# OBSERVATIONS ON THE MICROFLORA OF PADDY FIELDS (EBRO DELTA, SPAIN)

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The Ebro Delta is an alluvial plain (350 $km^2$) situated in the northeast of the Iberian Peninsula. The area include coastal lagoons, a few marshes and paddy fields, that make up an important biotope (over 40%) with a very dense network of irrigation channels carrying Ebro river freshwater, from May to November. The water flowing out enters a series of lagoons which are also influenced by nearby sea water. In the paddy fields FORES & COMÍN (1986, 1987) studied the seasonal changes in phytoplankton, and in physical and chemical parametres, as well as the effect of the usual fertilization and biocide treatments on animal and plant populations. They found changes synchronized with agricultural treatments, but very few differences among different fields from year to year.

This study is based in field observations and samples collected from 1979 to 1990. Scraped soil surfaces and floating masses of algae coming from soils, lagoon edges and rice-fields were cultured (HERNÁNDEZ-MARINÉ, 1984). A quota of the sample was fixed in formalin solution. The temperature in water fluctuates from 12.0 to 36.2°C and conductivity from 0.44 to 2.40 $mS.cm^{-1}$.

Eighty-three taxa were recorded : 37 Cyanophyta, 26 Chlorophyta and 20 Bacillariophyta

**CYANOPHYTA :** *Anabaena cylindrica* Lemm., *Calothrix marchica* Lemm., *C. parietina* (Näg.) Thur., *Chroococcus minutus* (Kütz.) Näg., *C. turgidus* (Kütz.) Näg., *Cylindrospermum muscicola* Kütz., *Gloeocapsa polydermatica* Kütz., *Hydrocoleus lyngbyaceus* Kütz., *Lyngbya aestuarii* (Mert.) Liebm., *L. confervoidea Ag., L. hieronymusii* Lemm., *L. lagerheimii* (Möb.) Gom., *L. semiplena* (C.A.Ag.) *J.G.Ag. ex* Gom., *Microcoleus chthonoplastes* (Mert.) Thur. *ex* Gom., *Microcystis pulverea* (Wood) Forti, *Nodularia harveyana* Thur., *Nostoc ellipsosporum* (Desm.) Rabenh., *N. linckia* (Roth) Bornet *et* Flah., *N. punctiforme* (Kütz.) Hariot, *Oscillatoria bonnemaisonii* Crouan. *ex* Gom., *O. brevis* (Kütz.) Gom., *O. limosa* Ag. *ex* Gom., *O. nigro-viridis* Thwaites *ex* Gom., *Phormidium hypersalinum* Campbell *et* Golubi., *P. tenue* (Menegh.) Gom., *Plectonema nostocorum* Bornet *et* Thur. *ex* Gom., *Porphyrosiphon fuscus* Gom.*in* Fremy, *Pseudanabaena catenata* Lauterb., *Raphidiopsis curvata* Fritsch *et* Rich., *Spirulina maior* Kütz. *ex* Gom., *Sp. subsalsa* Oerst. *ex* Gom., *Sp. subtilissima* Kütz. *ex* Gom., *Tolypothrix byssoidea* (Hass.) Kirchn., *Xenococcus acervatus* Setch. *et* Gard., *X. kerneri* Hansg., *X. minimus* Geitler, *X. shousboei* Thur. *in* Bornet *et* Thur.

**BACILLARIOPHYTA:** *Cyclotella meneghiniana* Bréb., *Melosira granulata* (Ehr.) Ralfs, *Amphora ovalis* (Kütz.) Kütz., *Bacillaria paradoxa* Gmel., *Cocconeis placentula* Ehr. *Cymatopleura elliptica* (Bréb.) W.Smith, *C. solea* (Bréb.) W.Smith, *Cymbella prostrata* (Berk.) *Cl., Diatoma vulgare* Bory, *Gomphonema constrictum* var *capitata* (Ehr.) *Cl., Gyrosigma attenuatum* (Kütz.) Rabenh., *Hantzschia amphioxys* (Ehr.) Grun., *Navicula cryptocephala* var *veneta* (Kütz.) Grun., *Navicula tripunctata* (O.F.Müll.) Bory, *Nitzschia acicularis* W.Smith, *N. acicularis* var *closterioides* Grun., *N. sigmoidea* (Ehr.) W.Smith, *Roicosphenia abbreviata* (Ag.) Lange-Bert., *Synedra ulna* (Nitzsch) Ehr., *Surirella ovalis* Bréb.

**CHLOROPHYTA** *: Bracteacoccus minor* (Chod.) Petr., *Chlorella vulgaris* Beij., *Chlorococcum* ssp., *Chlorokybus atmophyticus* Geitler, *Chlorolobion braunii* (Näg.) Kom., *Coelastrum microporum* Näg., *Crucigeniella apiculata (Lemm.)* Kom., *Dictyosphaerium pulchellum* Wood, *Excentrosphaera viridis* G.T.Moore, *Gongrosira scourfieldii* G.S.West, *G. papuasica* (Borzi) Tupa, *Monoraphidium contortum* (Thur.) Kom.-Legn., *Neochloris terrestris* Herndon, *Pediastrum duplex* Meyen, *P. tetras* (Ehr.) Ralfs, *Pleurastrum insigne* Chod., *Scenedesmus armatus* Chod., *S. caudato-aculeatus* Chod. *S. intermedius* Chod., *S. quadrispina* Chod., *Schroederia setigera* (Schröd.) Lemm., *Tetraâdron minimum* (A.Br.) Hansg., *Chaetophora elegans* (Roth) Ag., *Oedogonium sp., Pithophora oedogonia* (Mont.) Wittr. var *polyspora* Rendle, *Rhizoclonium hieroglyphicum* (A.Ag.) Kütz.

The algal vegetation was neither rich in quality nor abundant. For every field conditions (soil, lagoon edges or rice-fields) the algal species grown in culture remained quite similar all year round and during the study years. In the paddy fields the occurrence of mats was irregular and restricted to the end of the summer period before harvesting and drying up, when no more biocides were applied. On the wet margins *Lyngbya aestuarii* and *Phormidium tenue* were the most common forms. *Microcoleus chthonoplastes*, although present, was never the main forming organism. The community was dominated by the Oscillatoriaceae and although all of them have been reported for similar habitats, the dominant species are not the same as those reported from other paddy fields (ANAGNOSTIDIS *et al*, 1981, LIU & LI, 1989). Among the blue green algae, 35% of the total taxa were heterocystous. The scarcity of diatoms and the exclusion of algal groups other than blue-green and green algae might be related to the negative effects of herbicide and pesticide applications (VENKATARAMAN & RAJYALAKSHMI, 1971, FORES & COMÍN, 1987) or inhibition due to added N fertilizer (SINGH & BISOYI, 1989), although the nutrient input seems to favor phytoplankton growth in the fields (FORES & COMÍN, 1986). A larger number of forms were common to soils, lagoon edges and rice-fields. However, cultures from bare soils display a larger species number than those from paddy field soils (HERNÁNDEZ-MARINé, 1984). In this case, resistant forms from soils and mats near the lagoons can lead to reestablishement in the paddy fields after ploughing (LIU & LI, 1989).

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