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Distribution and Habitat Selection of Dytiscid Beetles in Characteristic Vegetal Units of Southern Québec

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Abstract: A five years survey of dytiscid beetles in southern Québec was realized with an approach refering to vegetal units qualified as characteristics habitats. This approach was successfully tested in biting flies studies and is now applied to dytiscid beetles. In this study, six vegetal units were retained. On fourty-five dytiscid species, were founded there, someones are appeared as exclusive for one type of vegetal unit, when others ubiquitous. Phenology of dytiscid beetles is also presented.

Key words: Coleoptera Dytiscidae – aquatic beetles – vegetal units – habitat selection.

Introduction

Many papers have been published on distribution and systematic of aquatic beetles particulary dytiscids but few on ecological selection of habitats by them. In Europe, description of habitats colonized by dytiscids is rather vague as reported recently by CUPPEN (1983) and this fact is particulary true for North America. Meanwhile, some authors consider the nature of habitats as determinant of the presence or absence of dytiscids; recent papers on this have been published by GALEWSKI (1971), BRANCUCCI (1980), WIGGINS et al. (1980) and CUPPEN (1983).

GALEWSKY (1971) underlines the necessity to consider in studies, larvae and adults to understand particular ecological preference of dytiscids in colonization of habitats. Because of their impossibility to fly, larvae are ecologically more specialized than adults and as a matter of fact more regular in samples. However, the actual difficulty to identify most of the larvae obliges us to attempt an integration of all data on dytiscids to provide a global picture of ecological preferences.

An ecological community is composed of many species grouped into a habitat. Major characteristic of this community is its structure as defined by functional relations in and between species (TYLER, in: HART, 1981); population fluctuations depend on those relationships. All species founded in a community are expected to answer to global conditions of habitat. In this view, selection of preferential habitat by biting

flies populations particulary Culicidae and Tabanidae in Diptera was recently understood; these insects have larvae highly integrated to specific habitats while adults may fly easily from breeding pools. A reference to vegetal units has unabled us to detect and characterize preferential breeding sites for biting flies (Pautou et al., 1973; Maire et al., 1976; Baribeau & Maire, 1983).

A five years survey of dytiscid beetles in six major distinct water habitats of southern Québec, Canada has given 45 species belonging to 15 genera. From this material, many species are mentioned for the first time for the province of Québec. Few data exist on dytiscids on this territory with so many marshes, bogs and ponds. Until recently, sampling of aquatic beetles in Québec was the preoccupation of few biologists and some dabbles. Papers published on the subject are rare. In Québec, it would have taken the development of mid and northern territories involvement with the problem of mosquito, and protection or ecological evaluation of swamps, to bring recently some interest in dytiscid beetles, as associated fauna of mosquito populations. In this respect, results presented in this paper follow ecological studies on habitats of biting flies in Québec. Dytiscids were found to be major predators of mosquito larvae and their survey has raised the problem of particular habitat selection by aquatic insects as demonstrated for biting flies. Also, the knowledge of distribution of dytiscids would be a great practical tool for an eventual population control of biting flies or at least to evaluate their ecological importance in alimentary chain of swampy habitats. We attempted to verify if vegetal units were efficient as bioindicator for defining and locating dytiscid habitats as it is for mosquito and tabanid flies.

Material and methods

Larvae and adult beetles were collected from six physiognomic sites of southern Québec (Canada), located in the surroundings of Trois-Rivières (46°20'N – 72°31'W). Sampling localities are all situated on alluvial deposits in confluence of St-Maurice and St-Lawrence Rivers. Survey was conducted in a qualitative way from the melting snow period in April until August of years 1979–1983; sites were visited once a week.

The field approach was facilited firstly by using aerial photographies to detect damp habitats. Afterwards, and according to Pautou et al. (1973) and ecological survey of vegetation permit us to recognize some plants as indicators of a kind of habitat. Phytosociological charac-

teristics of aquatic and semi-aquatic studied habitats are based on MAIRE et al. (1976).

Sampling was realized by using a five mesh-sized net (0,5 mm); sweeping vigorously of the net through aquatic or semi-aquatic vegetation, along margins of water, surface and several centimeters deep was necessary to catch as diversified dytiscids as possible. Specimens were sorted in the field using a white tray; for transport to laboratory, each of them was put into individual small vials to avoid cannibalistic effect. As often as possible, larvae were reared until adults in small basins filled with filtered water on substrate from the original pool; this technique was necessary to make the identification of specimens more easy. Since there is no general key to identifying all dytiscid beetles of North America; it is then necessary to refer to more than one key and principally to those of ANDERSON (1971), HILSENHOFF (1975), LARSON (1975), ZIMMERMANN (1981). All collected specimens were kept in the entomological collection of the University of Trois-Rivières. Following a brief description of vegetal units, where dytiscids samples were made.

Vegetal units:

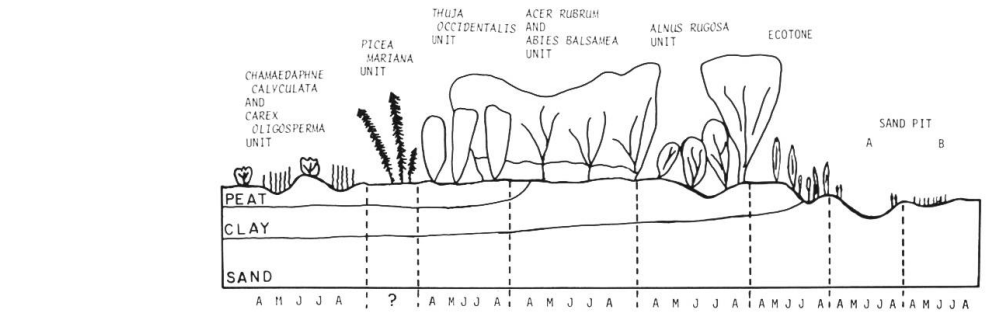
1. *Chanaedaphne calyculata* and *Carex oligosperma* unit: open habitat situated in a peat-bog; all the ground surface is *Sphagnum* covered; several small (15–25 m^2) and deep water bodies with pH 4,0–4,5.

2. *Thuja occidentalis* unit: mixed forest habitat where *Abies balsamea* and *Acer rubrum* are the other abundant trees; ground covered with *Sphagnum;* numerous small (1,0–10 m^2) and shallow temporary pools with pH 4,5.

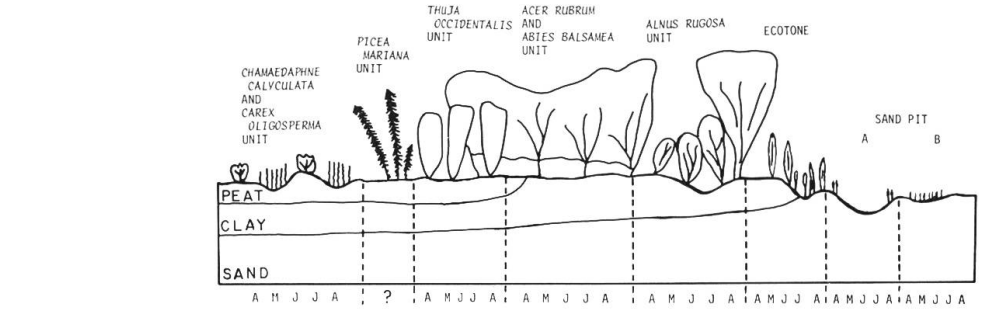
3. *Acer rubrum* and *Abies balsamea* unit: forested habitat where pools situated in depression have variable size (25–125 m^2) according to precipitations; permanent water bodies (depth $<$ 200 cm) with bottom covered by fallen leaves, pH 5,0–5,5.

4. *Alnus rugosa* unit: open habitat with permanent pools of variable size (25–150 m^2; depht $<$ 100 cm); pH 5,5–6,5.

5. Ecotone: localizated between sand pit and *Acer rubrum/Abies balsamea* forest. Open and permanent pool (50m^2, depth $<$ 100 cm)



Acilius semisulcatus
Coptotomus interrogatus
Colymbetes sculptilis
Desmopachria convexa
Dytiscus dauricus
Graphoderus liberus
Graphoderus perplexus
Hydroporus badiellus
Hydroporus brevicornis
Hydroporus hockingi
Hydroporus niger
Hydroporus tristis
Hygrotus impressopunctatus
Hygrotus sayi
Ilybius biguttatus
Ilybius discedens
Laccophilus maculosus
Liodessus affinis
Liodessus fuscatus
Rhantus suturellus
Rhantus wallisi
Uvarus granarius



Agabus bifarius
Agabus phaeopterus
Agabus semipunctatus
Laccornis latens
Agabus anthracinus
Agabus erichsoni
Agabus gagates
Dytiscus fasciventris
Hydroporus levandiri
Hydroporus notabilis
Hydroporus signatus
Hydroporus striola
Hydroporus tenebrosus
Hydroporus undulatus
Rhantus sinuatus
Dytiscus harrisii
Dytiscus verticalis
Hygrotus laccophilinus
Rhantus binotatus
Rhantus consimilis
Dytiscus hybridus
Hygrotus nubilis
Ilybius ignarus

Fig. 1: distribution of dytiscid beetles in the distinguished vegetal units of southern Québec from April to August of years 1979–1983. For description of vegetal units see text.

characterized by semi-aquatic shrub *Salix discolor* and *Alnus rugosa;* pH 7,0–7,5.

6. Sand pit with two types of water bodies.
A: pond with large and open surface (300–400 m^2) and a maximum depth of 200 cm; bordered partially by a fringe of emergent plants (*Thypha* spp., *Salix* spp.); pH 7,0–7,5.
B: temporary pool with open and variable surface (25–75 m^2) and bottom covered by *Leersia oryzoïdes;* pH 7,0–7,5.

In southern Québec, natural vegetative succession involves a *Picea mariana* vegetal unit (black spruce) between *Chamaedaphne calyculata/ Carex oligosperma* unit and *Thuja occidentalis* unit. No data on dytiscid beetles for this vegetable unit is available for the present survey.

Results and discussion

Qualitative survey of dytiscid beetles in the studied vegetal units has permitted us to detect some tendencies reflecting habitat selection by some species. Figure 1 (A,B) gives the species collected from April to August and vegetal units where they are observed.

Forty-five species were inventoried. The majority of them appeared in summer months; this is particularly true for dytiscids of peat-bog, *Alnus rugosa* vegetal unit and sand pit water bodies. Others seem to appear earlier in April, May and June; *Acilius semisulcatus, Graphoderus perplexus* and *Laccophilus maculosus* were collected as soon as April when snow is melting. Although the majority of the species appears in peat bog only in July; this habitat contains half of all species inventoried in prospected localities. On the other hand, only six species have been found in *Thuja occidentalis* vegetal unit.

Among species collected, we recognized exclusive ones for a type of habitat while others were rather ubiquitous in their distribution. Eighteen of forty-five species seem exclusive for a type of vegetal unit; six in *Acer rubrum/Abies balsamea* unit: *Agabus anthracinus, A. erichsoni, A. gagates, Hydroporus levandii, H. tenebrosus, Rhantus sinuatus;* five in *Chamaedaphne calyculata/Carex oligosperma* unit: *Dytiscus dauricus, H. badiellus, H. brevicornis, H. hockingi, Uvarus granarius;* three in *Thuja occidentalis* unit: *Agabus bifarius, A. phaeopterus, A. semipunctatus;* two in *Alnus rugosa* unit: *Hygrotus laccophilinus, R.*

consimilis; one in pond A of sand pit: *Hy. nutilis;* one in pond B of sand pit: *Ilybius ignarus.* No exclusive species were found for ecotone.

Thus, open localities (peat-bog, *Alnus rugosa* unit and sand pit) contain nine exclusive dytiscids beetles of which two, from artificial ponds (sand pit). Even if no single species was common in all types of habitats studied, two were in five of the six habitats described above (*Laccophilus maculosus* and *Liodessus affinis,* except in *Thuja occidentalis* unit) and two others in four habitats (*A. semisulcatus* and *Hy. sayi,* except in *T. occidentalis* and *A. rubrum/Ab. balsamea* units). Among the six habitats, *T. occidentalis* vegetal unit may be considered as a particular habitat for dytiscid beetles.

In north America, only one study exists that allowed us some comparisons with our data on habitat selection by dytiscid beetles. Using in an exhaustive description of species found in Alberta (Canada), Larson, (1975) gives many but general informations on types of sites where aquatic beetles have been collected. Except particular species to southern Québec (about fifteen), habitat selection by dytiscid beetles in Canada and southern Québec seems to be similar. However, difficulties of comparison are attributable to local or vernacular names about habitats (ex.: flooder grass, beaver pond, wood-pool, peat-bog). Also, each habitat is very heterogeneous and has an influence on number of aquatic beetles species (Timms & Watts, (1981). According to Pautou et al. (1973), vegetal unit approach includes whole environmental variables determining preferences or aversions of species for habitats. This approach may permit us to regroup many species with the same range of ecological preferences and make a better integration of sites characteristics. Yet, phytosociological surveys are necessary to realize this integration and an ecological map on distribution of dytiscids may be made. In southern Québec, more than thirty-six vegetal units have been described (Maire et al., 1976) and make technically survey of insect fauna more easy, with ecological perspective. Each vegetal unit is the reflect of particular hygrometry degree of soil under climatic conditions and may permit us to anticipate on insect fauna present in seasonal periods. Concurrently, it is important to consider physical and chemical characteristics so as to provide a better detailed description as possible, on distribution and habitat selection by dytiscid beetles; coexistence of some species would be more understood as established for biting flies.

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