1.5. DIVERSITY PATTERN AND HABITAT CHARACTERISTICS OF FEMALE TABANID FLIES IN A WETLAND AREA OF DRÁVA RIVER

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1.5.1. INTRODUCTION.

Female Tabanidae are known as important pests of livestock and humans, and vectors of several diseases of man and the animals. Studies of their biology have focused on the host seeking and blood feeding behaviours and the physiological ages of females populations. The effect on the distribution of Tabanids investigated some European and American specialists (i.e. Auroi and Graf, 1982, Auroi, 1986, Pollet, 1991, Roberts, 1971, Strickman and haga, 1986). Species of the family Tabanidae often are frequent member of semiaquatic and wetland environments.

The purpose of this study was to derive a generalised relationship between the basic characteristics of deer fly habitats and the spatial patterns of species diversity, richness, and evenness in the assessment of riverine wetlands. A linear relationship found between some environment characteristics and the pattern of diversity, richness and evenness in deer fly (Diptera: Tabanidae) communities. The results of investigations show that diversity was highest in moisture substrates and in better balanced physical conditions. Richness was highest in moisture substrates, better balanced physical conditions and frequency of inundation. The best evenness was found in moisture substrates and in better balanced physical conditions (physical stability) abundance of vegetation and presence of standing water.

Among the chosen 12 habitat characteristics 4-5 (some of them closely related) could be the primary causes of the presence and pattern of Tabanids in a wetland habitat of Dráva river. Some effect of these environment factors on Tabanids have already bee n investigated separately but not all to gather. This indicates that these community parameters are important and they could be primary causes of the patterns found in this work.

1.5.2. MATERIAL AND METHODS.

Tabanidae were captured with red coloured Malaise traps. Trap operation generally corresponded to photoperiod. Collecting operations started about sunrise and ended at sunset. The daily trapping period was about 14 hours per day until late July were operated for a 14 h period each day,. 2435 specimen of collected deer flies were stored and determined. 31 species were captured in 21 collection days. From the study of literature and our observations, we postulate that there are 12 basic characteristic of most tabanid's habitats and that these characteristics are important in regulating species diversity and abundance patterns. Lack of the quantitative data all variables were scored in qualitative manner. We postulated that there are 12 basic characteristics of all tabanid habitats and these characteristics are important in regulating species diversity and abundance patterns.

The variation in species diversity (H') was primarily accounted for by frequency of inundation (31,60%), physical stability (includes dependent variables of climatic measured factors) (11,40%), and the presence of sand (7,10%). the variation in species richness was primarily accounted for by the type of vegetation (35,00%), the abundance of vegetation (32,16%), the presence of running water (4,00%), substrate moisture (41,84%), lotic habitat (5,4%), presence of a shore (18,0%), presence of standing water (9,8%) abundance of vegetation (7,2%), and frequency of inundation (6,7%).

The 12 characteristics of tabanid habitats used in this study and the method of scoring are:

- inundation (1 = few during year, 2 = numerous during year);
- physical stability, persistence (1 = unstable, 2 = moderately unstable, 3 = stable);
- and the presence of sand (0 = no, 1 = yes);
- the variation in species richness was primarily accounted for by the type of vegetation . vegetation type (0 = none, 1 = floating, 2 = emergent and floating, 3 = emergent, 4 = emergent and terrestrial, 5 = terrestrial);
- the abundance of vegetation, (0 = no vegetation, 1 = sparse, 2 = abundant in late summer, 3 = abundant in all summer);
- the presence of running water (0 = no, 1 = yes);
- substrate moisture (0 = shallow water, 1 = wet substrate to shallow water, 2 = wet substrate; 3 = moist to wet substrate, 4 = moist substrate)
- lotic habitat (0 = no, 1 = yes);
- presence of a shore (0 = no, 1 = yes);
- presence of standing water (0 = no, 1 = yes);
- abundance of vegetation (0 = no vegetation, 1 = sparse, 2 = abundant in late summer, 3 = abundant in all summer);
- and frequency of inundation inundation (1 = few during year, 2 = numerous during year); and 12 = physical stability or persistence (1 = unstable, 2 = moderately unstable, 3 = stable);

Tabanidae were trapped with 6 Malaise traps similar to the design of Townes (1962), except they were red coloured, the original traps were white. The study wetland areas situated along the Dráva river and at the Boros Dráva oxbow (18°15'05' East and 45°48'34' North). Trap operation generally corresponded to photoperiod. Trapping operations started about sunrise and ended at sunset. The daily trapping period was about 14 hours per day until late July were operated for a 14 h period each day. During the trapping period, collecting cages were removed at 1 – hour intervals and replaced with empty cages. 2435 specimen of collected flies were stored and determined. 31 species were captured in 21 collection days. The Shannon – Wiener diversity index (H') and evenness (J') was calculated. The rationale and permissibility of using these indices in this type of study have been discussed by Scheiring (1974) and Scheiring and Deonier (1979). The linear multiple regression model (Harris, 1975) is a useful technique for determining the effect and importance of several independent variables on a single dependent variable. A step – wise multiple regression adds one independent variable at a time, choosing to include that independent variable which has the highest partial correlation with the dependent variable at that point in the analysis. This model is described by the equation:

$$Y = b_o + b_1X_1 + b_2X_2 + \ldots + + b_nX_n$$

(Y = dependent variable, b = intercept, X = independent variable, b_1 = intercept of X_1 (X_1 = first independent variable)).

The NuCoSA (Tóthmérész, 1995), and own made PC programs were run using diversity, richness, and evenness as the dependent variables and the 12 habitats characteristics as the independent variables. Each analysis was run until all independent variables had been included, only those included up to the point where the standard error (S. E.) of the estimated Y was minimum were considered to be significant.

1.5.3. RESULTS AND DISCUSSION

1.5.3.1. Diversity Patterns

The result of the step – wise multiple regression using diversity (H') as the dependent variable and the 12 habitat characteristics as the independent variables are give in Table 1. The substrate moisture seems to be the most important factor affecting diversity in this study and accounts for 41,84% of the observed variation of H'. The other more important factors in this research area vegetation type and physical stability. These variables together take the 88,24 % variation in H'.

Substrate moisture, vegetation type and physical stability are positively related to diversity. We do not have facilities to measuring of wind velocity yet. Probably it is negatively related to H'. The substrate moisture and the vegetation allows presence highest species diversity of deer flies.

Both substrate moisture and physical stability are significantly correlated ($r = 0,696$, $p < 0,01$; $r = 0,486$, $p < 0,05$) with deer fly abundance.

Table 1. result of multiple regression using diversity (H') as the dependent variable and 12 habitat characteristics as independent variables.

Independent variable	% variation of H'*	R^a	R^2
Significant variables			
+ Substrate moisture	41,84	0,853	0,792
+ Vegetation type	35,00	0,593	0,321
+ Physical stability	11,40	0,884	0,654
Non significant variables	11,76	0,998	0,999

R^a = multiple correlation coefficient' R^2 = variation of H' accounted for by all independent variables entered at this point.

1.5.3.2. Richness Patterns

The result of the step – wise multiple regression using species richness (s) as the dependent variable and the 12 habitat characteristics as the independent variables are give in Table 2. The substrate moisture seems to be the most important factor affecting diversity in this study and accounts for 41,84% of the observed variation of s. The other more important factors in this research area physical stability and frequency of inundation. These variables together take the 84,84 % variation in s.

Substrate moisture, physical stability and frequency of inundation are positively related to species richness. We do not have facilities to measuring of wind velocity yet. Probably it is negatively related to s. The substrate moisture and the physical stability allow more species of deer flies.

Both substrate moisture and physical stability are significantly correlated ($r = 0,673$, $p < 0,01$; $r = 0,557$, $p < 0,05$) with deer fly abundance.

Table 2. result of multiple regression using species richness (s) as the dependent variable and 12 habitat characteristics as independent variables.

Independent variable	% variation of H'*	R^a	R^2
Significant variables			
+ Substrate moisture	41,84	0,571	0,528
+ Physical stability	11,40	0,813	0,511
+ Frequency of inundation	31,60	0,901	0,716
Non significant variables	15,16	0,998	0,998

R^a = multiple correlation coefficient' R^2 = variation of s accounted for by all independent variables entered at this point.

1.5.3.3. Evenness Patterns

The result of the step – wise multiple regression using diversity (J') as the dependent variable and the 12 habitat characteristics as the independent variables are give in Table 3. The substrate moisture seems to be the most important factor affecting diversity in this study and accounts for 41,84% of the observed variation of J'. The other more important factors in this research area abundance of vegetation, physical stability and presence of standing water. These variables together take the 70,04 % variation in J' only.

Substrate moisture, abundance of vegetation, physical stability and presence of standing water are positively related to diversity. The substrate moisture and the vegetation type allows presence highest species diversity of deer flies.

Table 3. result of multiple regression using diversity (J) as the dependent variable and 12 habitat characteristics as independent variables.

Independent variable	% variation of H'*	R^a	R^2
Significant variables			
Substrate moisture	41,84	0,701	0,792
Abundance of vegetation	7,00	0,619	0,321
Physical stability	11,40	0,864	0,676
Presence of standing water	9,80	0,892	0,824
Non significant variables	29,96	0,999	0,998

R^a = multiple correlation coefficient' R^2 = variation of J accounted for by all independent variables entered at this point.

1.5.3.4. Habitat Characteristics an Community Patterns

The results of this work verify that a linear relationship exists between some environment characteristics and the pattern of diversity, richness and evenness in deer fly (Diptera: Tabanidae) communities. The results of investigations show that diversity was highest in moisture substrates and in better balanced physical conditions. Richness was highest in moisture substrates, better balanced physical conditions and frequency of inundation. The best evenness was found in moisture substrates and in better balanced physical conditions (physical stability) abundance of vegetation and presence of standing water.

Among the chosen 12 habitat characteristics 4-5 (some of them closely related) could be the primary causes of the presence and pattern of Tabanids in a wetland habitat of Drava river. Some effect of these environment factors on Tabanids have already bee n investigated separately but not all to gather. This indicates that these community parameters are important and the could be primary causes of the patterns found in this work.

1.5.4. Summary

The composition of deer fly (Diptera: Tabanidae) communities is reported from wetland habitats of Drava river in Baranya County. Tabanidae were captured with red coloured Malaise traps. 2435 female specimen of collected deer flies were determined. 31 species were captured in 21 collection days. A generalised relationship between the basic characteristics of deer fly habitats and the spatial patterns of the habitat's species diversity (H'), species richness (s) and evenness (J) was derived using linear step-wise multiple regression. We postulated that there are 12 basic characteristics of all tabanid habitats and these characteristics are important in regulating species diversity and abundance patterns.

The results of this investigation of indicate that not at all evolutionary responses of deer flies to the environment need to be fine tuned but can at times be rather generalised.

1.5.5. Acknowledgements

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1.5.6. References

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