1-2 on Up exopod; hepatic spine blunt; postdorsal spine on VI abdominal somite present; ocular papilla absent; clasping organ with 4-6 serrated bristles; endopod of Mxp I with 3 segments; posterior branchial lobe above P III reduced but not lamellar. Petasma with PV extremely elongated, bearing hooks; LI and LA absent or rudimentary.

Species included: *Sergia crosnieri* n. sp., *S. lucens* (Hansen, 1922).

Remarks: Dr. N. Iwasaki, Japan, kindly sent me sketches of the petasma and clasping organ of specimens that he is going to describe as a new species. The sketches indicate that this new species belongs to the *Sergia lucens* species group.

Key to species of the *Sergia lucens* species group

1. Rostrum usually bidentate. Scaphocerite, Up exopod and Up endopod with 3, 3, and 2 photophores, respectively. Male outer A I flagellum with segment 3 bearing tubercle overlapping segment 4 and segment 4 bearing 5-6 serrated bristles on dorsal surface. PV of petasma with numerous hooks; LT

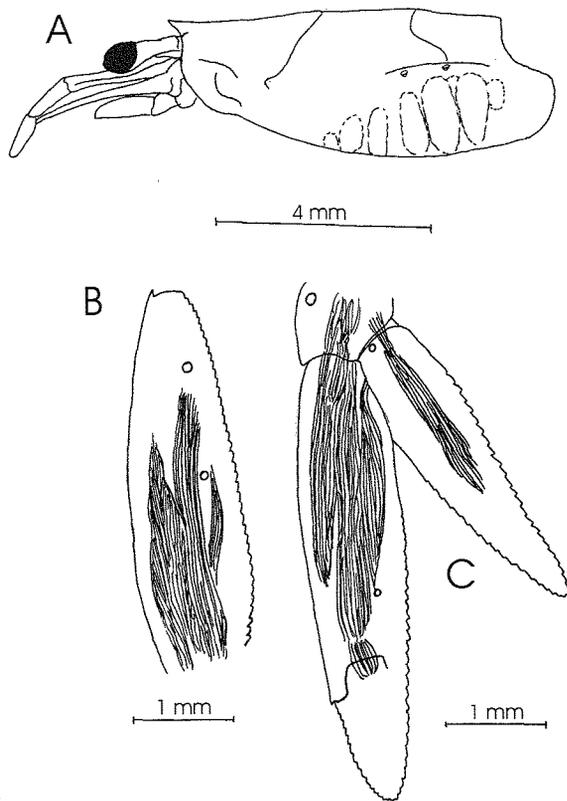


Fig. 85. *Sergia crosnieri* n. sp., holotype, male, "Dana" St. 3809-4, Cp length 5.7 mm. – A, lateral view of Cp. – B, scaphocerite. – C, Up.

directed distolaterally; LC developed
 *Sergia lucens*
 – Rostrum usually unidentate. Scaphocerite, Up exopod and Up endopod with 2, 2, and 1 photophores, respectively. Male outer A I flagellum with segment 3 bearing tubercle not overlapping segment 4 and segment 4 bearing 3-4 serrated bristles on dorsal surface. PV of petasma with single apical hook; LT directed distally; LC rudimentary *Sergia crosnieri* n. sp.

***Sergia crosnieri* n. sp.**

Figs. 85-87

Material examined: "Dana" stations: 3684-8 (1f 5); 3687-3 (34f 3¹/₂-6¹/₂ & 20m 4-6); 3688-4 (1f 6¹/₂); 3689-3 (1f 4 & 2m 4-5¹/₂); 3733-2 (13j 3-4¹/₂); 3809-2 (23f 4-6 & 25m 4-6); 3809-3 (23f 4-7 & 14m 4¹/₂-6); 3809-4 (29f 4-7 & 10m 4-6¹/₂); 3814-2 (1m 5); 3891-3 (1f 6); 3891-4 (4m 4¹/₂-6); 3893-3 (4f 4-6¹/₂ & 1m 5); 3893-8 (4f 5-7¹/₂); 3893-9 (8f 5-

6¹/₂ & 6m 5-6); 3894-2 (1f 7¹/₂); 3894-3 (1f 6); 3897-4 (1f 6 & 1m 5¹/₂); 3899-2 (1m 5).

Holotype: male (Cp length 5.7 mm, ZMUC CRU 3617), "Dana" St. 3809-4, 50 mw, sampled 04 Sept. 1929.

Paratype: female (Cp length 6.8 mm, ZMUC CRU 3618), same sample as holotype.

Type locality: Off Indonesian islands, 6°22'S, 105°12'E.

Type material: Holotype + 1 paratype (ZMUC, see above).

Diagnosis: Integument firm; rostrum acute, unidentate; cornea well pigmented, black, considerably wider than eyestalk; outer A I flagellum in male with segment 3 bearing well developed tubercle reaching end of segment 4 of flagellum and with segment 4 bearing 4 serrated bristles on dorsal surface; scaphocerite with distal tooth reaching end of blade; PV extremely developed, overlapping other lobes and processes, armed with single apical hook; LT directed distally; LC rudimentary; 2 photophores in lateral Cp rows, 2 organs on scaphocerite, 1 organ on Up exopod, and 1 organ on Up endopod.

Description: Cp 2.0 times as long as high and 0.38 times as long as abdomen (Fig. 85A). Abdomen with somite VI 1.7 times as long as high and 1.4 times as long as telson; telson 3.3 times as long as wide.

Cornea 1.0 times as long as wide, 0.5 times as long and 1.3 times as wide as eyestalk. A I peduncle 0.7 times as long as Cp, with segments 2 and 3 0.43 and 0.45 times as long as segment 1, respectively; segment 3 of outer A I flagellum in male with tubercle reaching end of segment 4 of flagellum, segment 4 of flagellum bearing 4 serrated bristles and few setae on dorsal surface and several setae on ventral surface (Fig. 86C). A II peduncle 0.5 times as long as scaphocerite; latter with distal tooth reaching end of blade (Fig. 85B), 3.3 times as long as wide, 0.83 times as long as A I peduncle.

Md palp 0.31 times as long as Cp, with proximal segment 1.9 times as long as distal. Mx I with palp 2.3 times as long as wide and 0.04 times as long as Cp; endopod 1.4 times as long as wide and 1.7 times as long as palp; endite 1.8 times as long as wide and 1.1 times as long as palp. Mx II with exo-

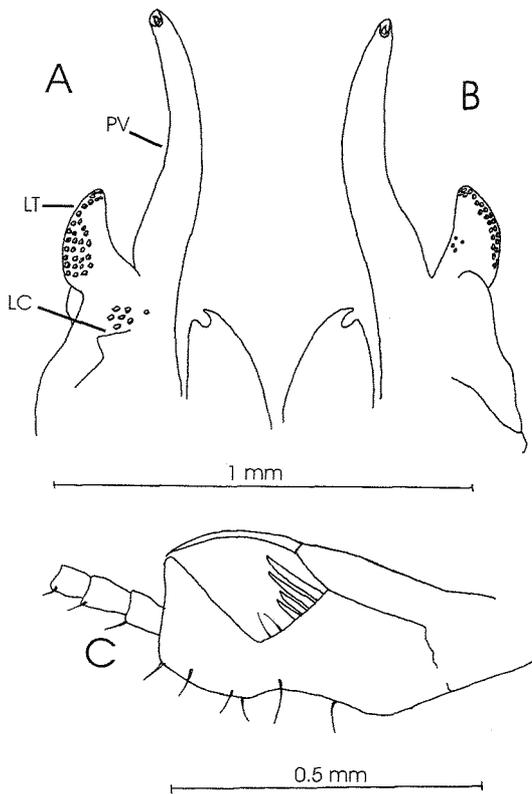


Fig. 86. *Sergia crosnieri* n. sp., holotype, male, "Dana" St. 3809-4, Cp length 5.7 mm. — A, oral view of petasma. — B, caudal view of petasma. — C, male outer A I flagellum.

pod 3.0 times as long as wide and 0.27 times as long as Cp; palp 3.0 times as long as wide and 0.05 times as long as Cp; endopod 1.2 times as long as wide and 1.1 times as long as palp; endites subequal, 1.5 times as long as wide and 0.4 times as long as palp.

Mxp I with exopod 2.8 times as long as wide and 0.13 times as long as Cp; endopod 1.3 times as long as exopod; segments 2 and 3 1.2 and 1.3 times as long as segment 1, respectively. Mxp II 0.7 times as long as Cp, with merus 1.0, carpus 0.9, propodus 0.8, and dactyl 0.4 times as long as ischium. Mxp III 1.1 times as long as Cp, with merus 0.6, carpus and propodus 0.7, and dactyl 0.5 times as long as ischium; subsegmentation of propodus and dactyl uncertain.

P I 1.0 times as long as Cp, with merus 2.0, carpus 1.1, and propodus 2.0 times as long as ischium; subdivision of propodus uncertain. P II 1.4 times as long as Cp, with merus 2.9, carpus 2.3, propodus 2.7, and dactyl 0.1 times as long as ischium; subdivision of propodus uncertain. P III 1.7 times as long as Cp, with merus 2.9, carpus 2.3, propodus 2.6,

and dactyl 0.1 times as long as ischium; subdivision of propodus uncertain. P IV 1.1 times as long as Cp, with merus 1.5, carpus 0.9, and propodus 1.0 times as long as ischium. P V 0.6 times as long as Cp, with merus 1.0, carpus 0.7, and propodus 0.6 times as long as ischium.

Somite VIII with arthrobranch 0.05 times as long as Cp and 4.0 times as long as epipod. Somite IX with anterior pleurobranch 0.13 times as long as Cp and 5.6 times as long as posterior pleurobranch. Somite X with anterior pleurobranch 0.17 times as long as Cp and 4.8 times as long as posterior pleurobranch. Somite XI with anterior pleurobranch 0.18 times as long as Cp and 4.0 times as long as posterior pleurobranch. Somite XII with anterior pleurobranch 0.19 times as long as Cp and 3.2 times as long as posterior pleurobranch. Somite XIII with anterior pleurobranch 0.14 times as long as Cp and 1.2 times as long as posterior pleurobranch.

Pl I with basipod 0.32 times as long as Cp and exopod 2.0 times as long as basipod. Pl II-III with basipod 0.29 times as long as Cp; exopod 2.0 and endopod 1.2 times as long as basipod, respectively. Pl IV with basipod 0.27 times as long as Cp; exopod 1.9 and endopod 1.3 times as long as basipod, respectively. Pl V with basipod 0.24 times as long as Cp; exopod 1.7 and endopod 1.1 times as long as basipod, respectively.

Up with exopod 4.4 times as long as wide, 5.5 times as long as basipod and 0.6 times as long as Cp; endopod 3.9 times as long as wide and 0.7 times as long as exopod (Fig. 85C).

Petasma (Fig. 86A-B). PV very long, 5.4 times as long as wide. LT well developed, 1.7 times as long as wide and 0.4 times as long as PV, covered with numerous hooks on medial surface. LC as small tubercle and several small hooks proximal to base of LT.

Photophores. Cp: 2 in lateral rows. Scaphocerite: 2 organs at level of inner muscle strip at 0.4-0.5 and at 0.7-0.8 blade length. Up exopod: 1 organ at tip of inner muscle strips, at 0.5 exopod length. Up endopod: 1 organ near base.

Other body photophores, all ventral, found on the following somites (al = anterolateral, am = antero-medial, l = lateral, m = medial): II (1m), III (1m+4l), labrum (1m+2l), IV (2m+2l), V (2m+2l), VI (2l), VII (2m+2l) VIII (1m+2l), IX (3m (female)/1m (male)), X (1m), XI (1m), XII (1am+3m+2l), XIII (1am+3m+2al), XIV (4m+2l),

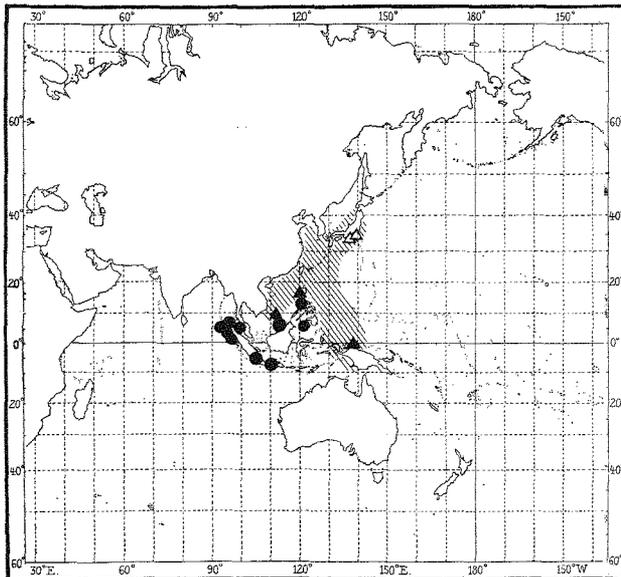


Fig. 87. Probable geographical distribution of *Sergia crosnieri* n. sp. (circles) and *S. lucens* (triangles, fine hatching). Black symbols indicate "Dana" stations, white triangles Th. Mortensen Exp. and "Tenyo Maru" stations.

XV (3m+2l); XVI (5m+2l), XVII (3m+2l), XVIII (3m+2l), XIX (3m+2l), XX (4m). Total (with those in Cp rows): 84 (female) or 82 (male).

Other photophores found on the following appendages (d = distal, p = proximal, Roman numerals indicate segments): eyestalk (1p+1d) A I (peduncle III - 1d), A II (peduncle I - 1p), Md (proper - 1d, palp I - 1d), Mxp II (II - 1d, III - 1d, V - 1d, VI - 1d), Mxp III (II - 1d, III - 1d, IV - 1d, V - 1d, VI - 1d), P II (III - 1p), P III (III - 1p+1d), Pl I - Pl V (1p). Total (with those on scaphocerite and Up): 56.

Thus, the total number of observed photophores in all examined specimens ranges from 138 in males to 140 in females.

Remarks: All the "Dana" specimens show very low variability in the characters studied; even the fine structure of the petasma and the number and position of the photophores remain almost the same. This species represents the last stage of regression in the structure of the petasma and the number of photophores. Whereas *S. lucens* possesses numerous hooks on the PV, a very rudimentary LA, and well developed LC, *S. crosnieri* n. sp. lacks all hooks (except a single terminal one) on PV, all traces of the LA, and has only a rudimentary LC. The number of photophores in *S. crosnieri* is also 15% less than that in *S. lucens*.

Sergia crosnieri is closely related to *S. lucens*. Both share all common characters of the species group, among which the most important are: (1)

lens-bearing photophores as in the *Sergia prehen-silis* and *S. challengeri* species groups, but much less abundant (2-3 on the scaphocerite, 1-2 on the Up exopod, 2-3 in single lateral Cp row), (2) clasping organ with few serrated bristles (4-5 instead of 0 or 8-12 in the *S. challengeri* species group), (3) very simplified petasma with LI and LA absent, (4) PV extremely elongated, bearing hooks.

Sergia crosnieri differs from *S. lucens* in the following characters: (1) rostrum unidentate (not bidentate), (2) male outer A I flagellum with tubercle not overlapping segment 4 of flagellum and (3) segment 4 bearing 4 (not 5) serrated bristles on dorsal side, (4) branches smaller, (5) 2 (not 3) photophores in lateral Cp row, (6) 2 (not 3) photophores on the scaphocerite, (7) 1 (not 2) photophores on Up exopod, (8) almost disarmed (except for single apical hook) PV, (9) LT directed distally (not distolaterally), (10) LC rudimentary, (11) absence of any trace of LA, and other minor features concerning number and position of the photophores on the body, proportions of body appendages and of lobes and processes of the petasma.

Etymology: This species is named after Dr. Alain Crosnier, who has devoted his life to studies of Decapoda and has made important contributions to our knowledge of the dendrobranchiate shrimps.

Geographical distribution (Fig. 87): Indo-West Pacific only: Off Java and Sumatra, off Borneo, off the Philippines ("Dana").

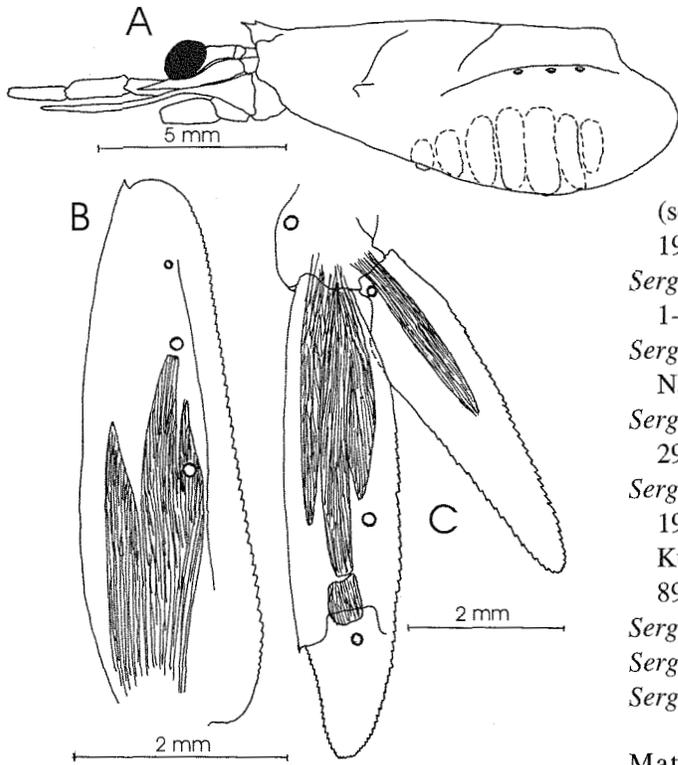


Fig. 88. *Sergia lucens*, male, Th. Mortensen Exp. St. in Suruga Bay, 01 Jun 1914, Cp length 9.7 mm. – A, lateral view of Cp. – B, scaphocerite. – C, Up.

Sergia crosnieri occurs in but a single area. This species seems to be biologically similar to *S. lucens*, being probably also a typical benthopelagic species, occurring mainly over the continental slopes, although a few specimens may be spread in the lateral layers above the deep sea. It is probable that within the hatched area there are numerous populations of this species over the shelf. *S. crosnieri* and *S. lucens* are nearly parapatric.

Vertical range: A benthopelagic species, migrating daily between the upper continental-slope contact zone (Vereshchaka 1995a) and the epipelagic zone. Specimens were taken within the depth range 20–700 m. Most occur at 20–30 m at night and at about 700 m during the day. This species is very scarce during the day samples, suggesting that the shrimp forms aggregations in a very narrow near-bottom layer, which is usually not sampled.

Sergia lucens (Hansen, 1922)

Figs. 87–89, Pl. 4E

Sergestes phosphoreus Kishinouye, [19??] [reference from Omori 1969: original paper not found by him, date unknown, cited by Nakazawa 1915

(see below)]; 1928: 125, fig. 1. – Nakazawa 1932a: 31; 1933: 365.

Sergestes phosphoreus ? – Nakazawa 1915: 1, figs. 1–5.

Sergestes prehensilis Bate or *Sergestes kishinouyei* Nakazawa & Terao, 1915: 622, figs. 1–16.

Sergestes prehensilis. – Terao 1916: 220; 1917: 299. – Yokoya 1933: 12. [Not Bate, 1881.]

Sergestes lucens Hansen, 1922: 38, 121. – Gordon 1935: 310, figs. 1, 3, 5. – Huzita; 1959: 235. – Kubo 1960: 113, pl. 56, fig. 6; 1965: 595, fig. 893. – Omori 1969: 1, figs. 3–22.

Sergestes kishinouyei. – Okada 1935: 699.

Sergestes (Sergia) lucens. – Yaldwyn 1957: 9.

Sergia lucens. – Krygier & Wasmer 1988: 50.

Material examined: “Dana” stations: 3689–2 (1m 5); 3733–2 (1f 6 & 1m 7); 3767–2 (1m 6).

Dr. Th. Mortensen’s Pacific Exp. 1914–15: plankton sample from Suruga Bay, collected 01.04.1914 (16f 9–12 & 5m 9–10^{1/2}).

“Tenyo-Maru” Exp.: sample of 02.11.1952 at 35°03’N, 138°36’E (1m 7).

Type locality: Suruga Bay, Japan.

Type material: The holotype of *Sergestes phosphoreus* could not be found in Japanese museums.

Diagnosis: Integument firm; rostrum acute, usually bidentate; cornea well pigmented, black, considerably wider than eyestalk; outer A I flagellum in male with segment 3 bearing well developed tubercle overlapping segment 4 of flagellum and with segment 4 bearing 5–6 serrated bristles on dorsal surface; scaphocerite with distal tooth reaching end of blade; PV extremely developed, overlapping other lobes and processes, armed with numerous hooks; LT directed distolaterally; LC overlapping LT; 3 photophores in lateral Cp rows, 3 organs on scaphocerite, 2 organs on Up exopod, and 1 organ on Up endopod.

Description: Cp 2.0 times as long as high and 0.36 times as long as abdomen (Fig. 88A), hepatic spine present. Abdomen with somite VI 1.6 times as

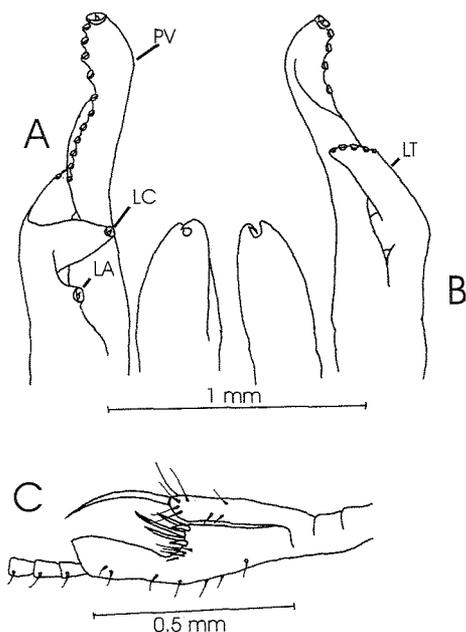


Fig. 89. *Sergia lucens*, male, Th. Mortensen Exp. St. in Suruga Bay, 01 Jun 1914, Cp length 9.7 mm. – A, oral view of petasma. – B, caudal view of petasma. – C, male outer A I flagellum.

long as high and 1.4 times as long as telson; telson 3.3 times as long as wide.

Cornea 0.8 times as long as wide, 0.8 times as long and 1.3 times as wide as eyestalk. A I peduncle 0.7 times as long as Cp, with segments 2 and 3 0.45 and 0.43 times as long as segment 1, respectively; segment 3 of outer A I flagellum in male with tubercle overlapping segment 4 of flagellum; flagellar segment 4 bearing 5–6 serrated bristles and few setae on dorsal surface and several setae on ventral surface (Fig. 89C). A II peduncle 0.4 times as long as scaphocerite; latter with distal tooth reaching end of blade (Fig. 88B), 3.3 times as long as wide, 0.83 times as long as A I peduncle.

Md palp 0.33 times as long as Cp, with proximal segment 1.8 times as long as distal one. Mx I with palp 2.7 times as long as wide and 0.06 times as long as Cp; endopod 1.8 times as long as wide and 1.8 times as long as palp; endite 1.8 times as long as wide and 0.9 times as long as palp. Mx II with exopod 3.0 times as long as wide and 0.30 times as long as Cp; palp 3.8 times as long as wide and 0.11 times as long as Cp; endopod 1.6 times as long as wide and 0.9 times as long as palp; endites subequal, 1.7 times as long as wide and 0.4 times as long as palp.

Mxp I with exopod 2.2 times as long as wide and

0.15 times as long as Cp; endopod 1.8 times as long as exopod; segments 2 and 3 0.8 and 0.9 times as long as segment 1, respectively. Mxp II 0.7 times as long as Cp, with merus 1.1, carpus and propodus 1.0, and dactyl 0.5 times as long as ischium. Mxp III 1.4 times as long as Cp, with merus 0.8, carpus 0.9; propodus and dactyl 0.8 times as long as ischium, propodus and dactyl divided into 3 and 5 subsegments, respectively.

P I 1.1 times as long as Cp, with merus 2.7, carpus 1.5, and propodus 2.6 times as long as ischium; propodus divided into 7 subsegments. P II 1.5 times as long as Cp, with merus 3.2, carpus 2.5, propodus 3.1, and dactyl 0.2 times as long as ischium; propodus divided into 8 subsegments. P III 1.8 times as long as Cp, with merus 2.7, carpus 2.4, propodus 2.7, and dactyl 0.2 times as long as ischium; propodus divided into 9 subsegments. P IV 1.1 times as long as Cp, with merus 1.5, carpus and propodus 0.9 times as long as ischium. P V 0.6 times as long as Cp, with merus 1.0, carpus 0.7, and propodus 0.5 times as long as ischium.

Somite VIII with arthrobranch 0.14 times as long as Cp and 2.7 times as long as epipod. Somite IX with anterior pleurobranch 0.23 times as long as Cp and 4.6 times as long as posterior pleurobranch. Somite X with anterior pleurobranch 0.25 times as long as Cp and 5.0 times as long as posterior pleurobranch. Somite XI with anterior pleurobranch 0.29 times as long as Cp and 5.7 times as long as posterior pleurobranch. Somite XII with anterior pleurobranch 0.29 times as long as Cp and 2.9 times as long as posterior pleurobranch. Somite XIII with anterior pleurobranch 0.25 times as long as Cp and 1.7 times as long as posterior pleurobranch.

Pl I with basipod 0.32 times as long as Cp and exopod 2.2 times as long as basipod. Pl II with basipod 0.29 times as long as Cp; exopod 2.6 and endopod 1.5 times as long as basipod, respectively. Pl III with basipod 0.29 times as long as Cp; exopod 2.3 and endopod 1.4 times as long as basipod, respectively. Pl IV with basipod 0.29 times as long as Cp; exopod 2.0 and endopod 1.3 times as long as basipod, respectively. Pl V with basipod 0.26 times as long as Cp; exopod 1.9 and endopod 1.1 times as long as basipod, respectively.

Up with exopod 4.5 times as long as wide, 6.1 times as long as basipod and 0.7 times as long as Cp; endopod 3.9 times as long as wide and 0.7 times as long as exopod (Fig. 88C).

Petasma (Fig. 89A-B, Pl. 4E). PV very long, 5.4 times as long as wide, armed with row of smaller hooks along distal half of medial side and 1 stronger apical tooth. LT overlapping LC, 2.4 times as long as wide and 0.3 times as long as PV, armed with several hooks in distomedial part. LC directed laterally, 1.3 times as long as wide and 0.2 times as long as PV, armed with single apical hook. Small tubercle armed with 1 hook proximal to base of LC is remnant of LA.

Photophores. Cp: 3 in lateral rows. Scaphocerite: 3 organs at level of inner muscle strip from 0.5 to 0.8-0.9 blade length. Up exopod: 2 organs at level of inner muscle strips, at 0.5 and at 0.7-0.8 exopod length. Up endopod: 1 organ near base.

Other body photophores, all ventral, found on the following somites (al = anterolateral, l = lateral, m = medial): II (1m), III (1m+4l), labrum (1m+2l), IV (2m+2l), V (2m+2l), VI (4l), VII (2m+2l) VIII (1m+2l), IX (3m), X (1m+2l), XI (3m+2l), XII (3m+2l), XIII (3m+2al), XIV (3pm (male)/4pm (female)+2al), XV (3m+2l); XVI (5m+2l), XVII (3m+2l), XVIII (3m-2l), XIX (3m+2l), XX (4m). Total (with those in Cp rows): 92 (female) or 91 (male).

Other photophores found on the following appendages (d = distal, p = proximal, Roman numerals indicate segments): eyestalk (lp+1d) A I (peduncle III - 1d), A II (peduncle I - 1p), Md (proper - 1d, palp I - 1d), Mxp II (II - 1d, III - 1d, V - 1d, VI - 1d), Mxp III (II - 1d, III - 1d, IV - 1d, V - 1d), P I (II - 1d, III - 1p), P II (III - 1p, V - 1d), P III (III - 1p+1d, IV - 1d), P IV (III - 1d (female)/0 (male)), P V (III - 1d (female)/0 (male)), Pl I - Pl V (1p). Total (with those on scaphocerite and Up): 70 (female) or 66 (male).

Thus, the total number of observed photophores in examined specimens ranges from 157 in males to 162 in females.

Remarks: This is a very abundant commercial species in Japanese waters (Suruga Bay); it was first mentioned as *Sergestes phosphoreus* Kishinouye by Nakazawa (1915) and slightly later by Nakazawa & Terao (1915) tentatively referred to *Sergestes prehensilis* Bate, 1881. At the same time they also proposed the name *S. kishinouyei* for the Suruga Bay species if it should be distinct from *S. prehensilis*. Since then *S. prehensilis* was used by several Japanese authors for the species, until Hansen (1919) compared Bate's type specimen of

Sergestes prehensilis and the figures of Nakazawa & Terao (1915) and came to the conclusion that Japanese species was different from *S. prehensilis* Bate. In a later paper, Hansen (1922) named the Japanese species *Sergestes lucens*, referring to the description and figures of Nakazawa & Terao (1915). However, until the paper by Gordon (1935) with detailed comparisons of *S. prehensilis* and *S. lucens*, the latter species, "Sakura-ebi" in Japanese, was known under three different names: *S. phosphoreus*, *S. prehensilis*, and *S. kishinouyei*. After 1935, only the name *S. lucens* was used for this species.

Although Omori (1969) in his very detailed studies on *S. lucens* did not mention the division of Mxp III dactyl and Mxp III-P III propodi, subsegmentation in this species is much more certain than in most of the other species of the genus. Since the description of *S. lucens*, attention of many authors was paid to the most remarkable character of this species, the photophores, and several reports were published on their position and number. Terao (1917) found 161 photophores and Omori (1969) 161±2 luminous organs. Although specimens available to me are different in minor aspects of the photophore position from those described by Nakazawa (1915), Gordon (1935), and Omori (1969), they agree well in the total number of luminous organs (157-162). It should be pointed out that number and position of photophores vary in reports of different authors. For example, Nakazawa & Terao (1915) reported 6 photophores on the sternite between the bases of P V and a single pair of organs on the sternite of abdominal somite VI, while Omori (1969) found 4 and 3 organs, respectively. Gordon (1935) found 42 photophores on the ventral surface of the abdomen, but Omori (1969) counted only 33 organs. It is uncertain whether this is due to morphological variation within the species (which is difficult to believe, taking into account the very restricted area of sampling of specimens in question), or due to the difficulty in searching for photophores.

Sergia lucens is close to *S. crosnieri* n. sp. (see affinities and differences in remarks to *S. crosnieri*).

Geographical distribution (Fig. 87): Western Pacific only: This species was believed to be an endemic of Japan, west of Sunosaki, the mouth of River Sakawa, Sagami and Suruga Bays, sometimes in Tokyo Bay (Dr. Th. Mortensen Exp.; "Ten-

yo Maru"; Yokoya 1933, Omori 1969). New "Dana" records expand this area very much, to off Borneo, off the Philippines, and off New Guinea. Omori et al. (1988) have reported some specimens morphologically similar to *S. lucens* off Tung-kang, southwestern Taiwan. The specific identity of the material is not yet certain, and they are not included on the map.

Remarks: The biology of this commercial species has been well studied (e.g., Omori 1969). It is a typical benthopelagic species, extremely abundant over the shelf, especially in Suruga Bay, although a few specimens may be spread offshore. Since very distant "Dana" records of this species may hardly be accounted for by the water transport from the

Japanese bays, one should rather expect to find other independent populations in the bays within the hatched area, including offshore Indonesian Islands. *S. lucens* and *S. crosnieri* have a nearly parapatric distribution.

Vertical range: A benthopelagic species, migrating daily between the shelf/lateral continental-slope contact zone (Vereshchaka 1995a) and the epipelagic zone. Specimens were taken within the depth range 200-800 m. A few occurred at about 200 m at night, and 1 specimen was found in a day sample from a depth of about 800 m. In his detailed paper, Omori (1969) provides similar depth ranges: fishing grounds are found along the 200 m isobath.

CONCLUDING REMARKS

The objective of this monograph is to show the present knowledge of the genus *Sergia*. The recent description of *S. umitakae* and of a third species of the *S. lucens* species group as well as descriptions of the new species above demonstrate how incomplete our data even on species composition of this group are. New discoveries concerning benthopelagic species with limited distribution belonging to the *S. prehensilis*, *S. challengerii*, and *S. lucens* species groups may be expected first of all. At the same time, it is difficult to exclude new findings in the deep sea, as this oceanic zone is the most poorly explored zone in all aspects.

In this monograph remarks on the vertical distribution of species are very restricted. Such extensive material as collected in the "Dana II" Expedition requires special efforts and separate publications

concerning vertical distribution of species. Although non-closing gears used during the "Dana" expeditions allow only semi-quantitative estimations of the abundance of animals, the analyses of the vertical ranges based on the "Dana I" data (Vereshchaka 1994a) demonstrate that results of general interest may be obtained in this field.

Sergestidae is one of the most poorly understood groups of Decapoda. A revision of the sister genus *Sergestes* is strongly necessary, as it comprises the second most abundant genus as regards number of species. After this revision and review of several minor groups belonging to the genera *Lucifer*, *Acetes*, *Petalidium*, *Peisos*, and *Sicyonella*, the phylogeny of the whole family Sergestidae may be analysed.

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Revisions of a difficult group like this will always contain some mistakes and misinterpretations, and I shall be grateful to receive any corrections.

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Note added in proof:

While this paper was in press, the following publication by Frogliá & Gramitto (2000) describing a new species of *Sergia*, *Sergia manningorum*, appeared. The species is a member of the *Sergia robusta* group.

Frogliá, C. & M. E. Gramitto, 2000: A new pelagic shrimp of the genus *Sergia* (Decapoda, Sergestidae) from the Atlantic Ocean. - J. Crust. Biol. 20, Special Number 2: 71-77.