

Karyology of the Genus *Labidocera* Lubbock from the Laccadive Sea (Lakshadweep)

USHA GOSWAMI & S C GOSWAMI

National Institute of Oceanography, Dona Paula, Goa 403 004

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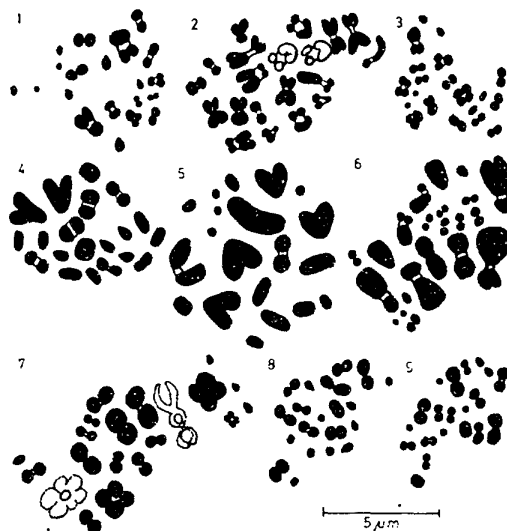
Labidocera euchaeta, *L. laevidentata*, *L. pseudacuta*, *L. acutifrons*, *L. bataviae*, *L. madurae*, *L. bengalensis* and *Labidocera* sp., collected from the Laccadive Sea during the 31st Cruise of *R V Gaveshani*, possess a diploid number of 20 chromosomes while *L. minuta* possesses 22. On the basis of similarities and dissimilarities of the karyotypic details, cytotaxonomic relationship has been derived and discussed at the intrageneric and interspecific levels.

Details of the karyotype in various genera of copepods have been utilized earlier in resolving systematic anomalies and in establishing intra and intergeneric relationship¹⁻⁴. The present communication gives an account of the diploid complements of chromosomes of 9 species of the genus *Labidocera* (Pontellidae, Calanoida, Copepoda). From the morphology of the chromosomes, cytotaxonomic interspecific relationship has been derived.

Karyotype studies have been made on *Labidocera euchaeta* Giesbrecht, *L. laevidentata* Brady, *L. pseudacuta* Silas and Pillai, *L. acutifrons* Dana, *L. bataviae*, A. Scott, *L. minuta* Giesbrecht, *L. madurae* A. Scott, *L. bengalensis* Krishnaswamy and *Labidocera* sp. Zooplankton samples were collected from the surface using a square net (mouth area 0.25 m², mesh width 0.3 mm) on board *R.V Gaveshani* during the 31st Cruise (March-April 1978) from stations 856-871 lying between lat. 8° to 14°N and long. 71° to 74°E in the Laccadive Sea. The various environmental parameters were as follows: salinity, 34.5-35.64 ‰; temperature, 28.5°C-30.5°C; dissolved oxygen, +4 - +12%. The material after filtration was fixed in acetic alcohol (1:3) and preserved in 70% alcohol. Male specimens were sorted out and stained in acetic orcein. Squash preparations were made from the gonads and karyotypic details were studied.

Number and shape of chromosomes—The diploid number of chromosomes encountered during the spermatogonial metaphases was 20 in all species studied except in *L. minuta* where it was 22 (Figs 1-9). The diploid karyotype formulae are given in Table 1. Metacentrics dominate in numbers in all the species, e.g. in *L. pseudacuta*, *L. acutifrons* and *L. madurae* these were 16; in *L. bataviae* and *Labidocera* sp., 14; in *L. euchaeta* 12; and in *L. laevidentata* and *L. bengalensis* 10 in number.

The morphology of the chromosomes was identical in all species studied. Acrocentrics were either rod-shaped with one end pointed or dot shaped (Fig. 10). In *L. laevidentata* alone, the acrocentric pair showed a



Figs 1 to 9—Spermatogonial metaphases of *Labidocera euchaeta* (1), *L. laevidentata* (2), *L. pseudacuta* (3), *L. acutifrons* (4), *L. bataviae* (5), *L. minuta* (6), *L. madurae* (7), *L. bengalensis* (8), and *Labidocera* sp. (9)

small arm. The metacentrics were dumb-bell, V-, and rod-shaped with both ends rounded. Sub-metacentrics were though rod and J-shaped, the centromeric gap was often visible. The sister-chromatids of the chromosomes were usually seen apart.

Chromosome size—The average total length (μm) of the homologous pairs was in the range of 0.9-2.1, *L. laevidentata*; 0.3-1.05, *L. pseudacuta*; 0.6-3, *L. acutifrons*, *L. madurae* and *L. bataviae*; 0.3-1.5, *L. bengalensis*, *L. euchaeta* and *Labidocera* sp. respectively. Average total length of the individual homologous pair is given in Table 1. The diploid chromosomal set of each species could distinctly be categorized into small and large groups (Fig. 10). The acrocentrics mainly belonged to the former group.

Sex chromosomes—In all the species studied, only in *L. laevidentata* and *L. madurae*, the sex-chromosomes could be identified because of the differential staining behaviour (Fig. 10).

Cytotaxonomical interspecific relationship—Silas and Pillai⁶ have reported the occurrence of 23 species belonging to the genus *Labidocera* from the Indian Ocean and adjacent waters. Of the 9 species described here, *L. acutifrons*, *L. euchaeta*, *L. bengalensis*, *L. pavo*, *L. bataviae* and *L. kroyeri* seem to be the first records from the Laccadive Sea. Karyologically, 14 species have so far been described including the present ones^{2,3}. The details of the karyotypes along with the similarities of taxonomic characters of the species investigated have been utilized to trace the cytotaxonomical relationship on the interspecific and intrageneric levels, e.g. karyologically all the species of

Table 1—Karyotype Formula, Average Total Length of Homologous Pairs (μm) and Position of Centromere in the Species Investigated

Species (karyotype formula)	Chromosomal pairs										
	1	2	3	4	5	6	7	8	9	10	11
<i>L. euchaeta</i> (12M+8A)	1.5M	1.2M	1.2M	0.9M	0.9M	0.6M	0.6M	0.6M	0.45M	0.3A	—
<i>L. laevidentata</i> (85M+10M+2A)	2.1SM	1.8SM	1.65SM	1.5SM	1.5M	1.2M	1.2M	1.2M	1.2M	0.9A	—
<i>L. pseudacuta</i> (16M+4A)	1.05M	1.05M	0.9M	0.9M	0.9M	0.9M	0.9M	0.6M	0.45A	0.3A	—
<i>L. acutifrons</i> (16M+4A)	3M	1.2M	1.2M	1.2M	1.05M	0.9M	0.9M	0.9M	0.6A	0.6A	—
<i>L. bataviae</i> (16M+4A)	3M	2.4M	2.4M	1.8M	1.2M	0.9M	0.9M	0.9M	0.6A	0.6A	—
<i>L. minuta</i> (65M+10M+6A)	3SM	2.4SM	1.8M	1.5M	1.2M	1.2M	1.2M	1.2M	1.2A	0.6A	0.30A
<i>L. madurae</i> (16M+4A)	3M	2.1M	1.8M	1.8M	1.5M	1.5M	1.5M	1.2M	0.75A	0.6A	—
<i>L. bengalensis</i> (10M+10A)	1.5M	1.2M	1.2M	0.9M	0.9M	0.6A	0.6A	0.6A	0.6A	0.3A	—
<i>Labidocera</i> sp. (14M+6A)	1.5M	1.2M	1.2M	0.9M	0.9M	0.9M	0.9M	0.75M	0.6A	0.3A	—

SM = submetacentric; M = metacentric; A = acrocentric

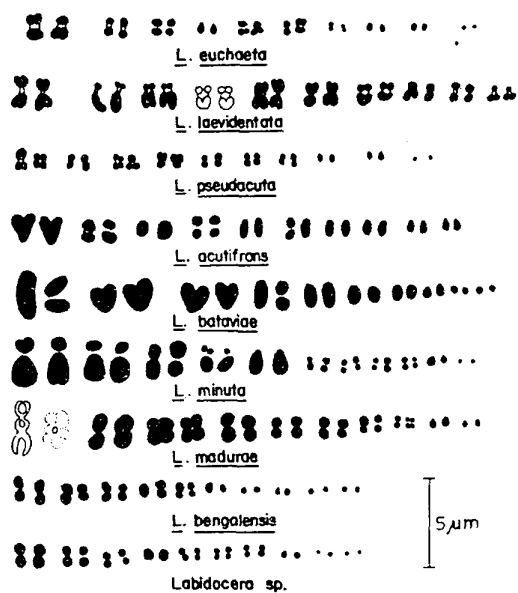


Fig. 10—Karyograms of various species investigated

the genus *Labidocera* possess $2n=20$ (except *I. minuta*), dominance of the metacentrics in the karyotypes, similar shape of the metacentrics in the karyotypes, similar shape of the chromosomes and similar sex mechanism. Taxonomically, also all of them possess similar generic characters. These similarities both in taxonomic and karyologic characters justify their placement under the same genus *Labidocera*. However, in details, each karyotype is quite distinct from the other. This feature supports their individuality on the species level.

Silas and Pillai⁵ taxonomically described a new species of *Labidocera*, viz. *L. pseudacuta* which was earlier treated as a variety of *L. acuta*^{7,8}. In view of the

morphologic similarities, these authors felt *L. acuta* and *L. pseudacuta* were closely allied species having the same ancestors. They further remarked that the former was distributed in the neritic regions of the Indian Ocean, whereas, the latter was oceanic.

Cytologically also, these 2 species possess similar generic characters, which reflect their common origin at some stage of their evolution. However, the details of the karyotype fall quite wide apart e.g. *L. acuta* collected from the Mandovi-Zuari estuaries and studied earlier² has all the chromosomes metacentric within a size range of 0.84 to 0.86 μm . But in *L. pseudacuta*, the karyotype formulae includes only 16 metacentrics and 4 acrocentrics. The size range is also larger (0.3-1.05 μm). Hence on cytotaxonomical basis also, we feel that *L. pseudacuta* and *L. acuta* should be treated as 2 separate species and not varieties of the same (*L. acuta*).

Similarly, Silas and Pillai⁶ while giving the taxonomic details of various species belonging to the genus *Labidocera*, have remarked that *L. pavo* was closely allied to *L. bataviae* and *L. madurae*. Karyologically, the latter 2 species show some closeness on the species level, e.g. the presence of the same chromosome number ($2n=20$), karyotype formulae (16M+4A) and the size range of the chromosomes (0.6-3 μm). But *L. pavo* possesses all the chromosomes metacentric within a size range of 0.84-1.48 μm . In fact, *L. acutifrons* not mentioned by Silas and Pillai⁶ as closely allied species show more chromosomal similarities to *L. bataviae* and *L. madurae*. The details of the karyotype are quite similar. Therefore, based on cytotaxonomic evidences, it is ascertained that *L. bataviae*, *L. madurae* and *L. acutifrons* are closely related species. Their speciation has occurred probably by some submicroscopic chromosomal changes which led to genetic change.

Modal chromosome number—In all 14 species analysed, cytologically 13 possess a diploid number of 20 and haploid number of 10 chromosomes and 10 (1n) is the modal number of this genus.

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Further Observations on Gaveshani Bank

S Z QASIM

National Institute of Oceanography, Dona Paula, Goa 403 004

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During the 31st cruise, *R V Gaveshani* made 4 runs over the bank in different directions. From the echograms obtained it became possible to draw an outline of the bank. Physical and chemical features over the bank were similar to those of the upper layers of the Laccadive Sea. Sediments taken from the bank consisted of calcareous sand with fragments of live corals, calcareous algae and a large number of animals typical of coral reef environment.

A bank with living corals, named as Gaveshani Bank¹, has been reported from the west coast of India. During the 31st cruise of *R V Gaveshani* (March-April 1978) the ship once again visited the Gaveshani Bank on 5th April 1978. Since the exact position of the bank was noted earlier by a satellite fix, the bank was located with ease.

The ship made 4 runs over the bank, from one extremity to the other, at a speed of about 2-3 knots to determine the size and shape of the bank. The 1st run was from SE to NE direction, the 2nd from N to W, the 3rd from W to S and the 4th from W to E. During the run echograms were taken using echosounders and sonar. From the several echograms thus obtained a generalized sketch of the bank was obtained (Fig. 1).

The bank has NW-SE orientation. It is about 770 m long and 330 m broad. The depth over the bank ranges from 32 to 40 m and the shallowest point is at the apex¹. Table 1 gives some of the physical and chemical features over the bank. The average Secchi disc reading over the bank was 16 m, which from the equation $k = \frac{1.7}{D}$ gave the value of attenuation coefficient of light (k) as 0.106 and the compensation depth of the euphotic

zone (1% of the surface illumination) at about 48 m. This means that the entire bank is within the photosynthetic (euphotic) zone. Other features over the bank (Table 1) were typical of the upper 0-30 m of the Laccadive Sea.

Measurements of primary production, chlorophyll a, phaeophytin and particulate organic carbon over the bank are given in Table 2. ¹⁴C uptake and chlorophyll a values were low and the particulate organic carbon was relatively high. These features were also similar to those of the Laccadive Sea. The general composition of

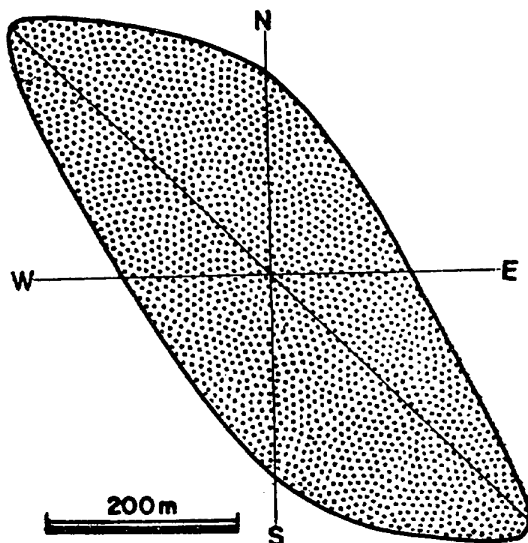


Fig. 1—Outline of Gaveshani Bank drawn from the echograms obtained during the 31st cruise

Table 1—Physical and Chemical Features over the Gaveshani Bank on 5th April 1978

Depth* m	Temp. °C	Salinity ‰	Oxygen ml/l	pH	PO ₄ -P µg-at/l
0	29.11	35.36	4.8	8.21	0.3
10	29.99	35.35	4.61	8.22	0.24
20	28.97	35.36	4.54	8.22	0.24
30	28.93	35.35	4.52	8.22	0.24

*NO₃-N not detected at any depth

Table 2—Primary Production and Other Related Aspects in the Water Column over the Bank

	Surface	Water column 0-30 m
¹⁴ C uptake	0.26 mgC/m ³ /hr	9.7 mgC/m ² /hr
Chlorophyll a	0.14 mg/m ³	2.49 mg/m ²
Phaeophytin	0.02 mg/m ³	0.48 mg/m ²
Particulate organic carbon	12 mg/m ³	0.41 g/m ²