Acta entomologica serbica, Supplement, 2006, 23-32 UDC 595.771 : 574

ECOMORPHOLOGICAL OBSERVATIONS BY COMPARISON OF IMAGES FROM DIGITAL REFERENCE COLLECTIONS OF SIMULIIDAE

MANFRED CAR[1] AND WOLFGANG LECHTHALER[2]

[1]Institut für Wissenschaftliche Analyse, A. Hruzastr. 3, A-2345 Brunn am Gebirge, Austria
[2]Technisches Büro für Biologie, Brunnengasse 76/22, A-1160 Vienna, Austria

ABSTRACT – The availability of digital image collections makes possible an easy comparison of taxonomic characters of species according to their habitat. With keys for Simuliidae and Trichoptera, the following larval characters are compared for species living in crenal/rhithral and potamal areas respectively: color of head capsule, microtrichia of head fan, postgenal cleft, and hypostomial teeth in Simuliidae; and presence of thorns on femur and head in Trichoptera. In Culicidae, length of the antennae and that of the siphon indicate their feeding habits and the type of habitat. Scrapers have short antennae and a short siphon, while filter feeders have long antennae and a long siphon. The ecology of new species can be predicted from their body structures.

KEY WORDS: Simuliidae, Culicidae, Trichoptera, ecology, digital keys.

INTRODUCTION

The shape of Simuliidae larvae, like that of most aquatic insects, is determined by their habitat. Comparison of images from a virtual reference collection containing pictures of a great number of species allows one to group species resembling each other morphologically, suggesting the possibility of adaptations to similar environmental conditions.

MATERIAL AND METHODS

Images of specific taxonomic characters taken from electronic keys to Simuliidae (LECHTHALER & CAR, 2005), Culicidae (LECHTHALER, 2005), and Trichoptera (LECHTHALER &

STOCKINGER, 2005) were compared. Species were selected according to their habitat (crenal, rhithral, potamal) and their feeding habits (scrapers versus filter feeders).

RESULTS

Simuliidae: Larvae living in turbulent currents (Fig. 1) and at high altitudes usually have dark head capsules, while species living in lower areas have light head capsules (Fig. 2).

In like manner the postgenal clefts of the larval head capsule have a narrow and flat shape in species occurring in springs (Fig. 3), while those occurring in the river potamal have a deeper postgenal cleft.

Similar observations were made comparing hypostomia and the microtrichia of filter rays in these groups of species living in different habitats. Hypostomia of species in fast flowing waters exhibit long teeth, and their head fans have long, widely separated microtrichia (Figs. 5 and 6).

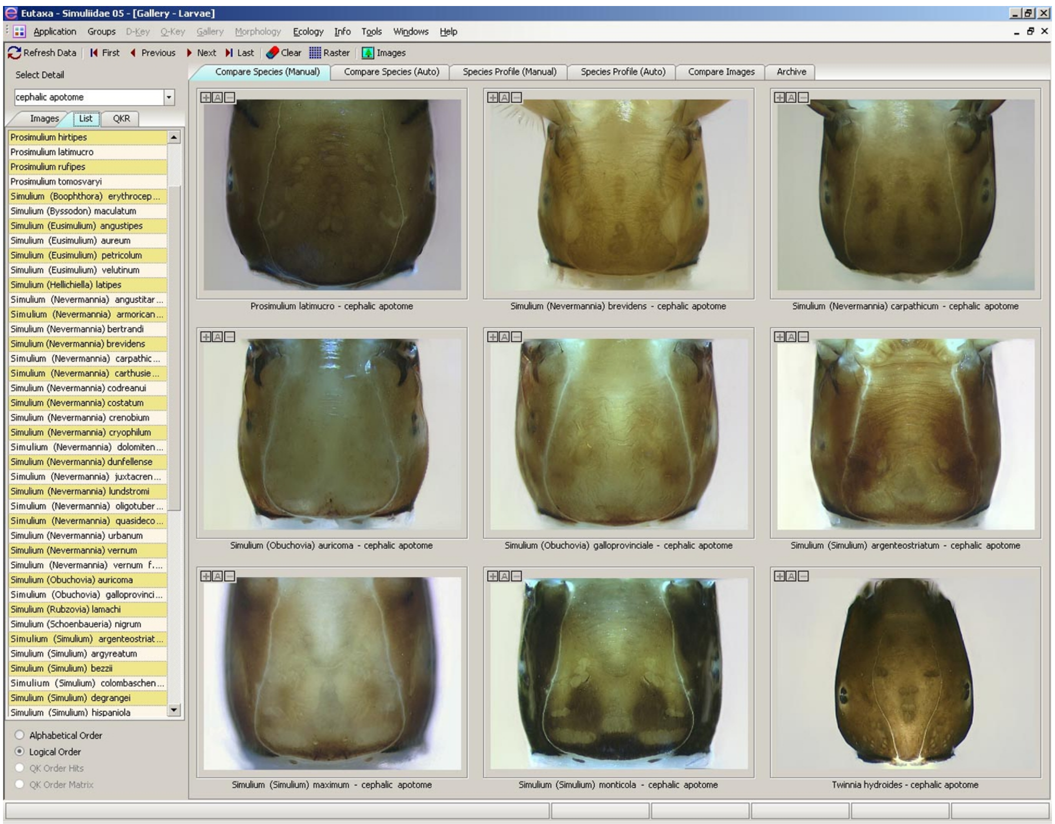

Fig. 1. Dark head capsules in *P. latimucro, S. brevidens, S. crenobium, S. auricoma, S. galloprovinciale, S. argenteostriatum, S.maximum, S. monticola,* and *T. hydroide.*

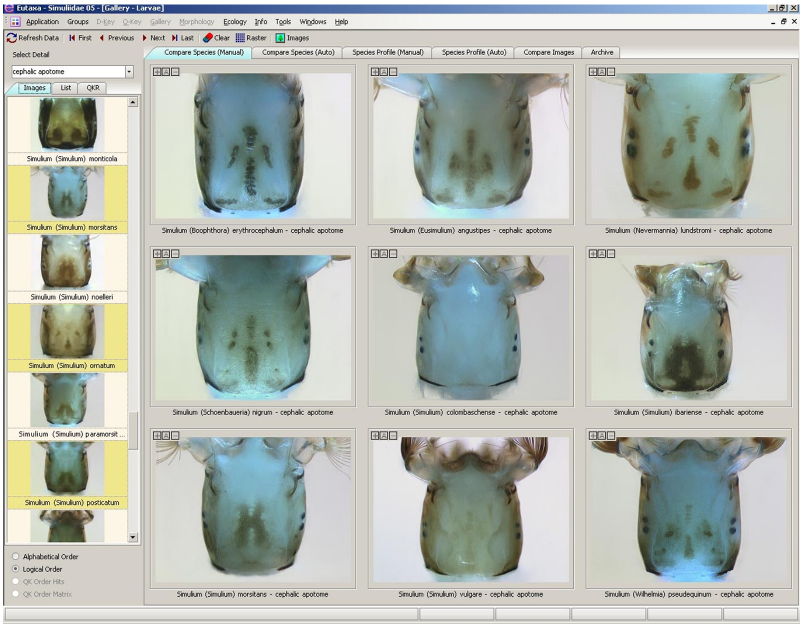

Fig. 2. Light head capsules in *S. erythrocephalum, S. angustipes, S. lundstromi, S. nigrum, S. colombaschense, S. ibariense, S. morsitans,* and *S. vulgare.*

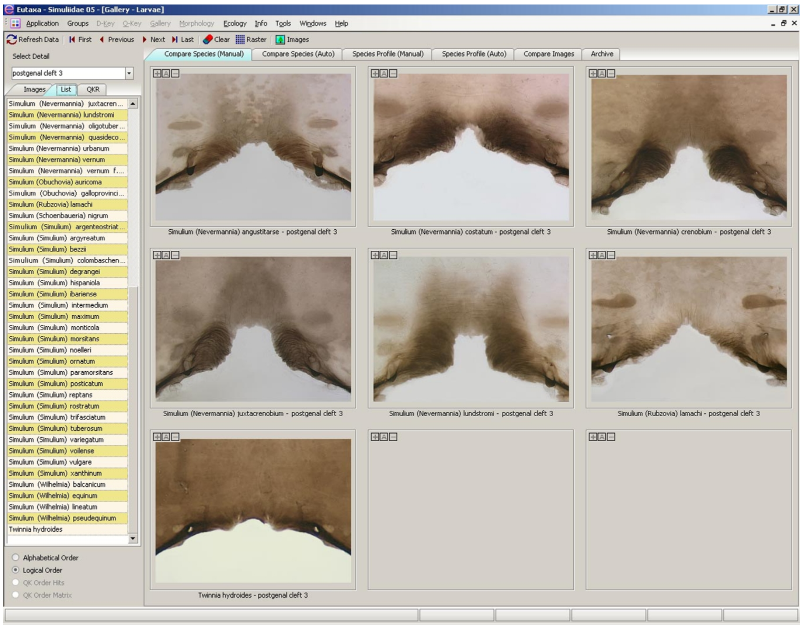

Fig. 3. Flat postgenal cleft in *S. angustitarse, S. costatum, S. crenobium, S. juxtacrenobium, S. lamachi,* and *T. hydroides.*

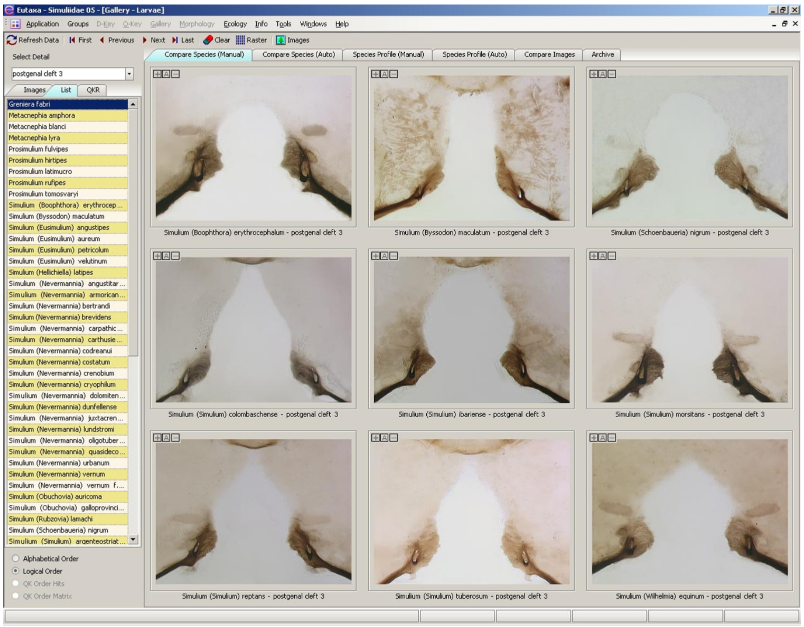

Fig. 4. Deep postgenal cleft in *S. erythrocephalum, S. maculatum, S. nigrum, S. colombaschense, S. ibariense, S. morsitans, S. reptans, S. tuberosum,* and *S. equinum.*

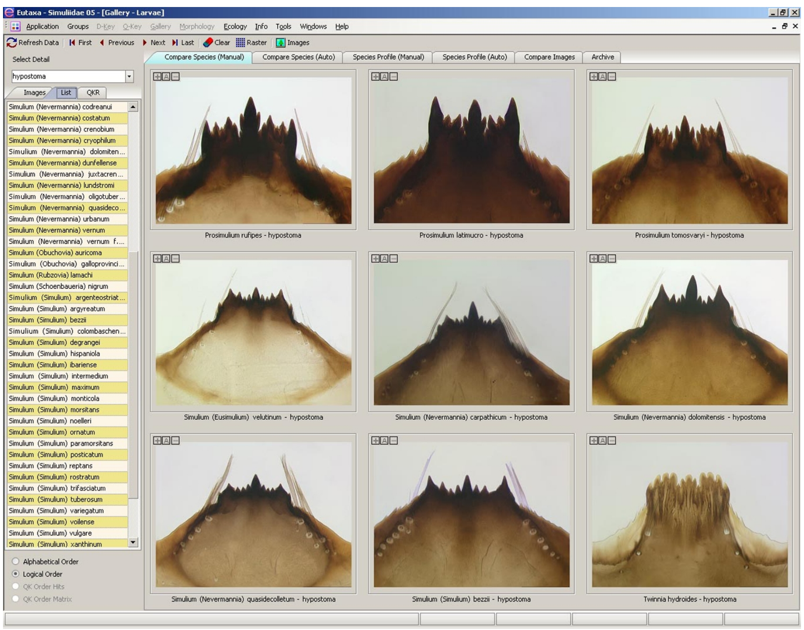

Fig. 5. Hypostomial teeth long in *P. rufipes, P. latimucro, P. tomosvaryi, S. velutinum, S. carpaticum, S. dolomitensis, S. quasidecolletum, S. bezzii,* and *T. hydroides.*

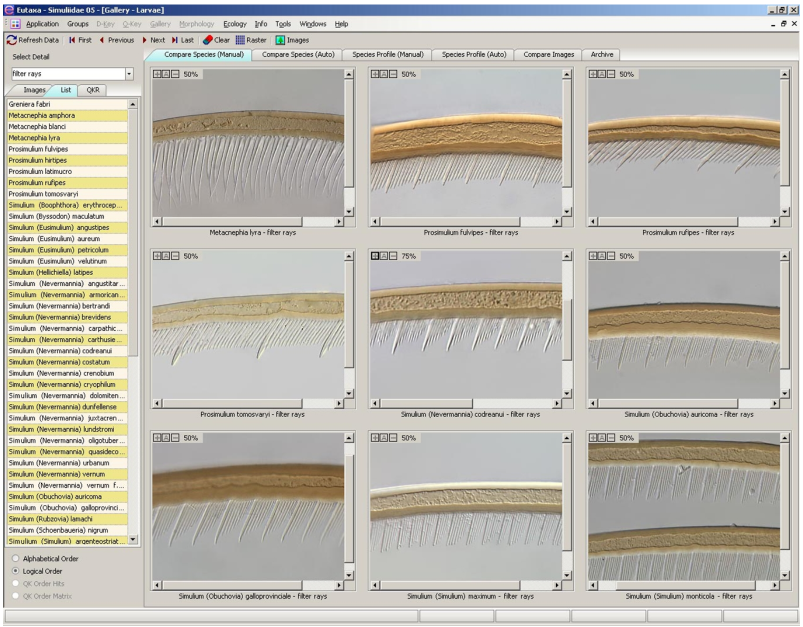

Fig. 6. Long microtrichia in *M. lyra, P. fulvipes, P. rufipes, P. tomosvaryi, S. codreanui, S. auricoma, S. gallprovinciale, S. maximum,* and *S. monticola.*

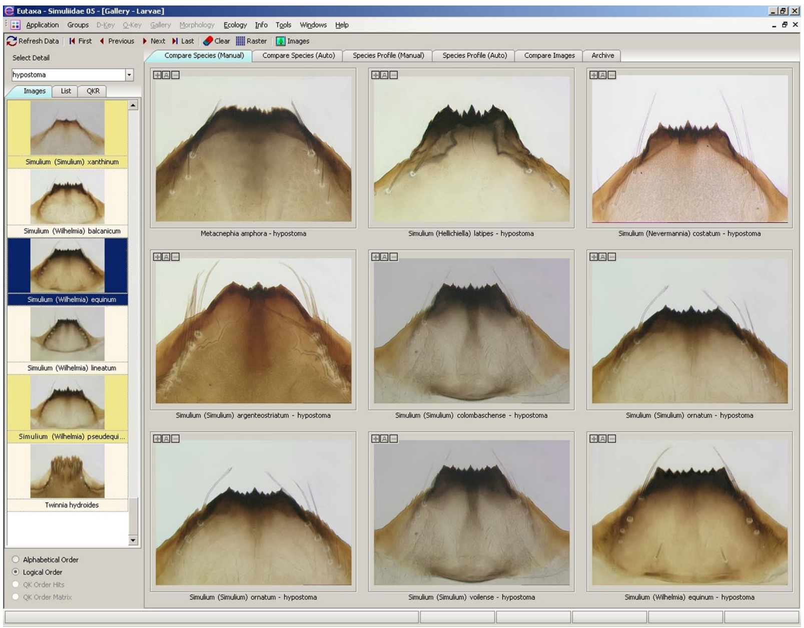

Fig. 7. Hypostomial teeth short in *M. amphora, S. latipes, S. costatum. S. argenteostriatum, S. colombaschense, S. ornatum, S. voilense,* and *S. equinum.*

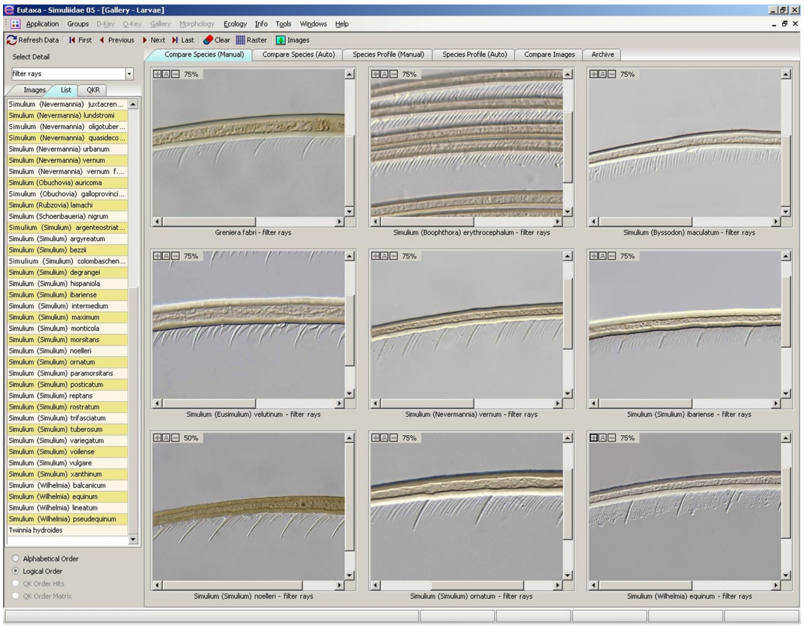

Fig. 8. Short microtrichia in: *G. fabri, S. erythrocephalum, S. maculatum, S. velutinum, S. vernum, S. ibariense, S. noelleri, S. ornatum,* and *S. equinum*.

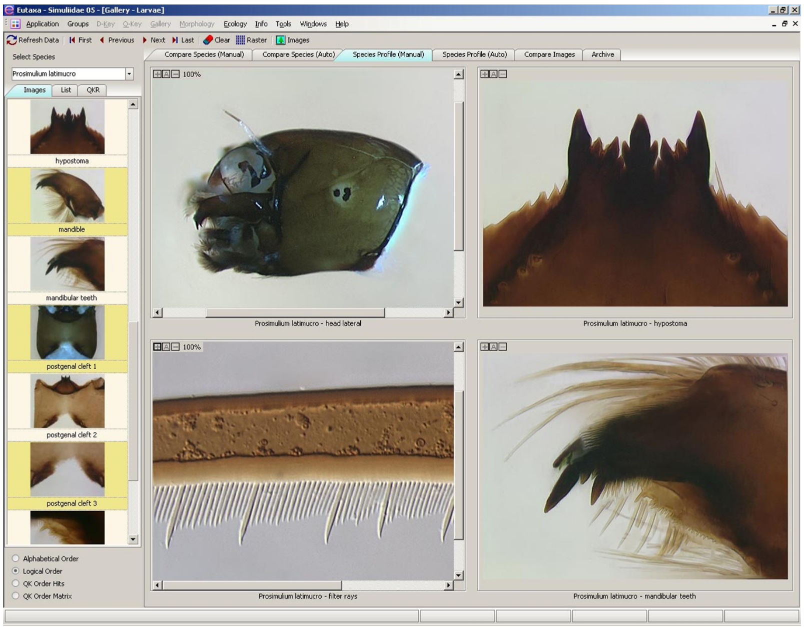

Fig. 9. *P. latimucro.*

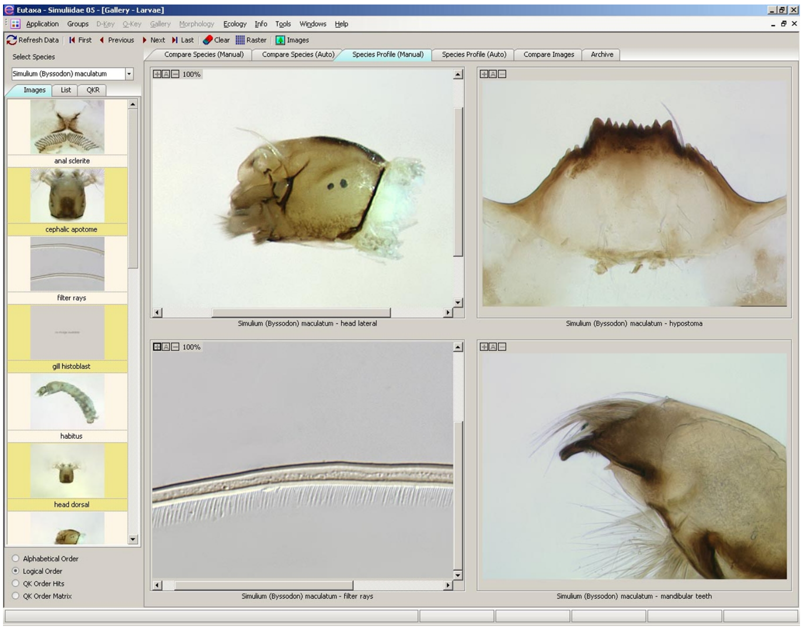

Fig. 10. *S. maculatum.*

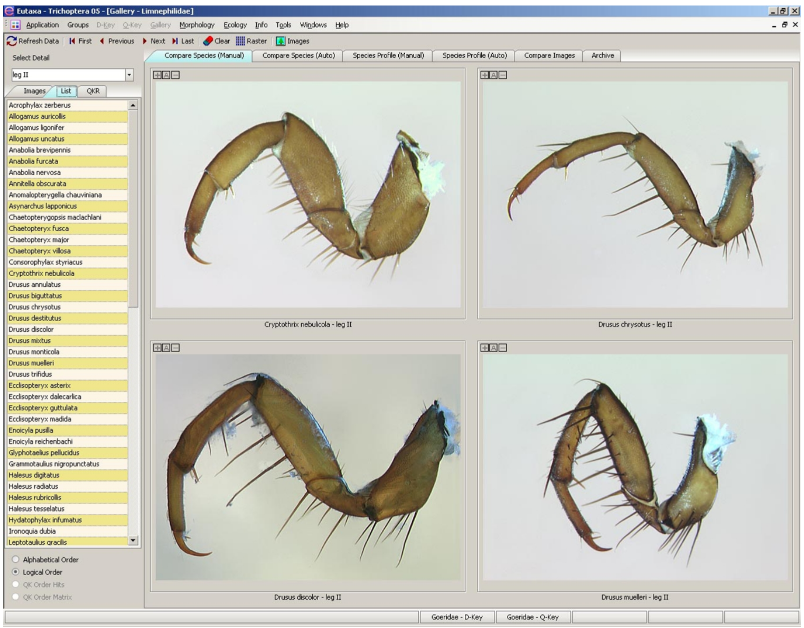

Fig. 11. Thorns on femora of: *Cryptothrix nebulicola*, *Drusus chrysotus* and *D. discolour,* and *D. muelleri.*

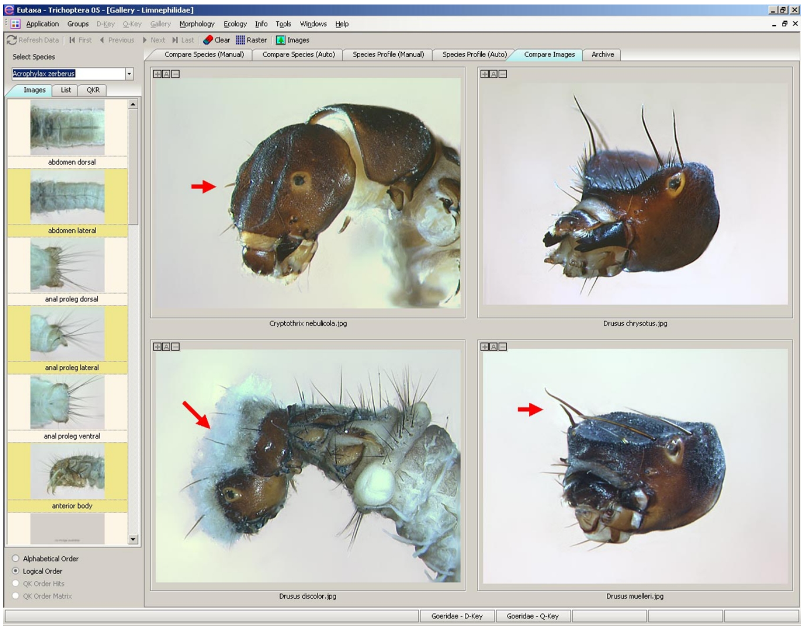

Fig. 12. Thorns on head capsules of: *Cryptothrix nebulicola*, *Drusus chrysotus* and *D. discolour,* and *D. muelleri.*

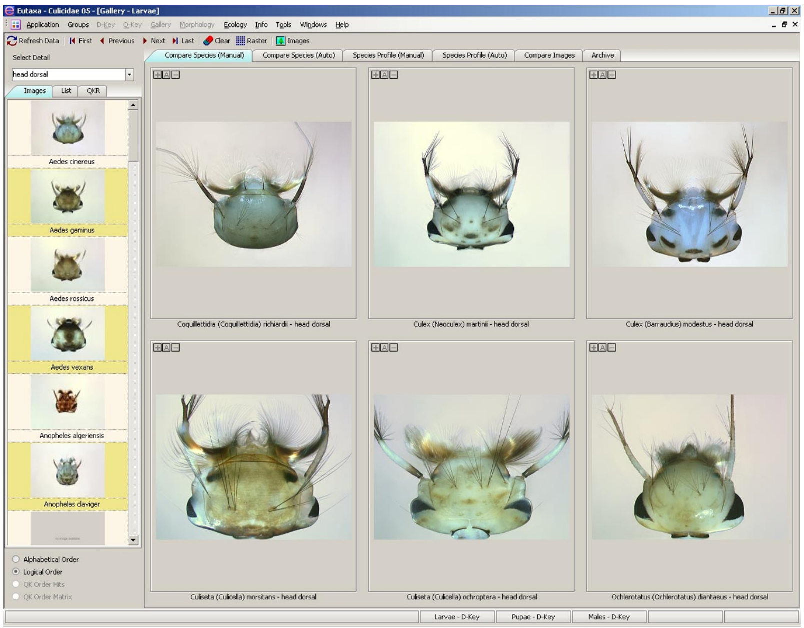

Fig. 13. Culicidae larvae with long antennae: *Coquill. richardii, Culex martini, Cx. modesti, Culiseta morsitans, Ca. ochroptera,* and *Ochlerotatus dianteus.*

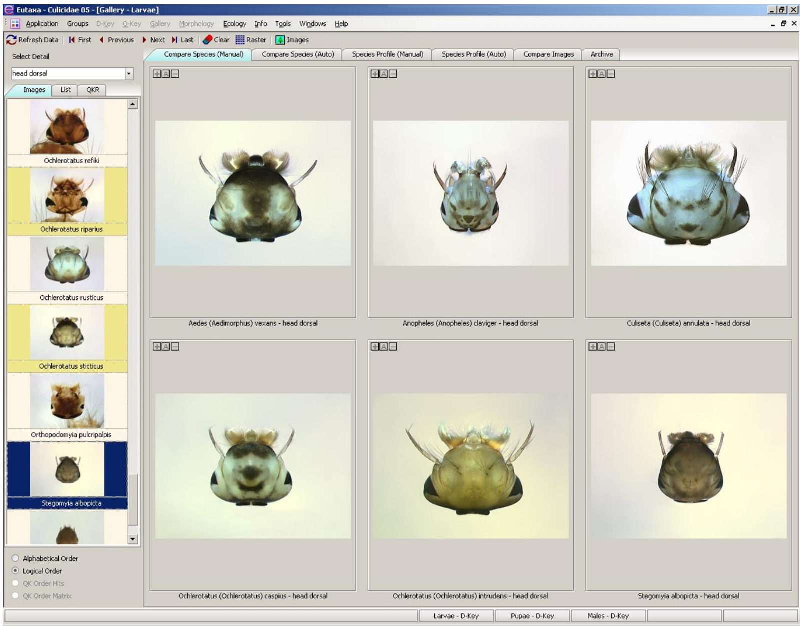

Fig. 14. Culicidae larvae with short antennae: *Aedes vexans, Anopheles calviger, Ca. annulata, Ochlerotatus caspius, O. intrudens,* and *Stegomyia albopicta.*

Hypostomia of species in slow-flowing waters exhibit short teeth, and their head fans have short closely spaced microtrichia (Figs. 7 and 8).

Figures 9 and 10 show a sample of typical characters in the ecologically separated species *Prosimulium latimucro* and *Simulium maculatum.*

Trichoptera: Figures 11 and 12 show the femora and head capsules of filter feeding Trichoptera larvae. They bear spines, which is unusual in Trichoptera with different feeding habits.

Culicidae: Antennae and siphons are shaped according to the feeding habits of larvae and the habitat they live in. Filter feeders have long antennae (Fig. 13), while scrapers (which often live in temporary ponds) have short ones (Fig. 14).

DISCUSSION

In Simuliidae, dark cuticula could originate as a result of increased radiation at high altitudes but also from mechanical stress in turbulent waters. The lack of bacteria in clean fast-flowing waters and its velocity could lead to the observed wide distance between microtrichia, which are especially suited to feeding on coarsely particulate organic matter (CPOM), while high numbers of bacteria in shallow waters necessitate a net of closely spaced microtrichia to make possible feeding on these small particles [finely particulate organic matter (FPOM) and ultra-finely particulate organic matter (UPOM)]. It seems logical that these species need short and small hypostomial teeth, while species feeding on large particles in fast-flowing water have long and slender teeth.

In Culicidae, length of the antennae and that of the siphon indicate their feeding habits and the type of habitat. Spring species living in temporary ponds are often scrapers with short antennae and a short siphon.

These observations also indicate that the ecology of new species can be assessed from the shape of body structures, as noticed in Trichoptera for the recently discovered larva of *Drusus muelleri*, which displays the same spinous legs as in *Cryptothrix nebulicola*, *Drusus chrysotus*, and *Drusus discolour*. The latter species are carnivorous, filtering rough particles (GRAF ET AL., 2005).

ACKNOWLEDGEMENTS

The authors thank Christine Kowal Post for useful hints concerning the text.

REFERENCES

GRAF, W., LUBINI, V. &, S., PAULS, 2005. Larval description of *Drusus muelleri* McLachlan, 1868 (Trichoptera: Limnephilidae) with some notes on its ecology and systematic position within the genus *Drusus*. – Ann. Limnol. – Int. J. Lim., 41(2): 93-98.

LECHTHALER, W., 2005. Culicidae - Key to Larvae, Pupae and Males from Central and Western Europe. EUTAXA, CD-edition, ISBN 3-950-1839-2-2, www.eutaxa.com

LECHTHALER, W. & M., CAR, 2005. Key to Larvae and Pupae from Central and Western Europe. EUTAXA, CD-edition, ISBN 3-950-1839-3-0, www.eutaxa.com

LECHTHALER, W. & W., STOCKINGER, 2005. Key to Larvae from Central and Western Europe. EUTAXA, DVD-edition, ISBN 3-950-1839-1-4, www.eutaxa.com