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The Colonisation of Disturbed Freshwater Habitats by *Characeae*

Keywords

Recovery of aquatic vegetation, Viability of charophyte oospores, Dredging, Herbicide treatment, Peat digging

Abstract

WADE P. M. (1990): The colonisation of disturbed freshwater habitats by *Characeae*. — Folia Geobot. Phytotax., Praha, 25: 275—278. — Various species of charophytes are able rapidly to colonise disturbed or cleaned shallow water bodies. This fact may be explained by the long-lasting viability of charophyte oospores, their easy dispersal and, probably, enhanced germination after passage through digestive tracts of waterfowl. Vegetative parts of Charophytes are sometimes resistant to herbicide treatment.

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Recent investigations into the ecological effects of dredging and herbicide treatment on freshwater habitats have shown a number of charophyte species to be important primary colonisers after such management. Consideration is given to the reasons why these species exploit this recovery period.

A number of species have been observed after the dredging of water bodies undertaken to maintain their function, for example navigation.

1. Drainage channels. In drainage channels on the Monmouthshire Levels, Gwent, *Chara vulgaris* L., (6 channels) *C. delicatula* AG. (1 channel) and *Nittela opaca* AG. (1 channel) only occurred in recently dredged channels. ALLEN (1950) comments on charophytes having "a partiality for freshly dug ditches" and GROVES et BULLOCK-WEBSTER (1924) describe *C. globularis* THUILL, and *N. cappillaris* (KROCK.) J. GR. et BULL-WEBST., from recently re-dug ditches. The latter species was known in Great Britain only from that one ditch. GEORGE (1976) and HOOGERS et VAN DER WEIJ (1971) have made similar observations for drainage channels for the Broadland area of Norfolk and the Netherlands respectively.

2. Canals. MOORE (1979) investigating the recovery of canals after dredging recorded *C. vulgaris* and *C. globularis* THUILL (Basingstoke Canal) and *N. flexilis* AG. and *Tolypella glomerata* (DESV,) LEONH (Thames and Severn Canal).

3. Ponds. Recent surveys in Leicestershire, Cambridgeshire and Worcestershire have described large beds of charophytes developing in field ponds in the first or second year after major renovation: *C. vulgaris* (9 ponds) and *C. hispida* L. rapidly colonised a section of derelict pond in N. Leicestershire which had been accidently dug out, and PALMER (1973) found the same species occupying more than half of the main pond at Castor Hanglands Naticnal Nature Reserve near Peterborough, four years after dredging. WHELDON et WILSON (1907) describe the colonisation of a newly dug pond by *N. opaca* and M. PALMER (pers. comm.) the development of large stands of *C. delicatula* in the recently created mere at Wood Walton Fen National Nature Reserve near Huntingdon.

4. Peat diggings. WALTERS (1958) re-discovered *N. tenuissima* (DESV.) KUTZ. in experimental peat diggings at Wicken Fen, Cambridgeshire, from whence the plant had originally been found in 1922. MOORE (1977) made further experimental diggings in 1976 but after the first year only *C. hispida* had been recorded.

Table 1 summarises instances where after herbicidal control of aquatic plants, substantial stands of charophytes have developed. ZONDERWIJK et VAN ZON (1974) also describe re-colonisation by *Chara* spp. after treatment with the bipyridilium herbicides, paraquat and diquat, in the Netherlands. There have been instances, however, where a charophyte was present before treatment and either subsequently disappeared (pers. comm. J. C. FRY), (paraquat and *Chara* sp.), or failed to develop significant stands (WAY et al., 1971) (paraquat and *Chara* sp.).

Charophyte oospores can remain viable for a long time (ALLEN, 1950; MOORE, 1979) and it is considered that oospores laid down in sediments are stimulated to germinate either by drastic management or by the conditions which prevail subsequently. WADE et EDWARDS (1980) have demonstrated that *C. vulgaris* has been restricted to specific drainage channels for as long as 89 years although for many years the plant might not be manifest in a particular channel, being present only as spores. The plant had not readily increased its distribution within the area studied despite fruiting regularly and the availability of other recently dredged channels. This persistence of certain species of *Chara* is also demonstrated in three of the examples of herbicide treatment where the species was effectively controlled but subsequently reappeared (Table 1). The experiment of WALTERS (1958) lends further support to this idea as do observations by ALLEN (1947) on *C. aspera* WILLD.

Oospores are known to be dispersed by wildfowl and PROCTOR (1962) found that oospores retained their viability after passage through ducks with the possibility that such treatment might facilitate germination in some species, an observation supported by IMMAHORI (1954). Clearly this means of dispersal can be effective, charophytes often being the first macrophytes to colonise newly created water bodies, e. g. flooded gravel pits (MOORE, 1979).

A number of authors have commented upon the rapid growth of charophytes (ALLEN, 1947, FISH, 1966, MOORE, 1979). *C. globularis* appeared in a 9 ha reservoir 20 days after paraquat treatment and 26 days later the plant was occupying

approximately two thirds of the reservoir (BROOKER et EDWARDS, 1973). This propensity to produce large stands enables the charophyte to establish itself in the water body, an important characteristic as these plants do not compete well against other aquatic macrophytes. In drainage channels, for example, a stand of *C. vulgaris* might last for only one or two years.

Table 1. Examples of charophytes colonising water bodies after herbicide treatment

species	herbicide	habitat	A or P	reference
C. globularis	paraquat	reservoir	A	BROOKER et EDWARDS 1973
C. contraria	diquat	small ponds	A(1 pond) P(1 pond)	NEWBOLD 1975
C. vulgaris	terbutryne	large pond	P	CRAGG 1980 and PMW
C. delicatula	Dichlobenil	small ponds	P	NEWBOLD 1975 and PMW
Chara sp.	Dichlobenil	fish pond	A	COPE et al. 1969
Nitella sp.	diquat	lake	P	FISH 1966

A = species absent before treatment, P = species present before treatment, PMW = author

Under certain circumstances charophytes are resistant to chemical control, particularly bipyridilium herbicides (COSTEN 1961; TIMMERMANS, 1964; YEO, 1967; BROOKER and EDWARDS, 1973; NEWBOLD, 1975). Nevertheless, records of successful control by both paraquat and diquat have been recorded (GUSE 1961; EARNEST, 1971). The resistance could be associated with the high concentrations of calcium and magnesium coating plant surfaces acting as a barrier to herbicide entry (BROOKER et EDWARDS 1973). Where a charophyte is resistant to herbicide treatment, its chances of recovery must be increased.

The nomenclature in this paper follows ALLEN (1950).

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