CYCLOSTOMATA

7.1 SYSTEMATICS:
Class: Stenolaemata Borg, 1926
Order: Cyclostomata Busk, 1852
Suborder Articulata Busk, 1859

7.1.1 Family Crisiidae Johnston, 1847
Genus: Crisia Lamouroux, 1812

Crisia elongata Milne-Edwards, 1838 pl. 25 figs.1, 2 & 3
1890 Crisia elongata Milne-Edwards, Kirkpatrick, p.170
1905 Crisia holdswarthis Busk, Thornely, p. 127.
1910 Crisia denticulate Lamarck, Waters, p.232, pl.24, figs. 1-3.
1915 Crisia elongata Milne-Edwards, Harmer, p.96, pl.8, figs. 1-8.
1953 Crisia elongata Milne-Edwards, Osburn, p.648, pl. 71, fig. 9.
1988 Crisia elongata Milne-Edwards, Braga & Barbin, p.505, pl.1, fig.2.


Measurements:

<table>
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Description:
Colonies erect, flexible having internodes. Internodes are biserial. 5-10 internodes present, surfaces punctuate. Zoocel aperture present on frontal wall and absent on dorsal side. Apertures are circular and slightly raised peristome. Peristome slightly curved laterally. Gonozooecium observed at the top of the branch, broadly inflated, wider distally. Oeciopore transverse slit like placed back of the distal end of gonozoooid.

Remarks:
The present species agrees with Crisia elongata (Milne-Edwards) Winston 1982 (p. 154, figs. 92, 93) in all essential characters. Crisia aculeata (Hassall)
Harmelin 1990 (P.1602, figs 2, 3-6) shows some resemblance with present species but differs in the position of gonozooecium and occurrence of long spines on each internode. *Crisia hoernesi* (Reuss) Zágoršek 2003 (P.108, Pl.1, fig. 2) differs in having striations on the frontal wall.

**Occurrence:**

*Furca* (23° 42’ 30"N, 68°47’ 12”E) 76 internode fragments from claystone (Middle Eocene, Lutetian), *Waio* (23° 25’ 30”N; 68° 41’ 58”E) 88 internode fragments from white nummulitic limestone (Upper Oligocene, Chattian), *Harudi* (23° 31’ 25” N; 68° 41’ 07” E) 166 internode fragments from gypseous shales (Middle Eocene, Lutetian), *Lakdi River* (23° 19’ 19”N, 68°56’14”E)157 internode fragments from yellow limestone (Lower Miocene, Burdigalian).

**Distribution:**

This species has cosmopolitan distribution in the Indo-Pacific region. Eocene: France; Oligocene: France & Italy; Miocene: France, Italy and USSR; Recent: West Africa, Gulf of California, West coast of India.

**Genus: Bicrisia** D’Orbigny, 1853

**Bicrisia sp.1  pl. 25 figs.4,5 & 6**

**Material:** Plesiotypes: GIS/B: 1381-1387.

**Measurements:**

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**Description:**


**Remarks:**

138
The present species shows close resemblance with *Bicrisia Sp.* (d’Orbigny); Lagaaïj 1974(p. 591, pl.2, figs.1-4) in having spiniform process and paired apertures. *Bicrisia robertsonae* Soule & Soule 1995(p. 311, pl. 120, figs. A-D) also shows resemblance with present species but it differs in having fine vertical striations on zooidal tube and occurrence of gonozooecium. *Bicrisia abyssicola* (Klug); Harmelin 1990 (p.1612, fig.17) differs in having jointed spines.

**Occurrence:**
Waior (23°25′ 30″N; 68°41′ 58″E) 6 internode fragments from white nummulitic limestone (Upper Oligocene, Chattian).

Suborder: Tubuliporina Milne-Edwards, 1838

7.1.2 Family: **Tubuliporidae, Johanston, 1838**

Genus: *Exidmonea* Mongereau, 1969

*Exidmonea babiensis* n.sp. pl. 26 figs.1,2 & 3

**Material:** Holotype: GIS/B: 1388; Paratypes: GIS/B: 1389-1400.

**Measurements:**

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**Type Horizon and locality:**
The argillaceous sediments of the Harudi Formation from the cliff, North of Harudi village by the side of the road from the Waior village to Narayan Sarovar.

**Age:** Middle Eocene (Lutetian).

**Description:**
Colony erect, dichotomously branched, bifurcating stems. The autozoooids arranged in uniserial rows, usually 3-4 autozooecia are arranged in each fascicular row, alternating on either side of the branch midline, protruding beyond the colony margin. Dorsal surface consisting of vertical thin distinct, wavy striations. Gonozooecium large, placed at bifurcation, triangular distal end broad tapering proximally, frontal surface perforated by small pores.

Remarks:

The present species closely resemblance with *Exidmonea atlantica* Taylor and Voight 1992 (p.84) but differs in having vertical distinct striations. *Exidmonea giebeli* Zágoršek 2010 (p.28, Pl.7, Figs. 1-4) shows close resemblance with present species but it differs in having additional apertures present between the pairs of colony, dorsal surface slightly convex and perforated. *Exidmonea dorsata* (von Hagenow), Taylor & Voigt, 1992 (p.124, figs. 1-5, pl.1, figs. 1-8) closely resembles the present species but differs in having less uniform autozoooids, apertures lacking peristome, gonozoooids located medially. *Exidmonea concave* Braga and Barbin 1988 (p.506, pl. 1. Fig.3-4) shows similar appearance but in having alternate fascicular grooves.

Occurrence:

Harudi (23°31’ 25” N; 68°41’ 07”E) 15 internode fragments from gypseous shales (Middle Eocene, Lutetian). Fulra (23°42’ 30” N; 68°47’12”E) 8 internode fragments from argillaceous claystone (Middle Eocene, Lutetian).

Etymology: The species is named after Babia Hill where the type section of Fulra Formation is exposed.

*Exidmonea cf. Undata* (Reuss) pl. 26 figs.4,5 & 6

1977 *Exidmonea undata* (Reuss), Vavra, p.28 (cum. syn.)

2010 *Exidmonea undata* (Reuss), Zágoršek, p.29, pl.7, figs. 1-4


Measurements:

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<td>0.04</td>
<td>0.017</td>
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</table>

**Description:**

Colony erect, oval in transverse section, dichotomously branched, bifurcating stems, usually 2-3 autozoocia are arranged in each fascicular row. The autozooids arranged in uniserial rows, alternating on either side of branch midline. Slightly protruding beyond the colony margin. Apertures rectangular to oval. Dorsal surface convex, smooth without striations. Gonozooeicum not observed.

**Remarks:**

The above species is comparable with *Exidmonea undata* (Reuss), Zágoršek, 2010 (p.29, pl.7, figs. 1-4) in having oval transverse section, 2 to 3 rectangular to oval autozooids and lacking gonozooeicum however, the present species has convex, smooth dorsal surface without ribs. Hence, we are tentatively placing these specimens under *E. undata* (Reuss) till more material in hand. *Exidmonea hornesi* (Stoliczka), Mongereau, 1969 (P.238, Pl.18, figs.8, 9) Shows some resemblance with present species in having oval transverse section and smooth, convex dorsal surface; however, it differs in having 5 to 6 autozoooidal apertures. *Exidmonea villaltae* (Reguant), Mongereau, 1969 (P.252, Pl.21, figs.4-5, 10 and 13) also shows close resemblance with the present species in having three autozoooidal apertures, convex and smooth dorsal surface and gonozooids wanting. However, present species differs from *E. villaltae* in having oval transverse section and autozooids are placed lateral side of the branch.

**Occurrence:** Harudi (23° 31’25” N; 68° 41’ 07” E) 3 internode fragments from gypseous shales (Middle Eocene, Lutetian).
Distribution:
Miocene: Tortonian: Austria.

7.1.3 Family Oncousoeiidae Canu, 1918
Genus Proboscina Audouin, 1826
‘Proboscina’ sp. pl. 27 figs.1,2 & 3
Measurements:

<table>
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<th>Mean</th>
<th>N</th>
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</table>

Description:
Colony, encrusting, unilaminar, bifurcating, fan-shaped ramification. Autozooids tubular, thin, peristomes slightly raised, circular apertures, arranged quincunxially and placed obliquely with the surface. Slight transverse striations and fine punctuate surface frontally on the rami. Gonozoooid not observed.

Remarks:
Only single specimen in our collection which is encrusting oyster shell. However, details of gonozoocarium are not preserved which is significant character to confirm the specific name. ‘Proboscina’ sp. described by Guha & Gopikrishna, 2007 (p.1278-77, pl.2, figs.5-6) resembles in having its unilaminar growth habit, circular apertures, autozooids arranged quincunxially, placed obliquely, with slight striations and punctuate frontal surface. However, in the present species gonozoocarium did not observed.

Occurrence:
Layyari (23° 24’40” N; 68° 48’ 56” E) one colony encrusting oyster shale obtained from yellow limestone (Lower Miocene, Aquitanian).
7.1.4 Family Plgioeciidae Canu, 1918

Genus *Plagioecia* Canu, 1918

*Plagioecia* Sp.indet. pl. 27 figs.4 & 5

**Material:** Plesiotypes: GIS/B

**Measurements:**

Mean Length of the colony = 0.055 and width of the colony = 0.033

**Description:**

Colony encrusting, unilaminar, orbicular in outline, thin and slender zooecia arranged in sub linear rows. Protoecium placed centrally, Protoecium small, circular to oval in outline. Autozooecia tubular thin long and placed sub linear rows, frontal wall convex, minutely pseudopores, peristome small, circular to oval in outline arranged quincunxially and placed oblique to the surface of the zooecia. Gonozooecium not observed.

**Remarks:**

The single specimen is obtained from Fulra and is infertile therefore the specific name is not given till we get fertile specimen showing gonozooecium. *Plagioecia taylori* Guha and Gopikrishna 2007 (P. 1277, Pl2, Fig 3-4) shows close resemblance with present species but, differs in having elongate-elliptical gonozooecium. *Plagioecia rotula* (Reuss) Zágoršek 2010 (P 30, Pl 11, Fig 1-5) & Vávra (19.) shows some resemblance with present species but, differs in having autozooecial tube situated on the distal half of the gonozooecium frontal wall. *Plagioecia bibensis* Braga & Bignot 1986 (P. 281, Pl.1 fig 3-13) shows resemblance with present species but, differ in having gonozooecium. ? *Plagioecia dispar* Canu & Bassler, Taylor & Foster, 1998, P. 65, Fig 1. Shows some resemblance with present species in the arrangement and nature of peristome however, in Indian specimens protoecium is present. *Plagioecia dispar* described by Winston, 1982 (P. 155 fig. 94) differs from the present species in having fan-shaped colony, presence of transverse striations on the frontal surface and presence of brood chamber.
Occurrence:

Fulra (23°42’ 30” N; 68° 47’12” E) one disc shaped colony from argillaceous clay section (Middle Eocene, Lutetian).

Suborder Rectangulata Waters, 1887

7.1.5 Family Lichonoporidae Smitt, 1867

Genus Lichenopora Defrance, 1823

?Lichenopora aff. radiata (Audouin, 1826) pl. 27  figs.6

1826 Melobesia radiata Audouin p.235, pl.6, fig.3
1929 Lichenopora radiata (Audouin), Canu & Bassler, p.556, pl.88, figs.1-6.
1974 Lichenopora radiata (Audouin), Mawatari & Mawatari, p.355, pl.XXX, fig.4


Measurements:

<table>
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<th>Mean</th>
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Description:

Colony encrusting, discoid. Convex with central area depressed. Auto zooidal tubes are arranged in universal. 5-6 fascicles present in each row and 10-12 radiating rows separated by dip grooves. Autozooidal apertures are oval to nearly rectangular. Central portion depressed. Ooeciopore absent.

Remarks:

The single specimen is available in our collection without Ooeciopore. Hence, its identification is tentative as Lichenopora. In Kutch region there is no previous record of Lichenopora. Our specimens show close affinity towards Lichenopora radiata (Audouin), Canu & Bassler, 1929 (P.556 Pl 88, figs. 1-6) and Mawatari & Mawatari, 1974 (P355. Pl XXX, fig.4 ) but, differs in having more number of uniserial fascicles and much depressed central area. Lichenopora (Domopora) strictolamellosa Canu & Bassler 1929 (P. 561 Pl. 89 Figs. 8, 9) shows superficial
resemblance with present species but, differs in having biserial fascicles and presence of ooeciopore. *Lichenopora verrucaria* (Fabricius), Mawatari & Mawatari, 1974 (P.355 Pl. XXX, Fig. 4) shows some resemblance with present species but, differs in having sub-circular colony and zooids with acuminate terminal. *Lichenopora betsibokensis* Brood 1977 (P.80, fig. 20) shows much difference in the arrangement of zooidal tubes, shape of the colony and the presence of ooeciopore.

**Occurrence:**

Fulra (23° 42'30" N; 68° 47'12"E) one discoid colony from argillaceous claystone (Middle-Eocene, Lutetian).

**Distribution:**

Helvetian: Italy, Miocene: Austria, Australia, Pleistocene: California, Quaternary: Italy, Recent: Sulu Archipelago, Japan.