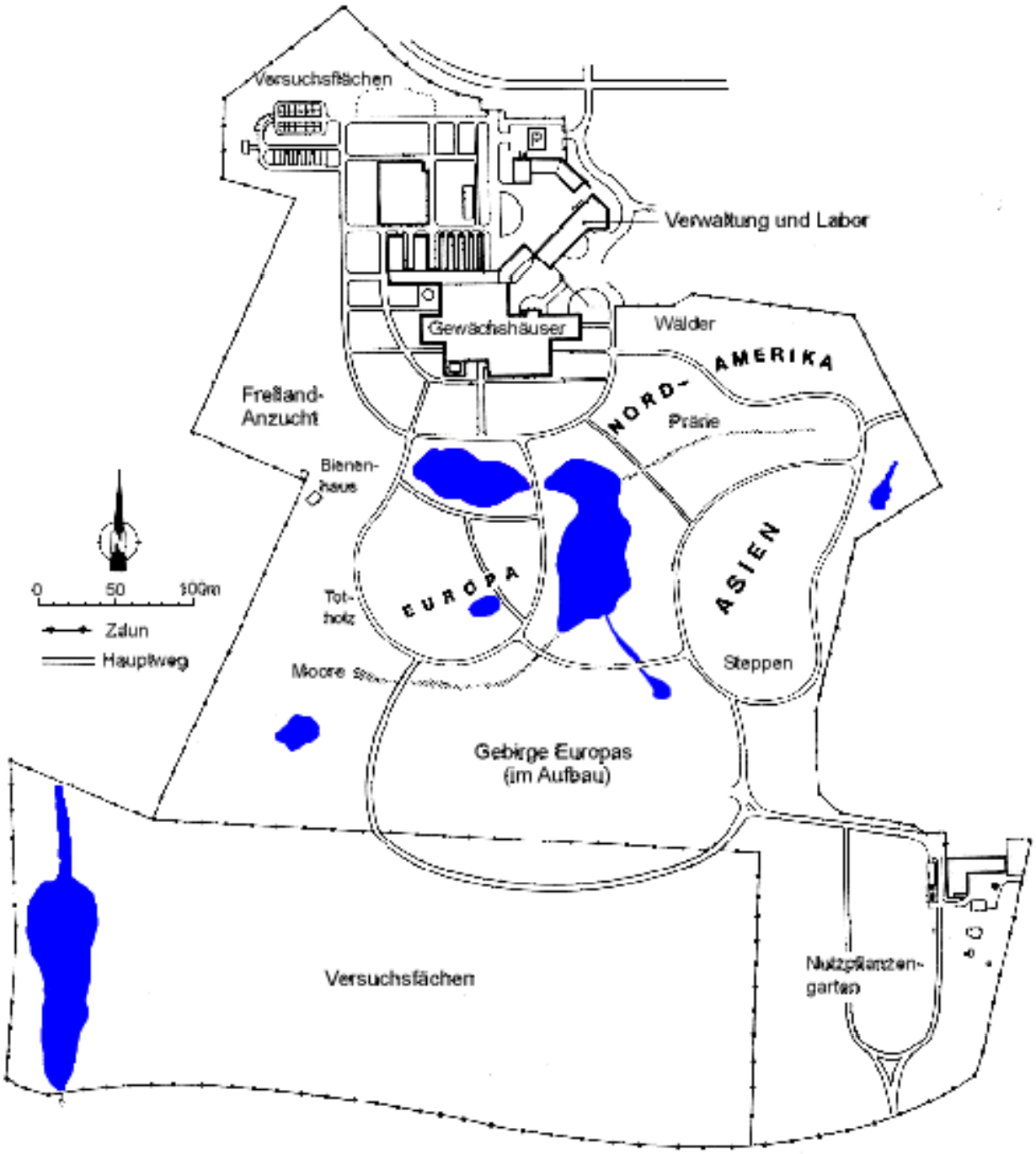
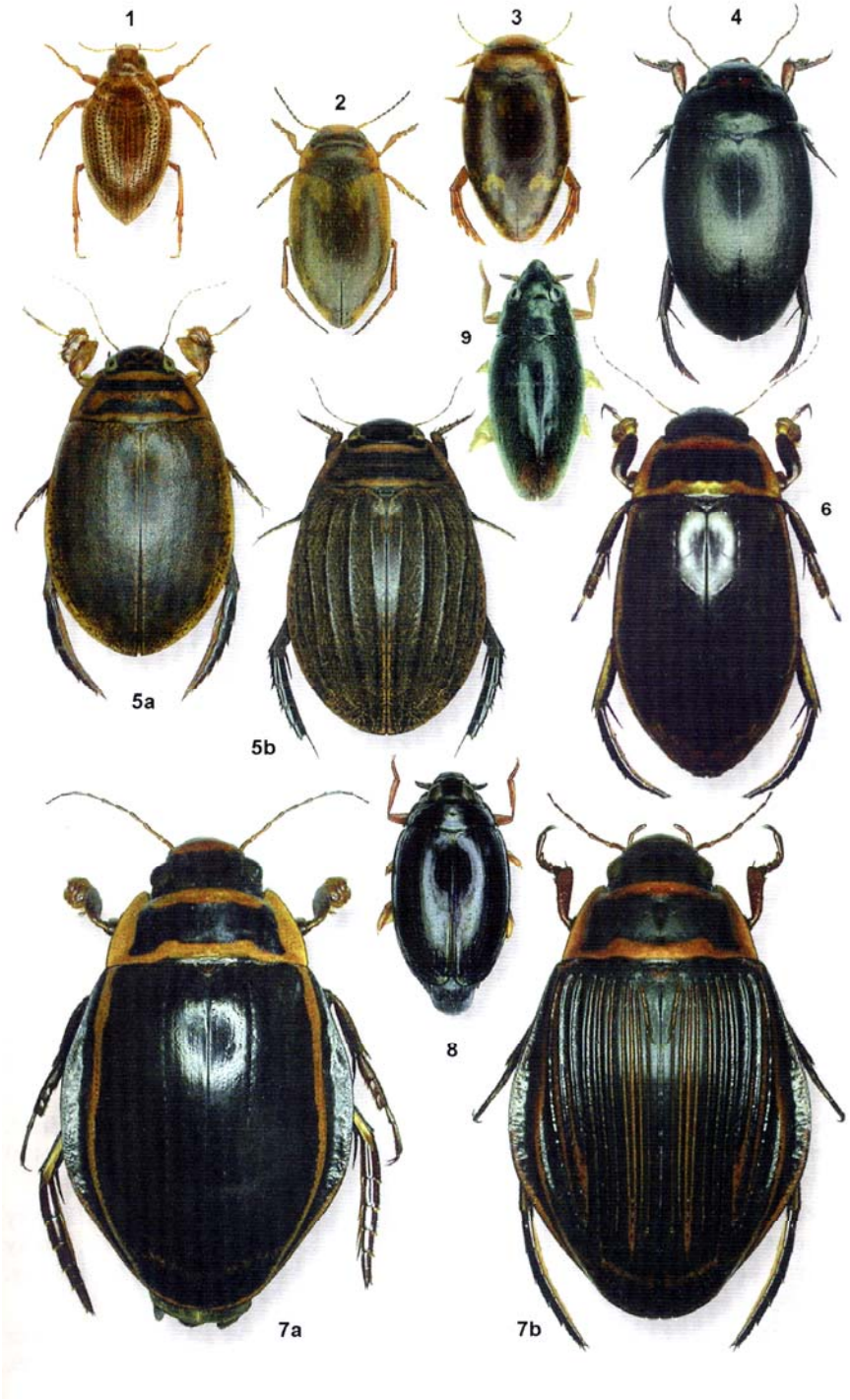

Versuchsflächen
Verwaltung und Labor
Gewächshäuser
Wälder
NORD-AMERIKA
Prärie
Freiland-Anzucht
Bienen-haus
EUROPA
ASIEN
Tot-holz
Moore
Steppen
0 50 100m
Zaun
Hauptweg
Gebirge Europas (im Aufbau)
Versuchsflächen
Nutzpflanzen-garten

Auswahl hydradephager Käfer

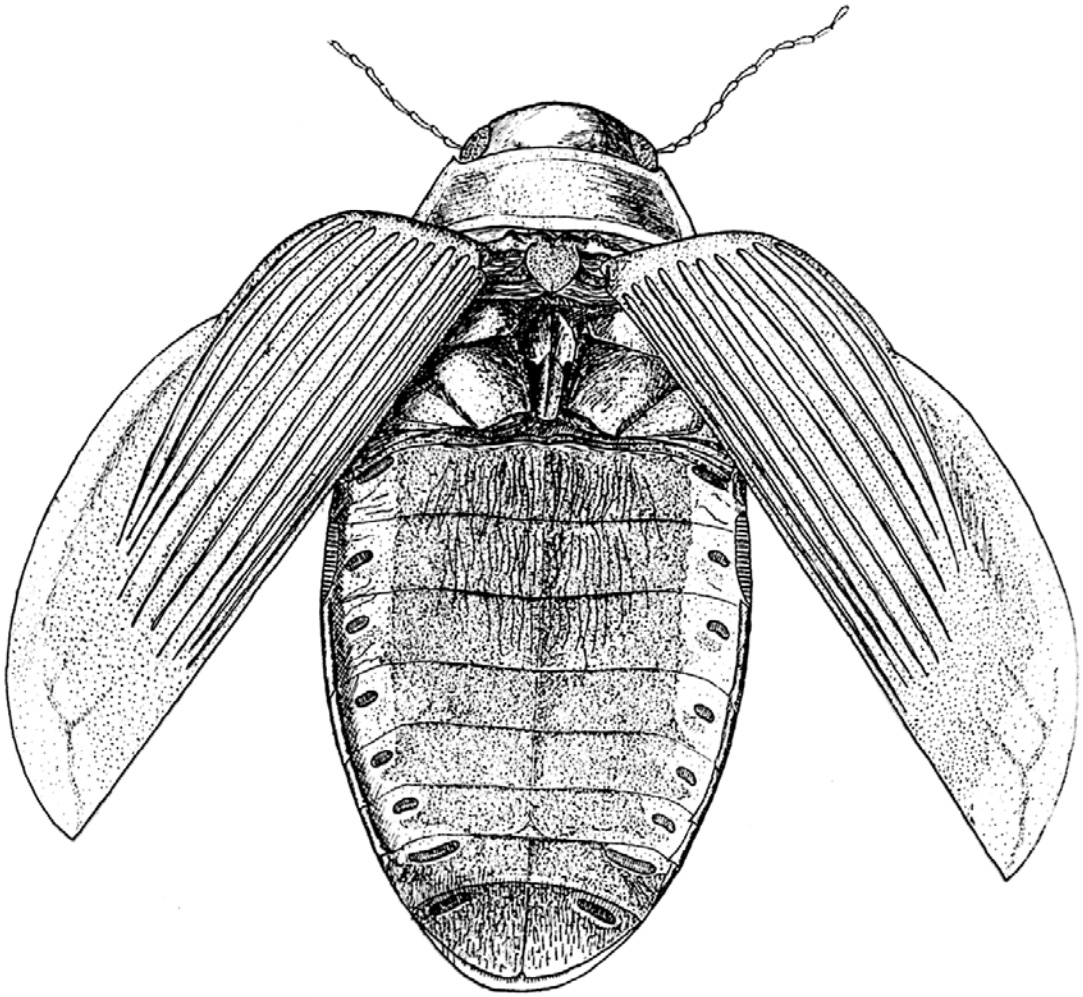
1 Haliplidae

2-7 Dytiscidae

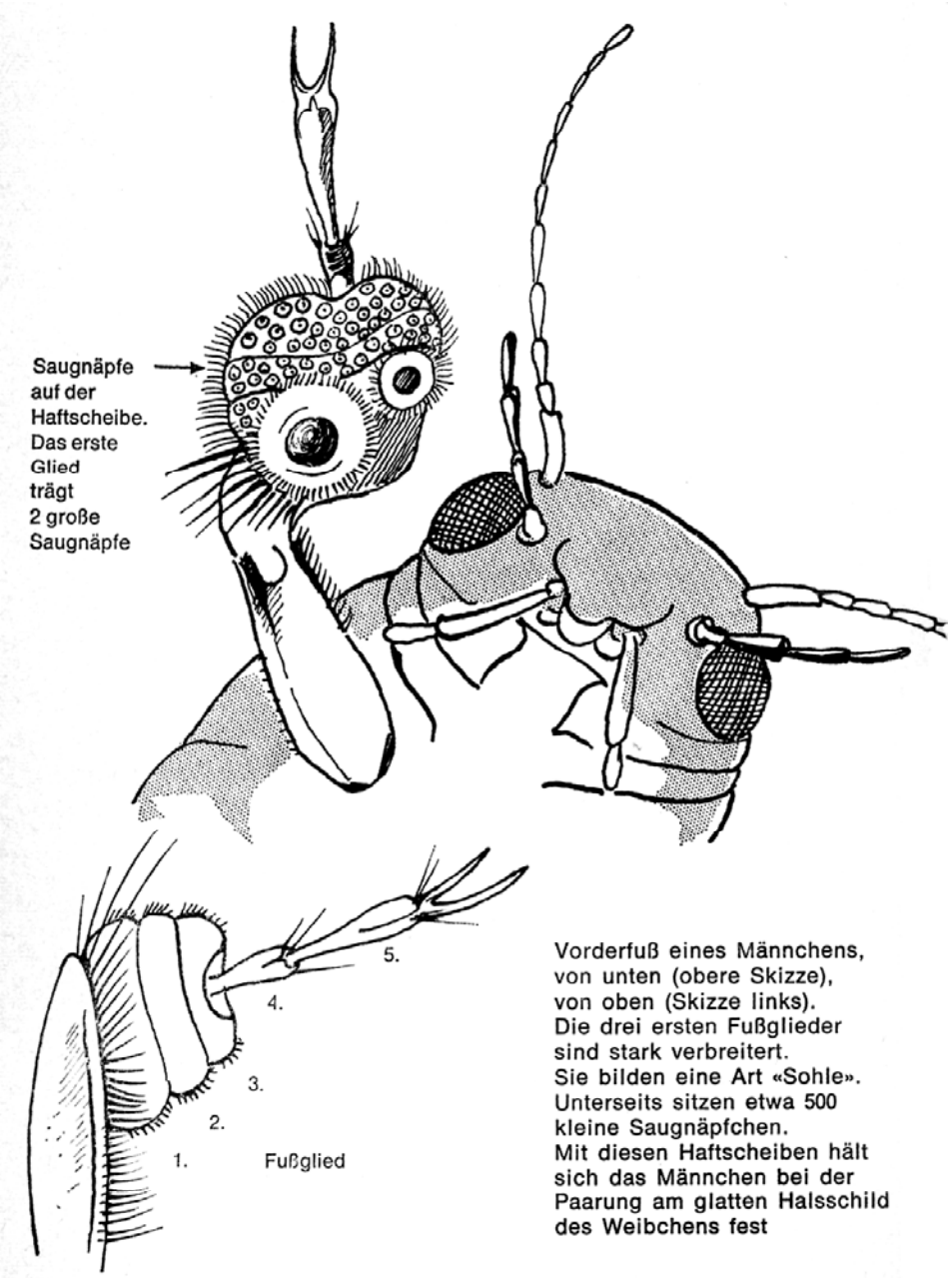
8-9 Gyrinidae



Graphoderus cinereus mit Prothorakal-Wehrdrüsen



Käfer von oben gesehen. Die Elytren sind hochgehoben, die Hinterflügel entfernt. Man sieht im Abdomen seitlich die acht abdominalen Stigmenpaare gelegen.



Vorderfuß eines Männchens,
von unten (obere Skizze),
von oben (Skizze links).
Die drei ersten Fußglieder
sind stark verbreitert.
Sie bilden eine Art «Sohle».
Unterseits sitzen etwa 500
kleine Saugnäpfchen.
Mit diesen Haftscheiben hält
sich das Männchen bei der
Paarung am glatten Halsschild
des Weibchens fest

Biologie des Gelbrandkäfers *Dytiscus marginalis*

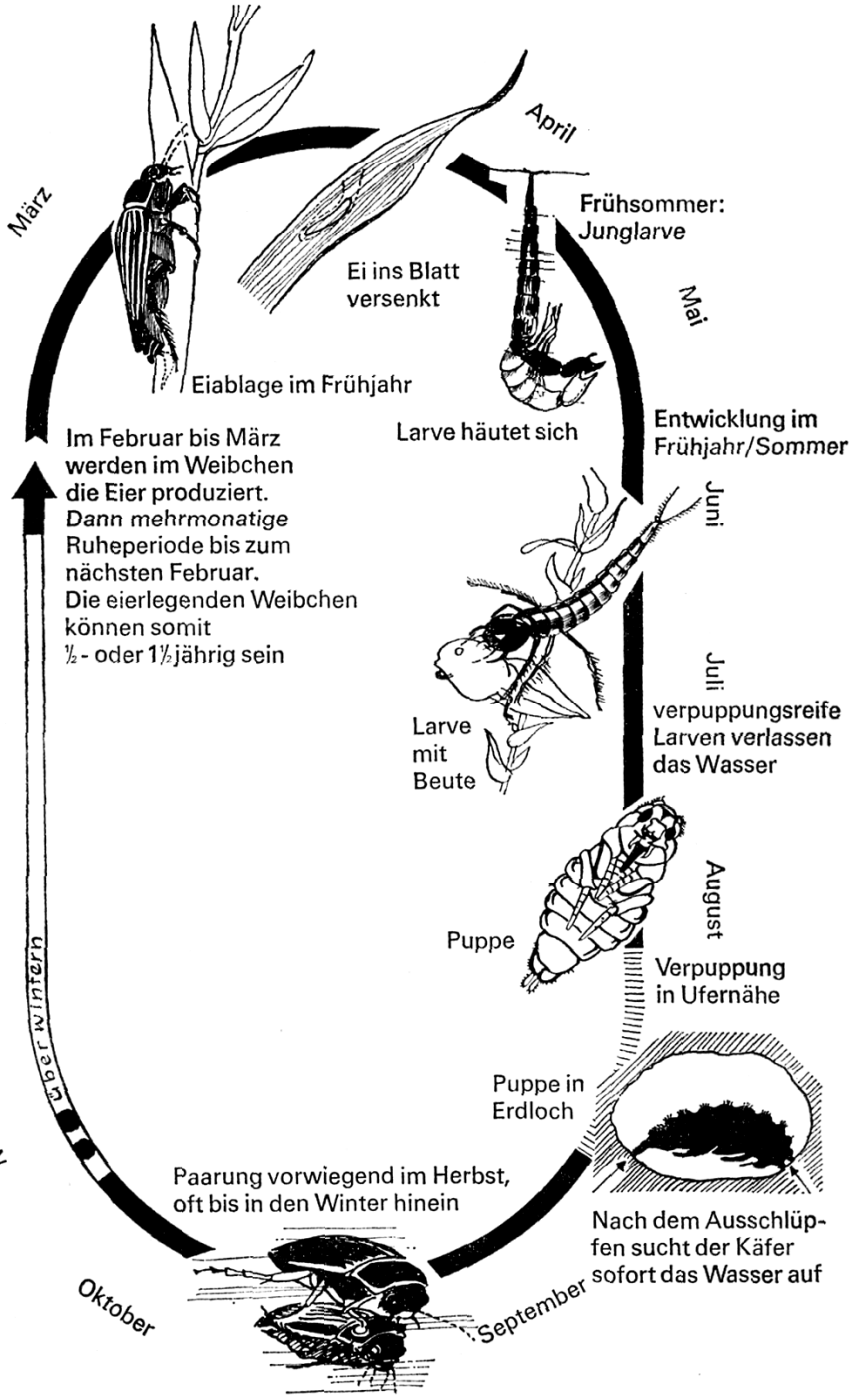
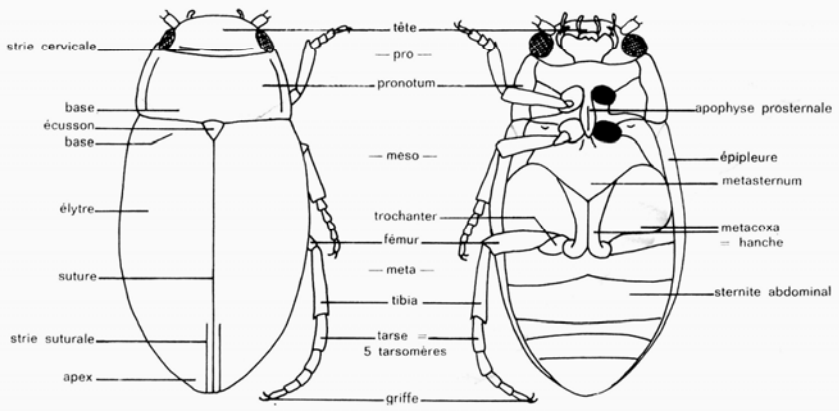
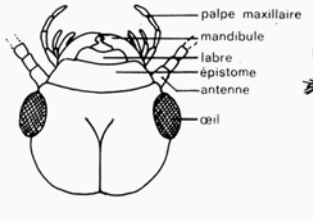


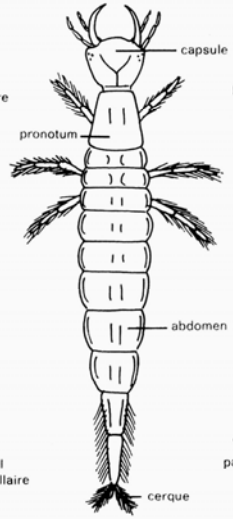
PLANCHE I **ORGANISATION GENERALE : ADULTE ET LARVE**



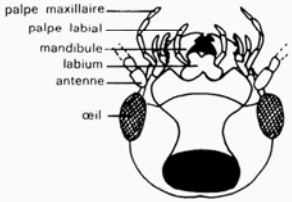
ADULTE : vue dorsale — ADULTE : vue ventrale



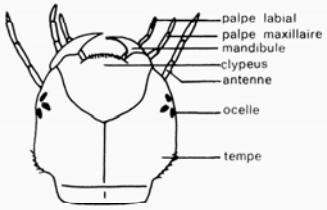
ADULTE : tête vue dorsale



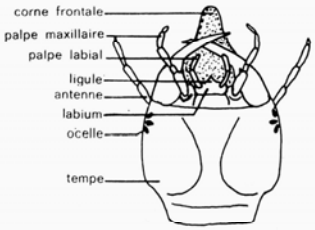
LARVE : vue dorsale



ADULTE : tête vue ventrale



LARVE : tête vue dorsale



LARVE : tête vue ventrale

PLANCHE II **ADULTES : Familles**

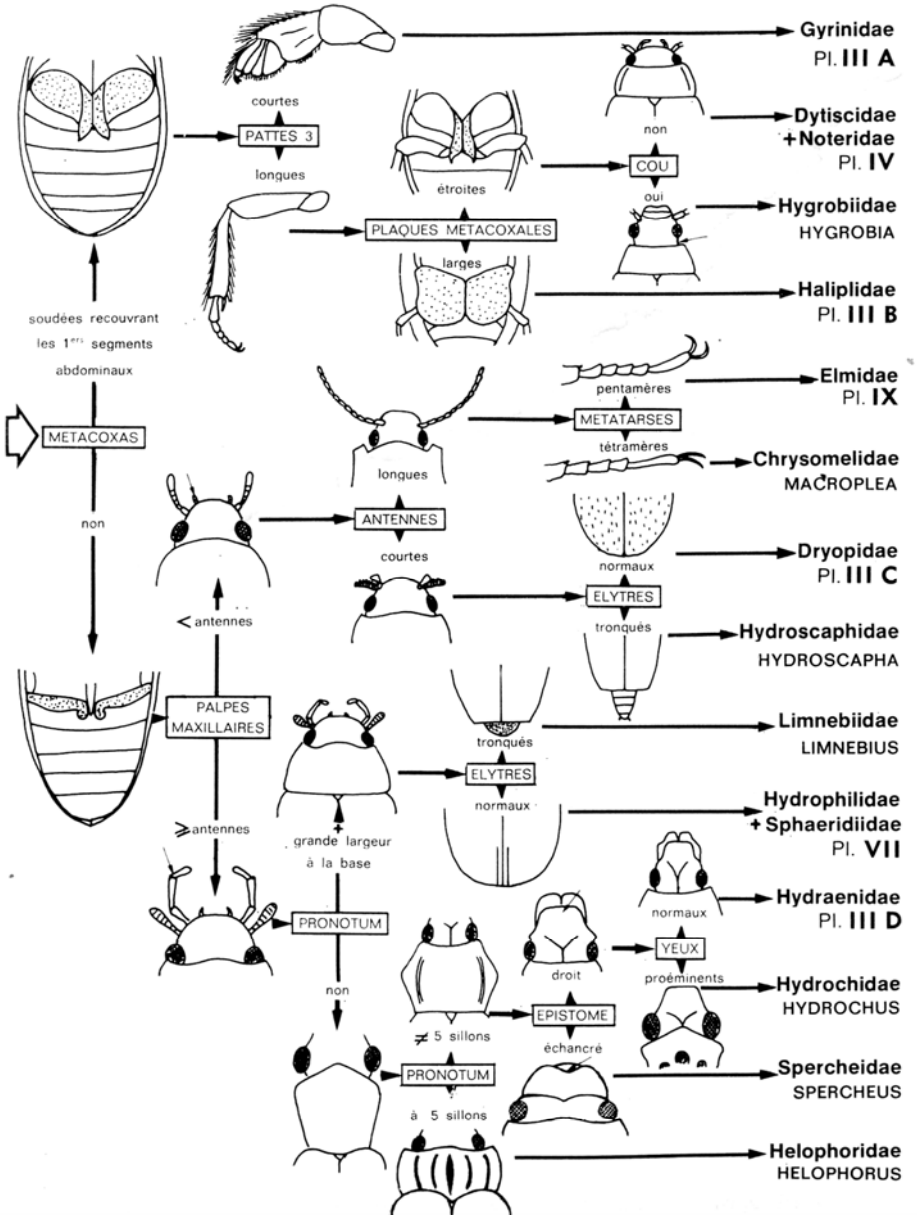


PLANCHE III **ADULTES : A — Gyrinidae ; B — Haliplidae**
C — Dryopidae ; D — Hydraenidae

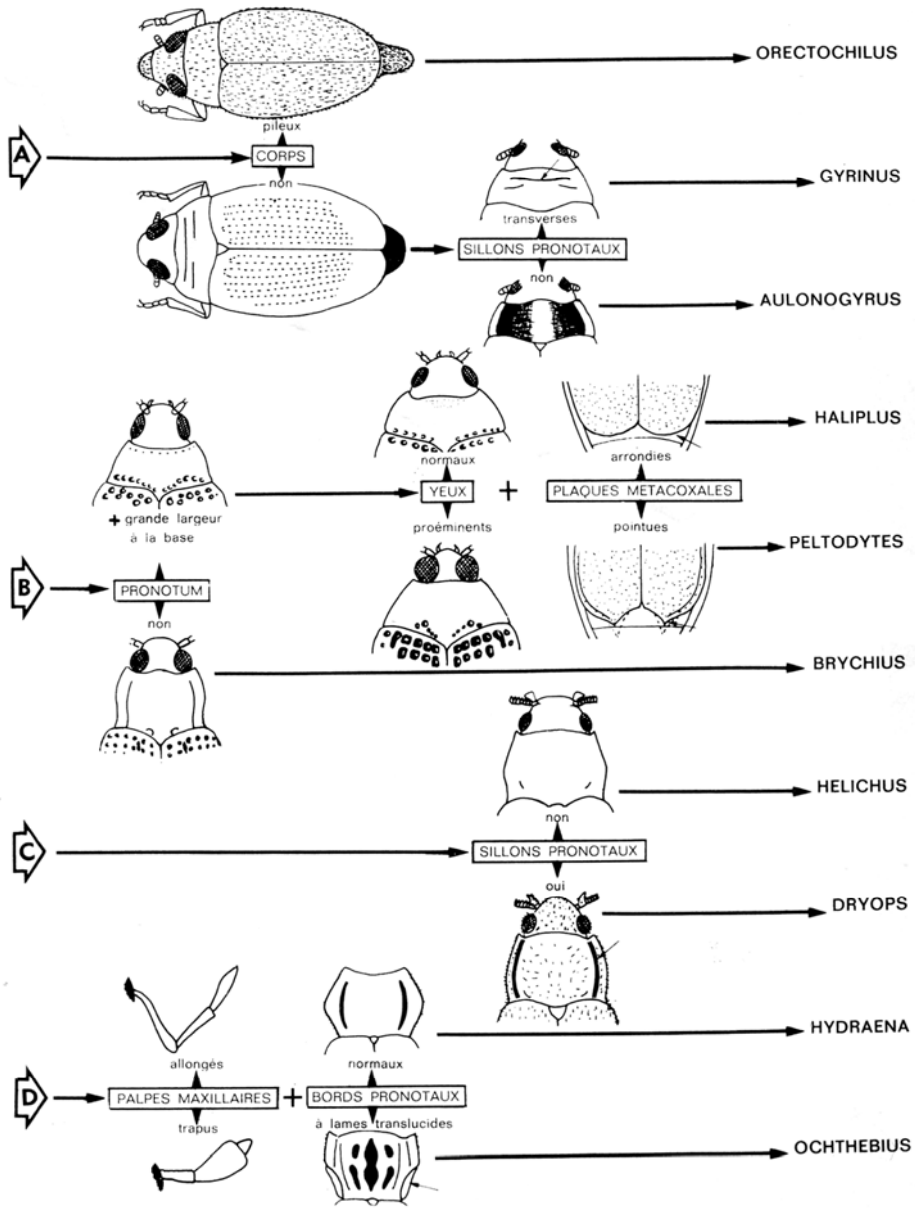
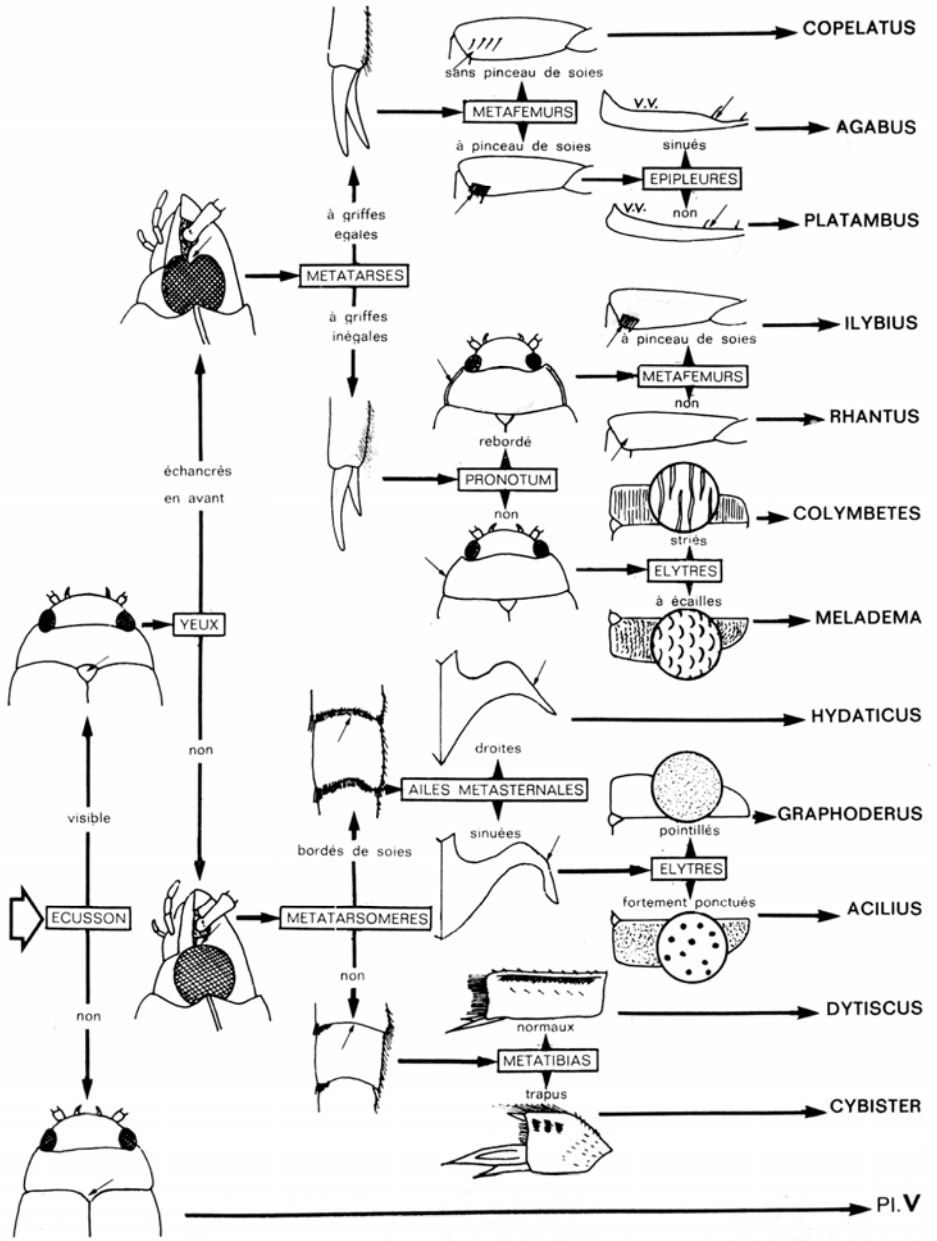


PLANCHE IV **ADULTES : Dytiscidae ; Noteridae ; (1)**



[11]

PLANCHE V **ADULTES : Dytiscidae ; Noteridae ; (2)**

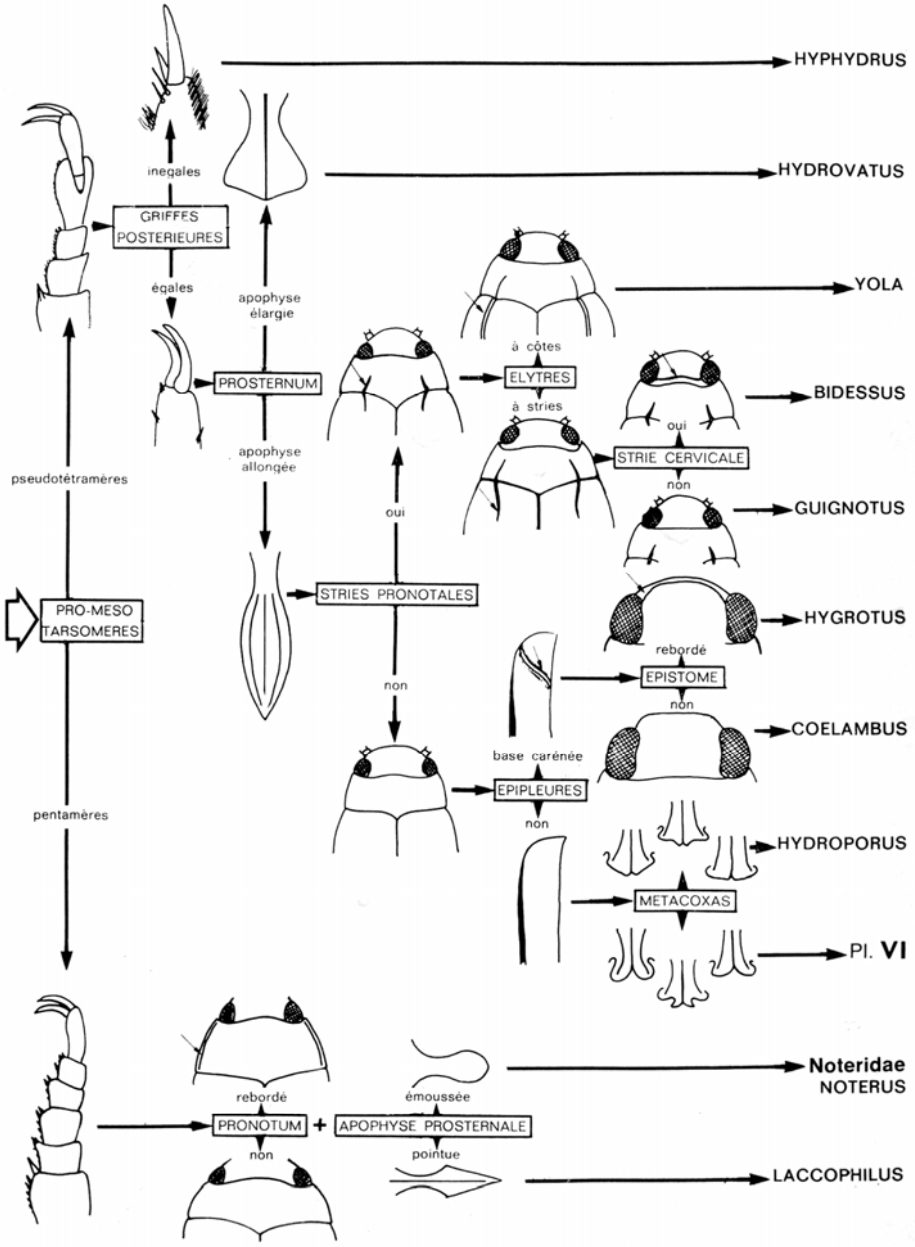


PLANCHE VI **ADULTES : Dytiscidae ; (3)**

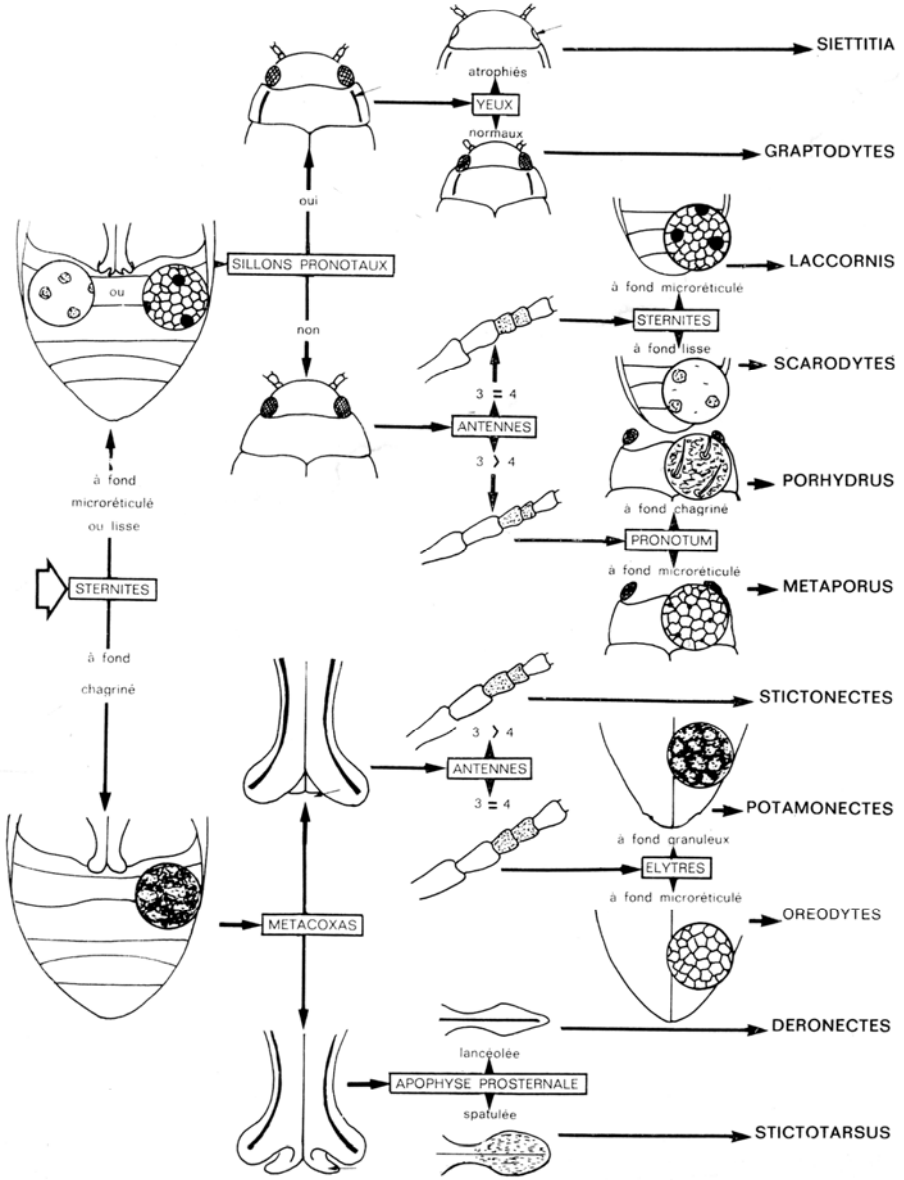


PLANCHE VII

ADULTES : Hydrophilidae ; Sphaeridiidae ; (1)

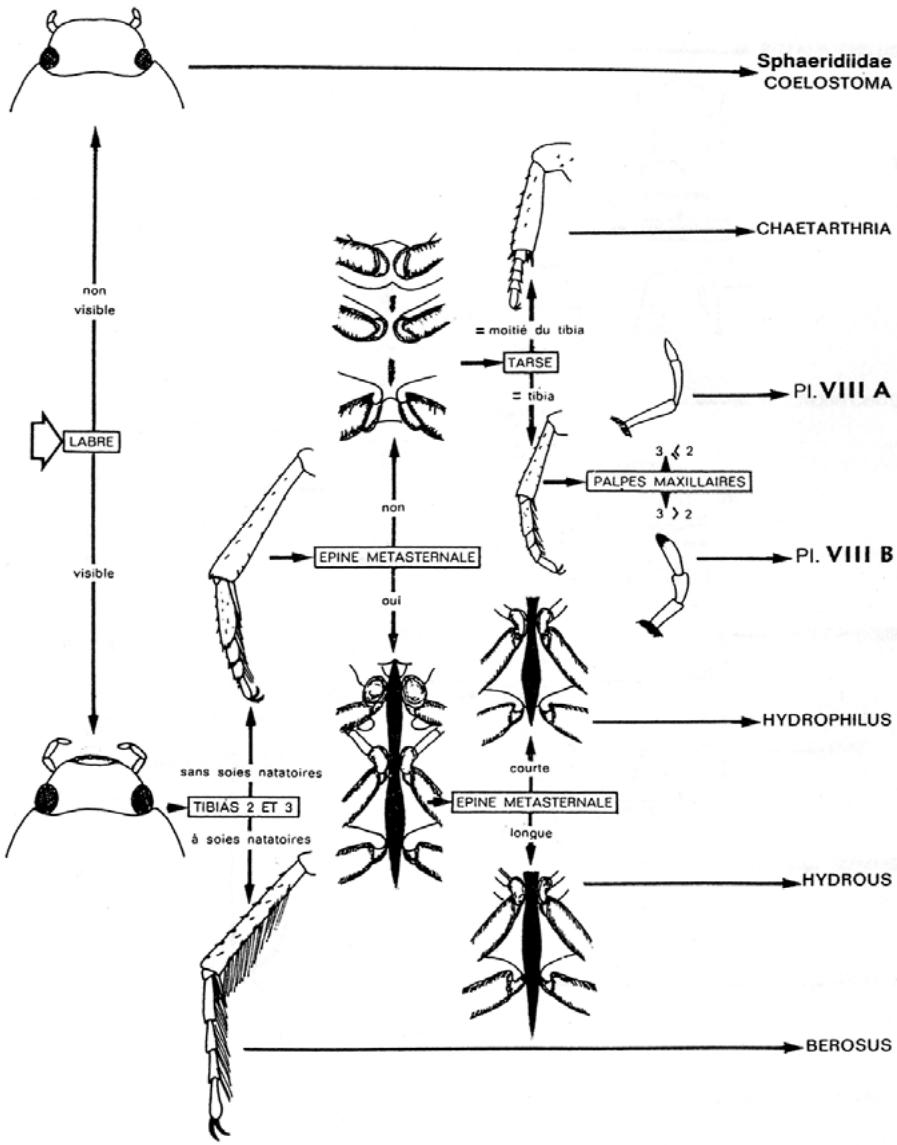
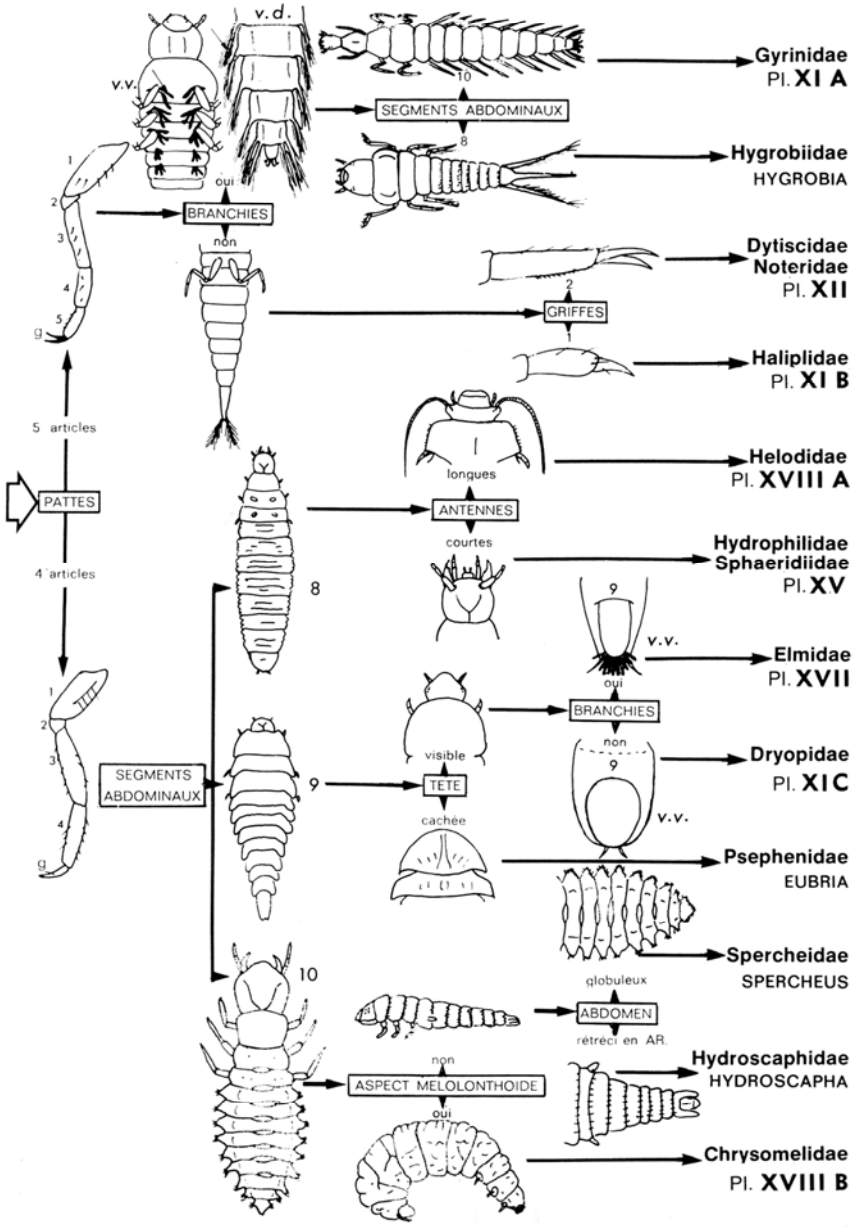


PLANCHE X

LARVES : Familles



[17]

PLANCHE XI **LARVES : A — Gyrinidae ; B — Haliplidae C — Dryopidae**

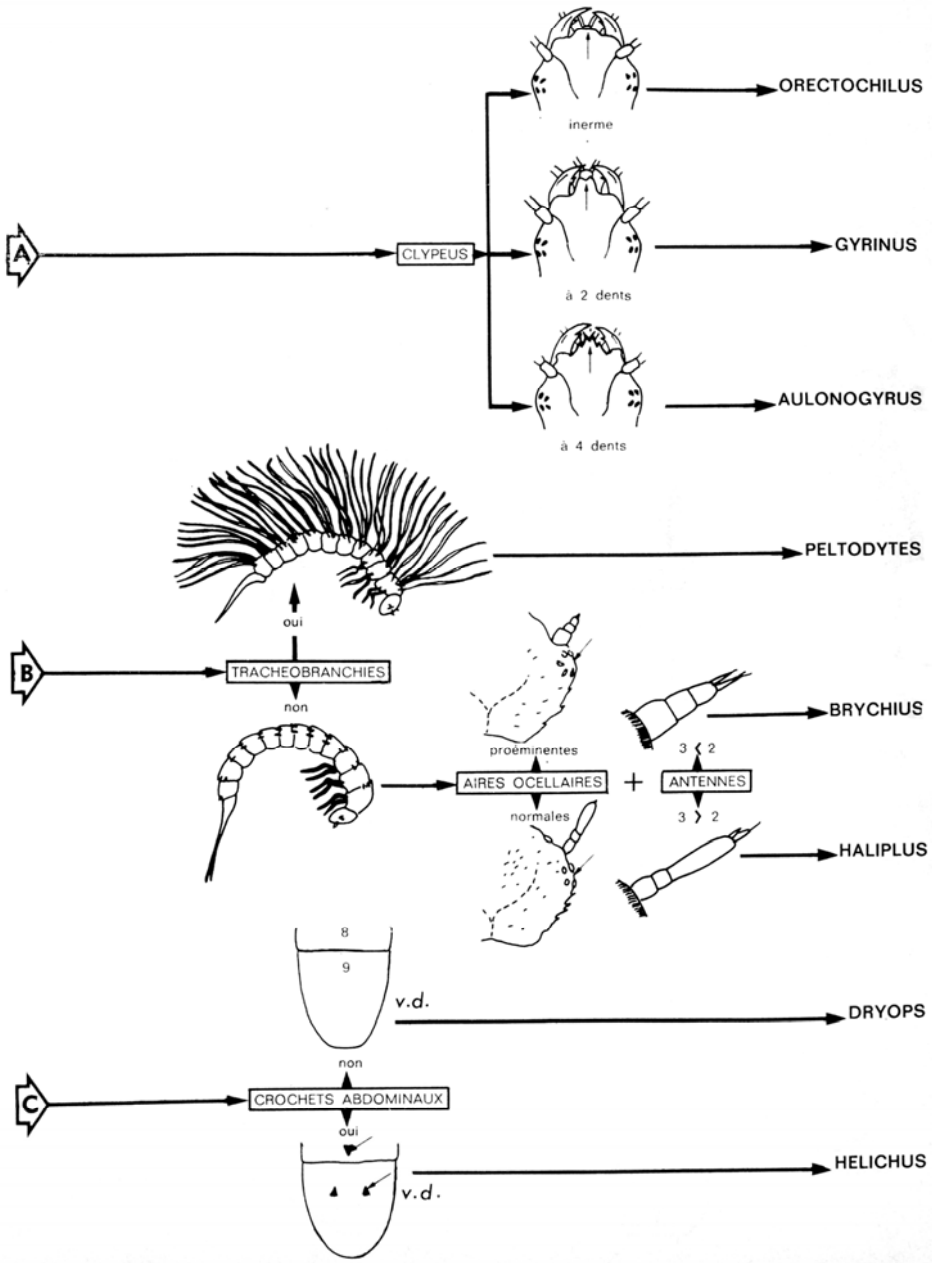


PLANCHE XII **LARVES : Dytiscidae ; Noteridae ; (1)**

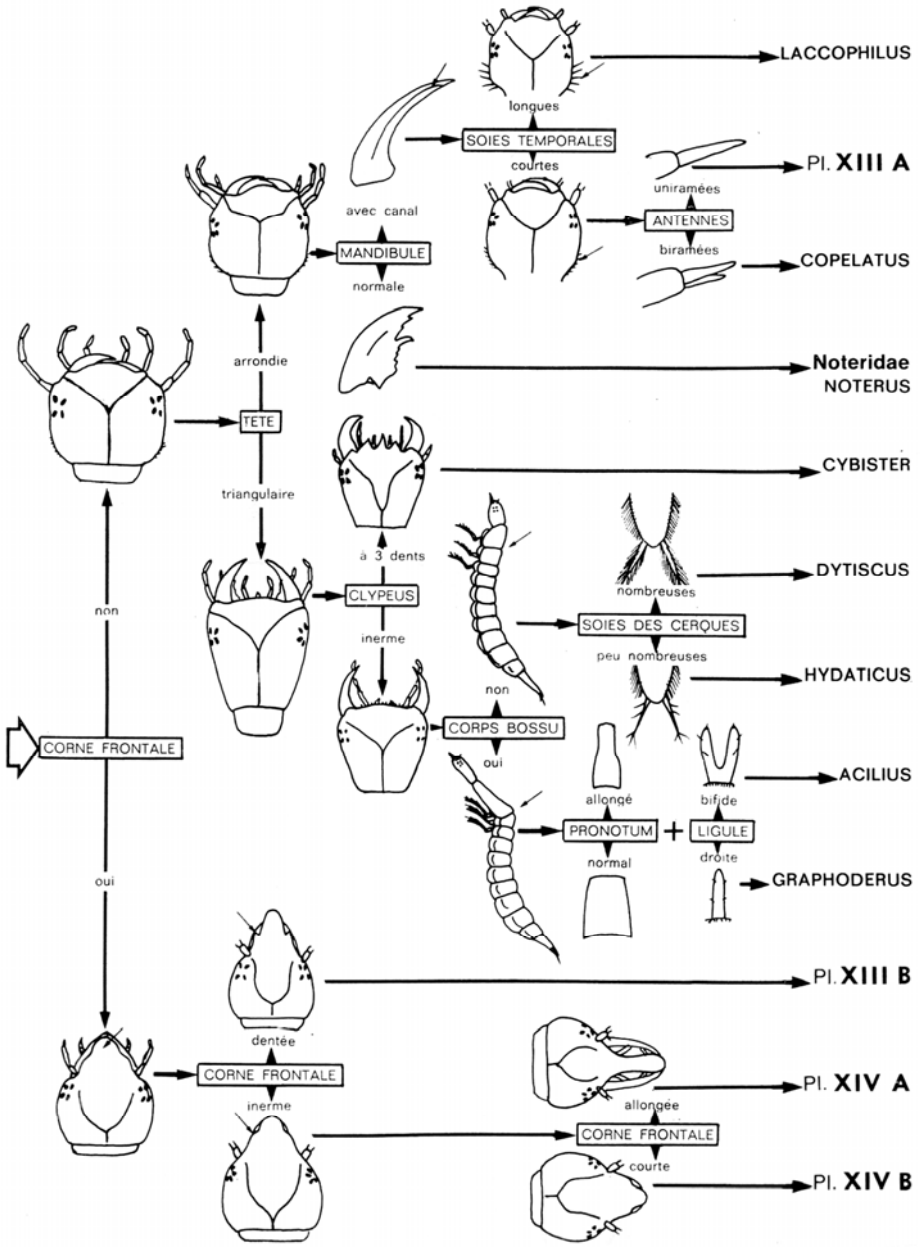


PLANCHE XIII **LARVES : Dytiscidae ; (2)**

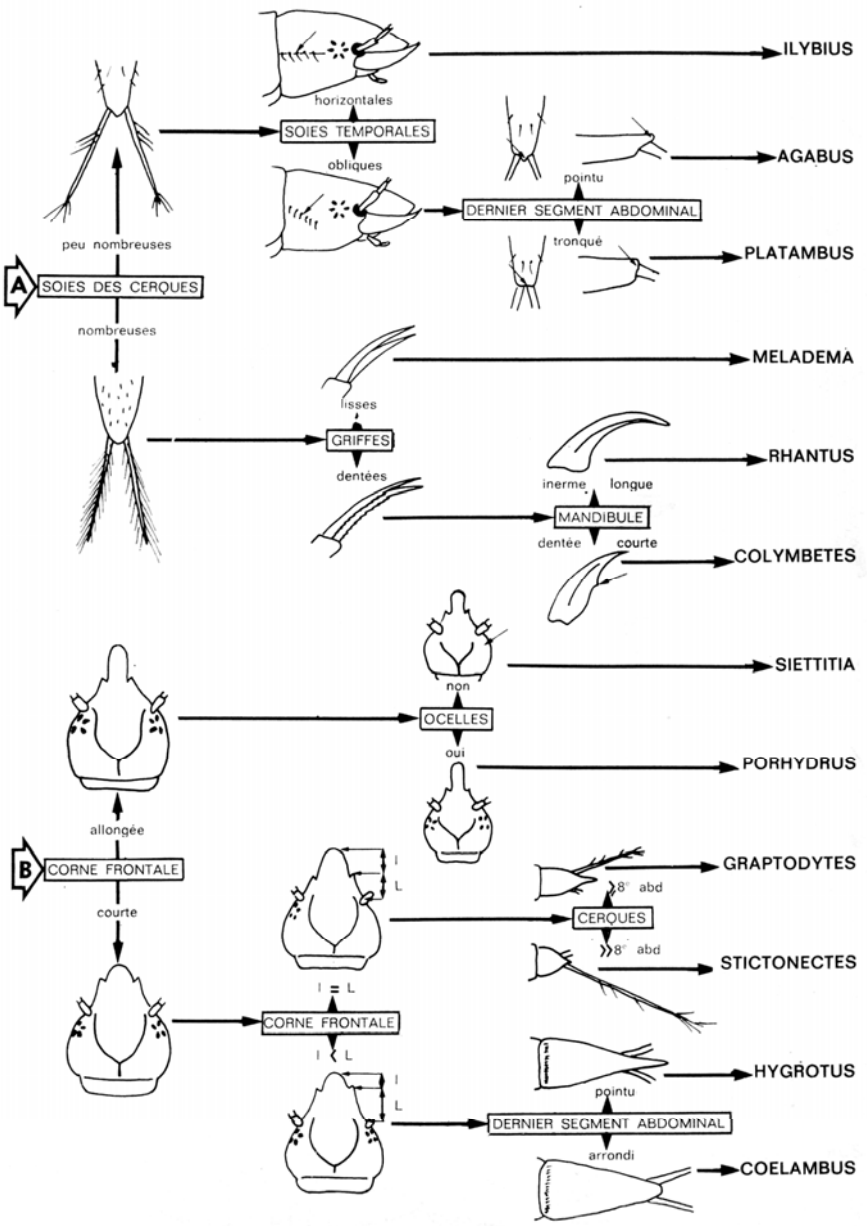
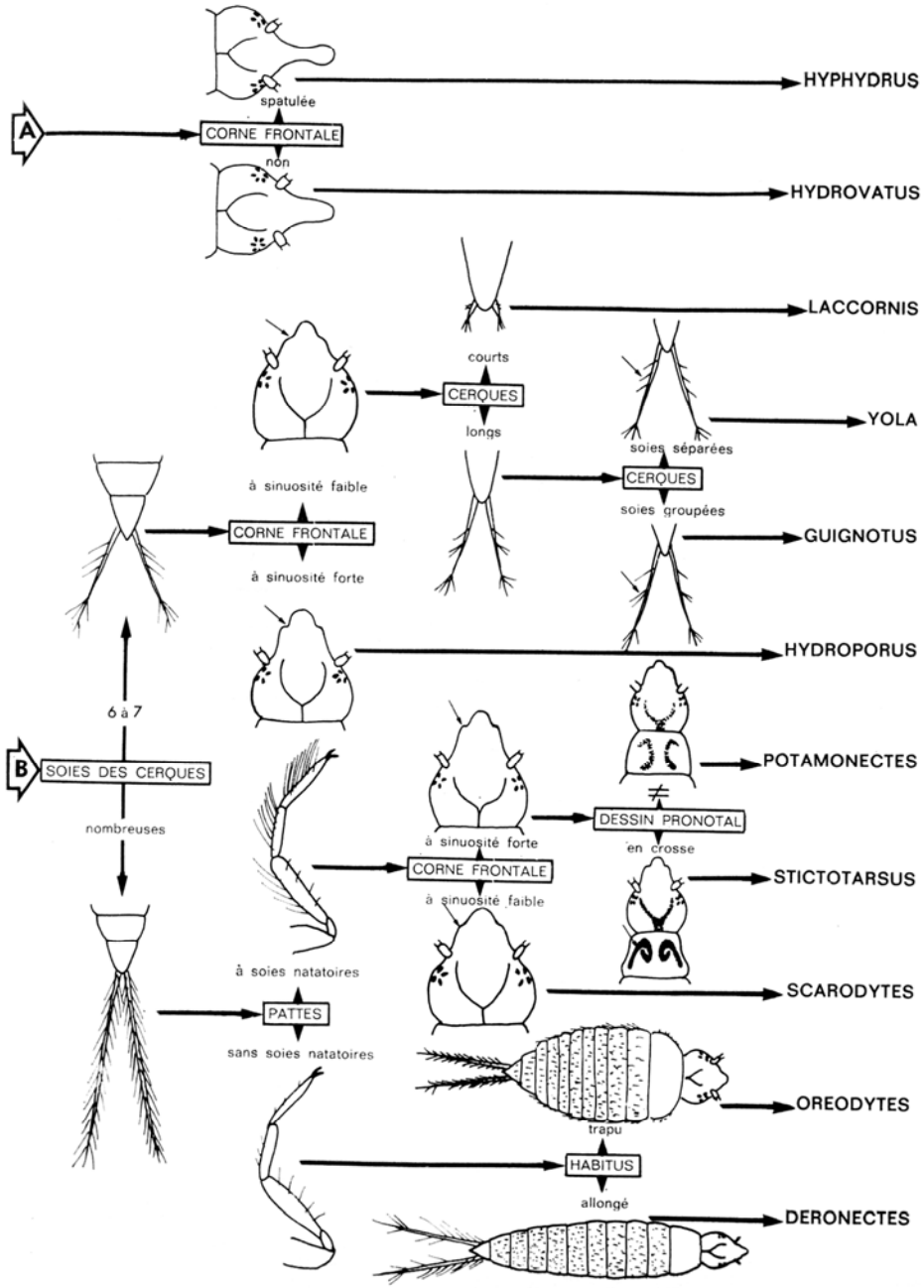
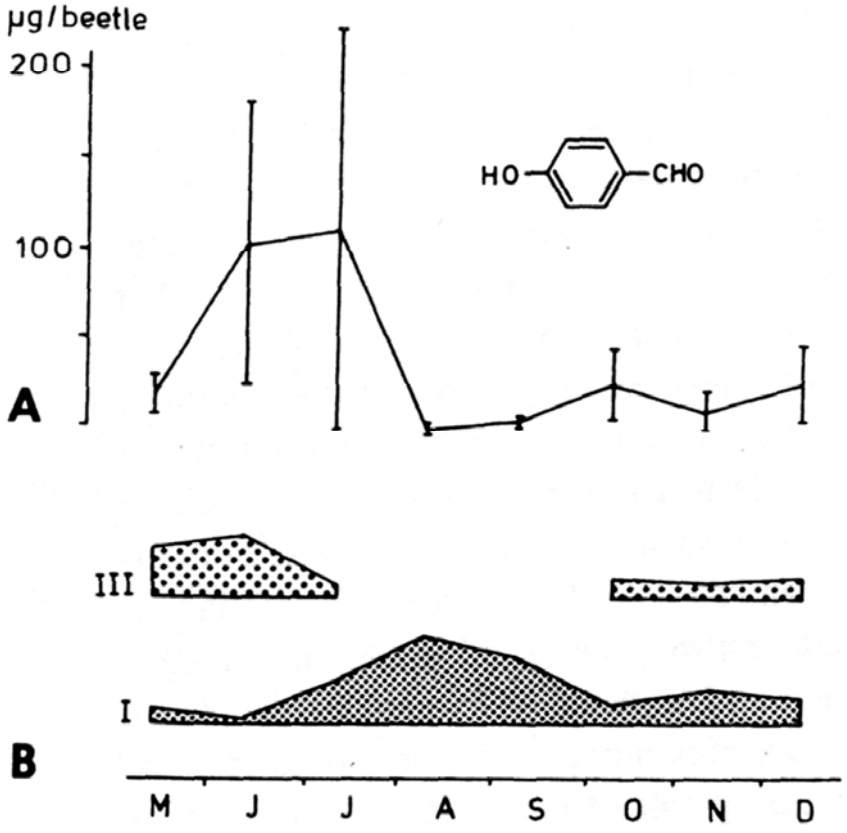


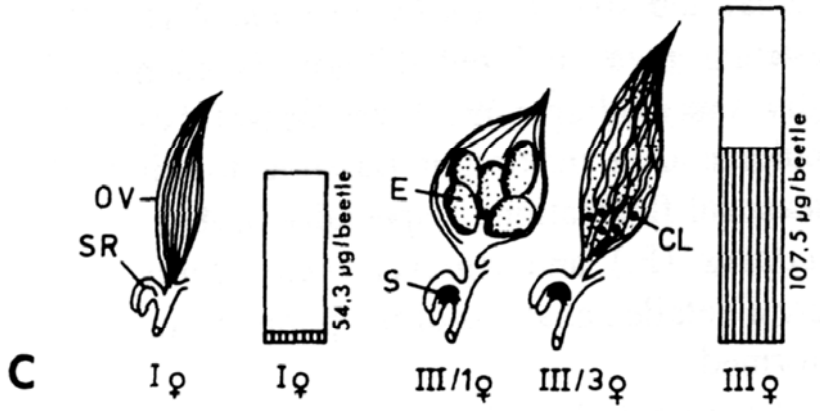
PLANCHE XIV **LARVES : Dytiscidae ; (3)**





A Saisonale Fluktuation des Hauptbestandteils des Pygidialdrüsensekrets p-Hydroxy-benzaldehyd von *Agabus paludosus* (F.)

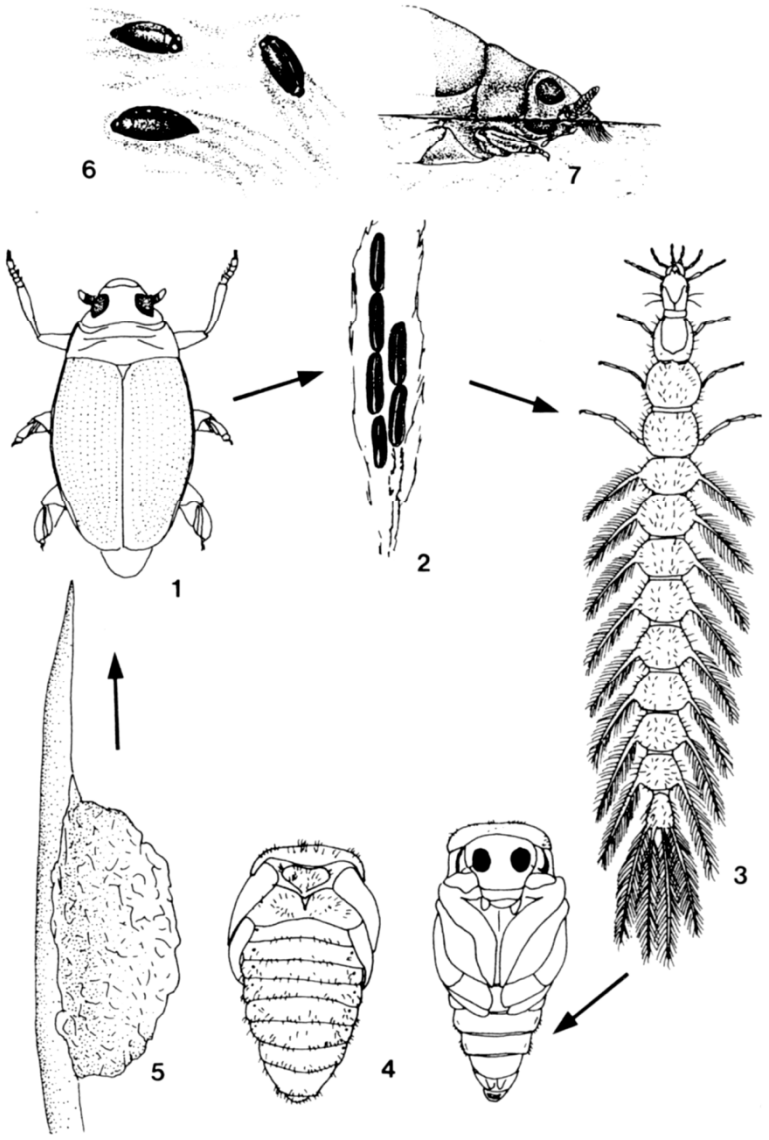
B Saisonale Verteilung von frisch geschlüpften (Altersklasse I) und älteren (Altersklasse III) männlichen und weiblichen Imagines von *Agabus paludosus.*



C Schematische Darstellung weiblicher Gonaden (*Agabus paludosus*, Altersklassen I – III). Durchschnittlich gespeicherte Menge an Pygidialdrüsensekret pro Altersklasse und Käfer ist durch die Säulen symbolisiert. Die schraffierten Flächen verdeutlichen den jeweiligen Anteil von p-Hydroxybenzaldehyd.

OV Ovar, **SR** Receptaculum seminis, **E** reife Eier, **S** Spermien, **CL** Corpora lutea

Entwicklungszyklus von *Gyrinus*



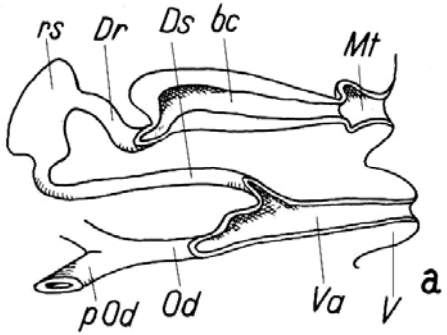
Wissenschaftlicher Artname	Deutscher Artname	SL	OG	T/S	Av/A	RL D
0 Ausgestorben oder verschollen						
Augyles pruinosus KIESENWETTER syn. *Heterocerus pruinosus* KIESW.						n.b.
Bidessus minutissimus (GERMAR)						V
Dytiscus semisulcatus O. F. MÜLLER	Schwarzbauch					2
Georissus laesicollis GERMAR						0
Georissus substriatus HEER						0
Graphoderus austriacus (STURM)						V
Graphoderus bilineatus (DE GEER)	Schmalbindiger Breitflügel-Tauchkäfer					1
Gyrinus minutus FABRICIUS						1
Gyrinus aeratus STEPHENS						3
Heterocerus fossor KIESENWETTER						n.b.
Hydaticus continentalis J. BALFOUR-BROWNE syn. *Hydaticus modestus* SHP.						V
Hydrophilus piceus (LINNAEUS)						2
Hydroporus notatus STURM						1
Hygrobia hermanni (FABRICIUS)						3
Ilybius similis THOMSON						1
Limnius muelleri (ERICHSON)						0
Micilus murinus KIESENWETTER						n.b.
Normandia sodalis (ERICHSON)						D
Ochthebius perkinsi PANKOW						0
Ochthebius foveolatus GERMAR						0
Ochthebius pedicularius KUWERT						n.b.
1 Vom Aussterben bedroht						
Agabus fuscipennis (PAYKULL)						2
Agabus labiatus (BRAHM)						2
Agabus striolatus (GYLLENHAL)						2
Augyles sericans KIESENWETTER syn. *Heterocerus sericans* KIESW.						
Cybister lateralimarginalis (DE GEER)	Gaukler					3
Dryops anglicanus EDWARDS						2
Dryops striatopunctatus (HEER)						0
Dytiscus circumcinctus AHRENS						3
Dytiscus latissimus LINNAEUS	Breitrand					1
Esolus pygmaeus (P. W. J. MÜLLER)						1
Graptodytes bilineatus (STURM)						3
Gyrinus distinctus AUBÉ						2
Gyrinus paykulli OCHS						V
Gyrinus suffriani SCRIBA						1
Haliplus furcatus SEIDLITZ						2
Haliplus variegatus STURM						2
Helophorus tuberculatus GYLLENHAL						1
Helophorus laticollis THOMSON						R
Helophorus villosus DUFTSCHMID						1
Hydrochus nitidicollis MULSANT						R
Hydrophilus aterrimus ESCHSCHOLTZ						2

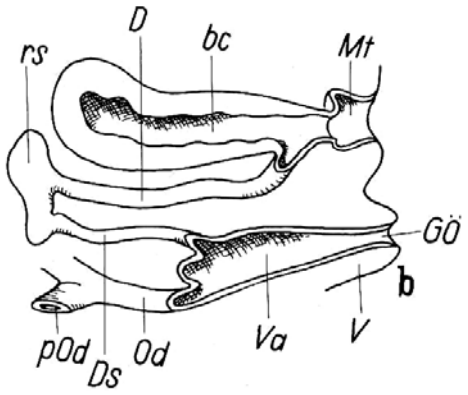
Wissenschaftlicher Artname	Deutscher Artname	SL	OG	T/S	Av/A	RL D
Hydroporus morio AUBÉ syn. *H. melanocephalus* (MARSH.)						2
Hydroporus pubescens (GYLLENHAL)						
Ilybius wasastjernae (C. R. SAHLBERG) syn. *Agabus wasastjernae* (SAHLB.)						2
Laccobius albescens ROTTENBERG syn. *L. striatulus* (F.) partim						n.b.
Laccobius alternus MOTSCHULSKY						2
Normandia nitens (P. W. J. MÜLLER)						1
Ochthebius nobilis VILLA						1
Pomatinus substriatus (P. W. J. MÜLLER)						1
Potamophilus acuminatus (FABRICIUS)						1
Rhantus bistriatus (BERGSTRÄSSER)						3
Rhantus notaticollis (AUBÉ)						2
Stenelmis canaliculata (GYLLENHAL)						2
2 Stark gefährdet						
Agabus unguicularis (THOMSON)						
Berosus geminus REICHE & SAULCY						2
Berosus luridus (LINNAEUS)						
Bidessus delicatulus (SCHAUM)						2
Bidessus unistriatus (SCHRANK)						V
Cyphon kongsbergensis MUNSTER						3
Cyphon punctipennis SHARP						2
Deronectes latus (STEPHENS)						3
Dryops viennensis (CASTELNAU)						1
Dytiscus dimidiatus BERGSTRÄSSER						
Elmis obscura (P. W. J. MÜLLER)						2
Georissus crenulatus (ROSSI)						3
Graphoderus zonatus (HOPPE)						3
Helophorus asperatus REY						3
Helophorus nanus STURM						
Hydraena belgica D'ORCHYMONT						3
Hydraena excisa KIESENWETTER						3
Hydraena pulchella GERMAR						2
Hydrochus angustatus GERMAR						3
Hydrochus brevis (HERBST)						
Hydrochus elongatus (SCHALLER)						
Hydrochus megaphallus VAN BERGE HENEGOUWEN						2
Hydrocyphon deflexicollis (P. W. J. MÜLLER)						3
Hydroporus elongatulus STURM						2
Hydroporus obsoletus AUBÉ						2
Hydroporus rufifrons (O. F. MÜLLER)						2
Hydroporus scalesianus STEPHENS						2
Ilybius subaeneus ERICHSON						
Ilybius subtilis (ERICHSON) syn. *Agabus subtilis* ER.						V
Laccobius atratus ROTTENBERG						2
Laccobius ytenensis SHARP syn. *L. atrocephalus* REITTER partim						2
Laccophilus poecilus KLUG. syn. *L. variegatus* (GERM.)						3
Limnebius atomus (DUFTSCHMID)						3
Limnebius nitidus (MARSHAM)						3
Limnius opacus P. W. J. MÜLLER						2
Limnoxenus niger (ZSCHACH)						V

Wissenschaftlicher Artname	Deutscher Artname	SL	OG	T/S	Av/A	RL D
Macronychus quadrituberculatus P. W. J. Müller						2
Nebrioporus assimilis (Paykull) syn. *Potamonectes assimilis* (Payk.)						1
Ochthebius bicolon Germar						
Ochthebius colveranus Ferro						1
Ochthebius gibbosus Germar						3
Ochthebius melanescens Dalla Torre syn. *Ochthebius forojuliensis* Ferro						2
Oreodytes davisii (Curtis)						R
Oreodytes septentrionalis (Gyllenhal)						2
Rhantus consputus (Sturm)						2
Rhantus suturellus (Harris)						3
3 Gefährdet						
Acilius canaliculatus (Nicolai)						
Agabus congener (Thunberg)						
Berosus signaticollis (Charpentier)						
Bidessus grossepunctatus Vorbringer						2
Brychius elevatus (Panzer)						3
Cyphon ruficeps Tournier						3
Deronectes platynotus (Germar)						3
Dryops griseus (Erichson)						
Dryops similaris Bollow						V
Elmis latreillei Bedel						3
Eubria palustris Germar						3
Graphoderus cinereus (Linnaeus)						
Haliplus confinis Stephens						3
Haliplus fulvus (Fabricius)						3
Heterocerus fusculus Kiesenwetter						n.b.
Hydraena dentipes Germar						
Hydraena polita Kiesenwetter						3
Hydraena saga D'Orchymont						3
Hydraena nigrita Germar						
Hydraena pygmaea Waterhouse						V
Hydrochara caraboides (Linnaeus)						V
Hydrochus ignicollis Motschulsky						
Hydroporus kraatzii Schaum syn. *H. kraatzi* Schaum						2
Hydroporus longicornis Sharp						2
Hydroporus longulus Mulsant & Rey						3
Hydroporus neglectus Schaum						3
Hydroporus obscurus Sturm						3
Hygrotus nigrolineatus (Steven) syn. *Coelambus lautus* (Schaum)						3
Hygrotus decoratus (Gyllenhal)						
Ilybius aenescens Thomson						3
Ilybius crassus Thomson						2
Ilybius guttiger (Gyllenhal)						V
Ilybius neglectus (Erichson) syn. *Agabus neglectus* Er.						3
Limnebius aluta Bedel						
Ochthebius exsculptus Germar						3
Ochthebius granulatus Mulsant						2
Ochthebius metallescens Rosenhauer						1
Ochthebius pusillus Stephens						3
Riolus cupreus (P. W. J. Müller)						3

Wissenschaftlicher Artname	Deutscher Artname	SL	OG	T/S	Av/A	RL D
Rhantus grapii (Gyllenhal) syn. *Nartus grapei* (Gyll.)						
G Gefährdung anzunehmen, aber Status unbekannt						
Helophorus dorsalis (Marsham)						3
Helophorus redtenbacheri Kuwert						2
Sphaerius acaroides Waltl syn. *Microsporus obsidianus* Kol.						V
R Extrem seltene Arten und Arten mit geographischer Restriktion						
Chaetarthria similis Wollaston						
Hydraena schuleri Ganglbauer						D
Hydraena angulosa Mulsant						2
Hydraena morio Kiesenwetter						n.b.
Hydraena reyi Kuwert						3
Hydraena rufipes Curtis						2
Hydraena testacea Curtis						
Hydrochara flavipes (Steven)						R
Hydrovatus cuspidatus (Kunze)						V
Ochthebius minimus (Fabricius)						
Riolus illiesi Steffan						0
Stictotarsus griseostriatus (De Geer) syn. *Potamonectes griseostriatus* (Deg.)						
V Arten der Vorwarnliste						
Gyrinus marinus Gyllenhal						V
Helophorus pumilio Erichson						3
Helophorus strigifrons Thomson						
Hydaticus transversalis (Pontoppidan)						
Hydroporus striola (Gyllenhal)						
Laccobius obscuratus Rottenberg						3
Laccobius gracilis Motschulsky						3
Nebrioporus elegans (Panzer) syn. *Potamonectes depressus elegans* Panz.						
Porhydrus lineatus (Fabricius)						
Suphrodytes dorsalis (Fabricius)						
D Daten defizitär						
Augyles hispidulus (Kiesenwetter) syn. *Heterocerus hispidulus* Kiesw.						n.b.
Dryops lutulentus (Erichson)						1
Elodes elongata Tournier syn. *E. koelleri* Klausnitzer						3
Elodes hausmanni (Gredler)						2
Elodes pseudominuta Klausnitzer						
Elodes tricuspis Nyholm syn. *Elodes elongata* Tournier sensu Klausnitzer						2
Enochrus fuscipennis (Thomson) syn. *E. quadripunctatus* v. *fuscipennis* Thoms.						D
Enochrus hamifer (Ganglbauer)						T
Helophorus paraminutus Angus						
Laccobius neapolitanus Rottenberg						D
Laccobius colon (Stephens) syn. *L. biguttatus* Gerh.						V
Limnebius papposus Mulsant						3
Scirtes orbicularis (Panzer)						3

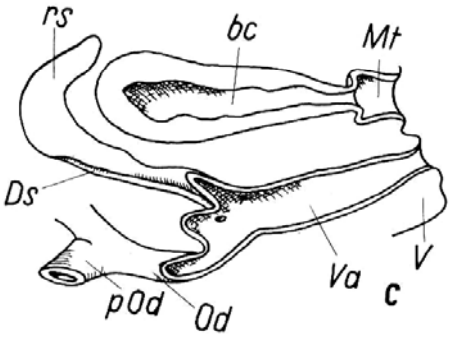
Hydroporinae +
Laccophilinae

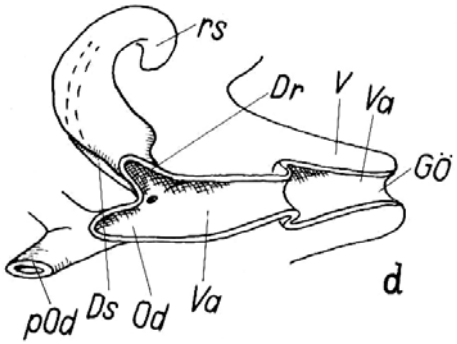




Colymbetini

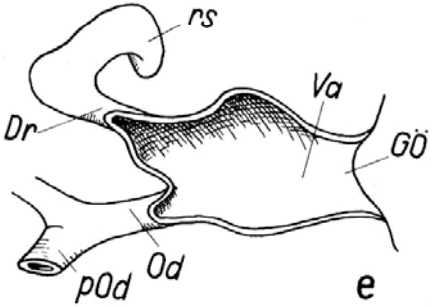
Agabini

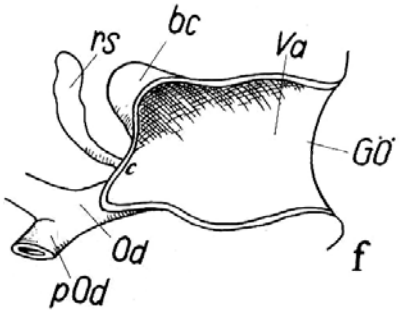




Dytiscinae

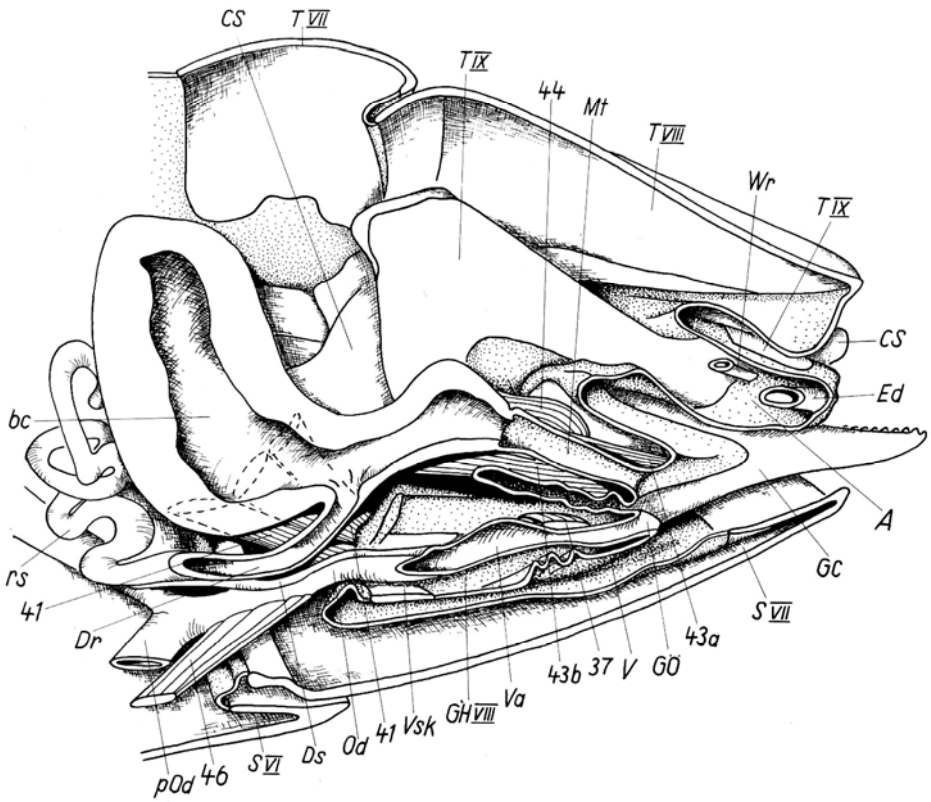
Noterus



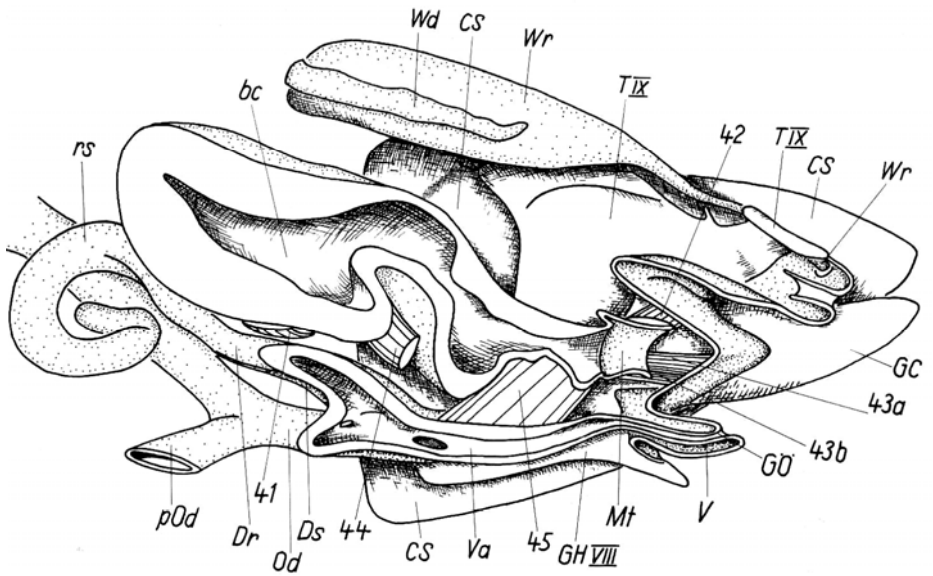


ursprüngliche
Carabidae

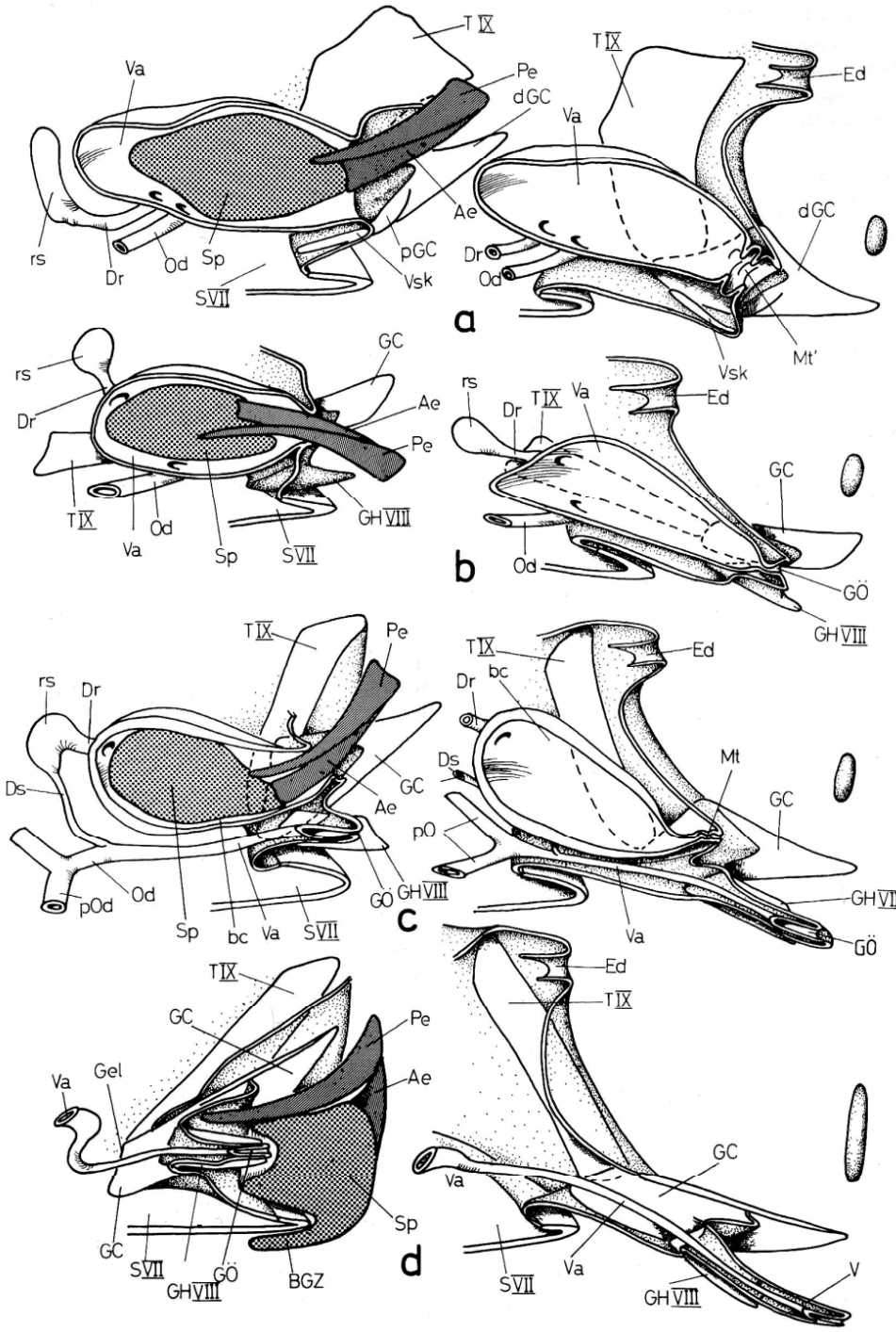
rs Receptaculum seminis, **Dr** Ductus receptaculus, **Ds** Ductus seminalis, **bc** Bursa copulatrix, **Mt** Membrantasche, **Od** Ovidukt unpaar, **pOd** Ovidukt paarig, **Va** Vagina, **V** Vaginalpapille, **GÖ** Geschlechtsöffnung



Ilybius ater, Medianschnitt durch die weiblichen Genitalsegmente und inneren Geschlechtsorgane



Agabus bipustulatus, innere weibliche Geschlechtsorgane



Vergleich von Kopulationsstellung (Lage der Spermatophore, Penis + Aedeagus und Spermatophore schraffiert), Eiablageposition und Eiform.

Carabidae (*Carabus*)

Gyrinidae (*Gyrinus*)

Colymbetinae

Dytiscinae

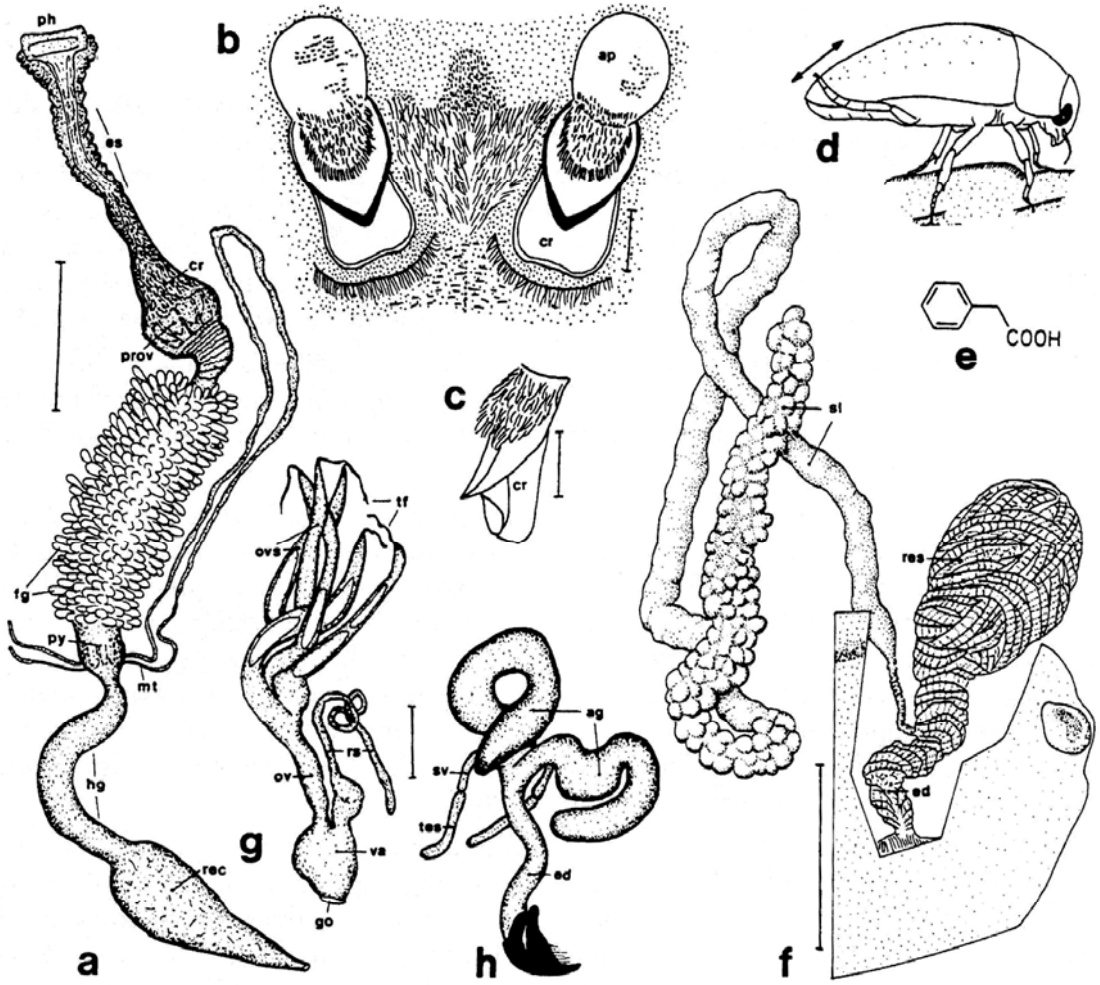
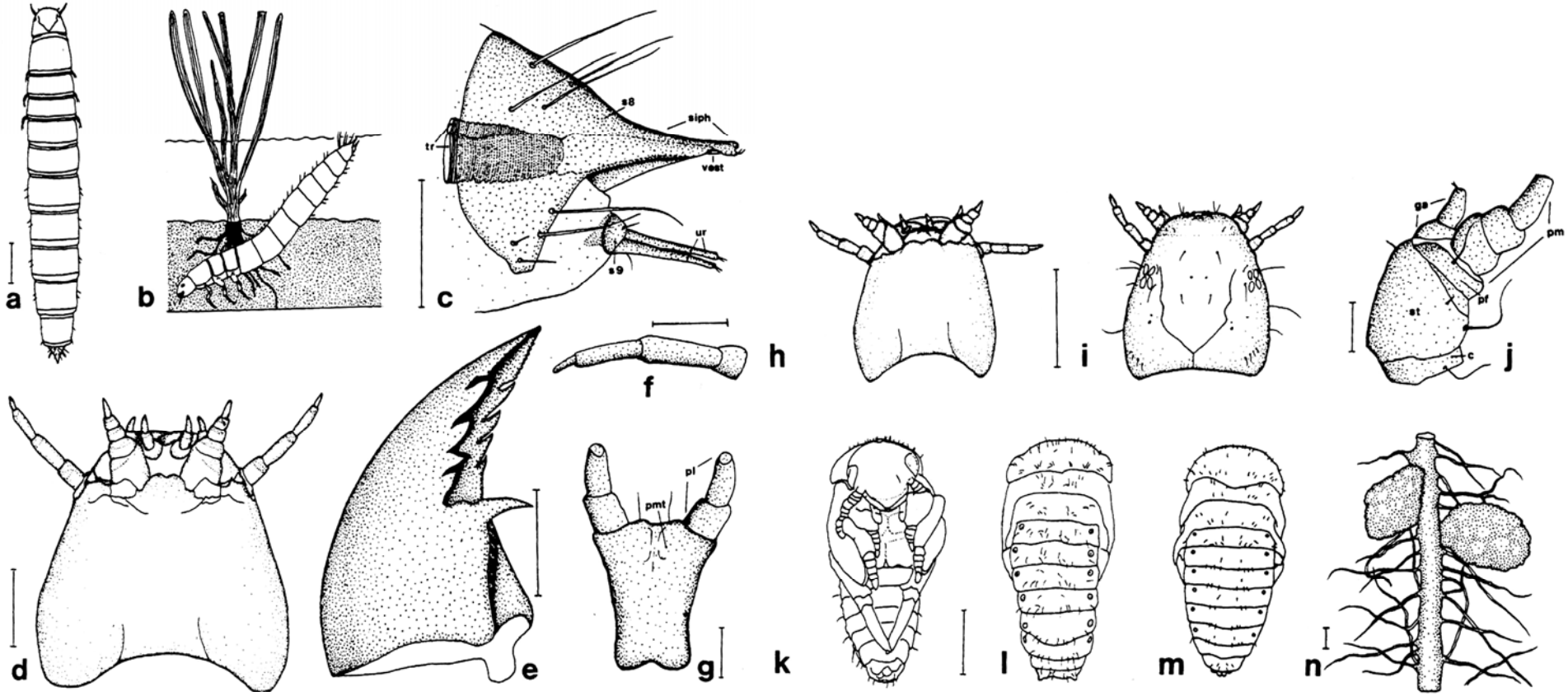
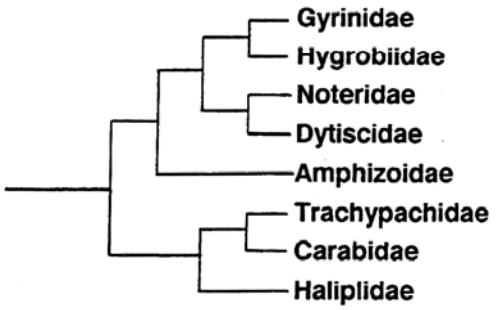


Fig. 3: Anatomy and bionomy of Noteridae. **a**, gut of *N. crassicornis*; **b, c**, lobes of proventriculus (b: interior view) and isolated crusher (c) of *N. clavicornis*; **d**, grooming behaviour of *Noterus*; **e**, phenylacetic acid, main constituent of pygidial gland secretion of *N. clavicornis*; **f**, pygidial gland of *Noterus* sp.; **g, h**, internal male (h) and female (g) genitalia of *N. crassicornis* (penis and paramere of male black).
Abbreviations in Fig. 3a: cr: crop, es: esophagus, fg: finger-like poutgrowths of mid gut, hg: hind gut, mt: Malpighian tubules, ph: pharynx, prov: proventriculus, py: pylorus, rec: rectum.
Abbreviations in Fig. 3b and c: ap: apron, cr: crusher.
Abbreviations in Fig. 3f: ed: efferent duct, res: reservoir, sl: bipartite secretory lobe.
Abbreviations in Fig. 3g: go: genital opening, ov: oviduct, ovs: ovarioles, rs: Receptaculum seminis, tf: terminal filament, va: vagina.
Abbreviations in Fig. 3h: ag: accessory gland, ed: efferent duct, sv: seminal vesicle, tes: testis.
Scales: a: 1 mm; b, c, g-h: 0.5 mm; f: 0.25 mm.
After Balfour-Browne (1944; b, c), Forsyth (1968; f) and Kovac & Maschwitz (1990; d); a, g, h, originals.

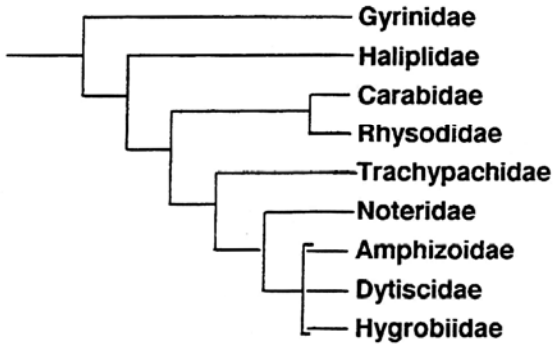


◄ **Fig. 2:**
Noterus spp., larval and pupal morphology (a, d, h, i, *N. clavicornis*; b, *N.* spec.; c, e-g, j, *N. crassicornis*). **a**, dorsal view of third instar larva; **b**, side view of a larva burrowing in the mud and extending its abdominal tip through water surface; **c**, squashed abdominal tip (side view) of second instar larva; **d** and **h**, ventral view of head of third instar (d) and first instar (h) larva; **e**, mandible of second instar larva; **f, g** and **j**, antenna (f), labium (g) and maxilla (j) of third instar larva; **i**, dorsal view of a head of a first instar larva; **k-m**, ventral view (k) and dorsal views (l and m) of pupae of *N. crassicornis* (k and l) and *N. clavicornis* (m); **n**, cocoons of *N. clavicornis* pupae adhering to the roots of water plants.
Abbreviations in Fig. 2c: s8: segment 8, s9: rest of segment 9, siph: siphon, tr: trachea, ur: urogomphi, vest: vestibule.
Abbreviations in Fig. 2g: pmt: praementum, pl: palpus labialis.
Abbreviations in Fig. 2j: c: cardo, ga: galea, pf: palpifer, pm: palpus maxillaris, st: stipes.
Scales: a, k-m; n: 1 mm; d: 0.5 mm; h-i: 0.25 mm; c, f: 0.1 mm; e: 0.05 mm; g, j: 0.04 mm.
According to BALFOUR-BROWNE & BALFOUR-BROWNE (1940; n), HOLMEN (1987; a, m), RUHNAU (1985; f, g, j-l), WESENBERG-LUND (1943; b); c-e, h, i, originals.

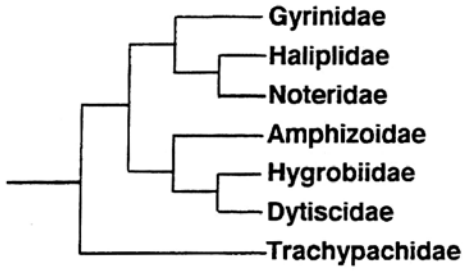
Phylogenie Hydradephaga



Kavanaugh 1986



Beutel 1993



Burmeister 1976,
Ruhnau 1986

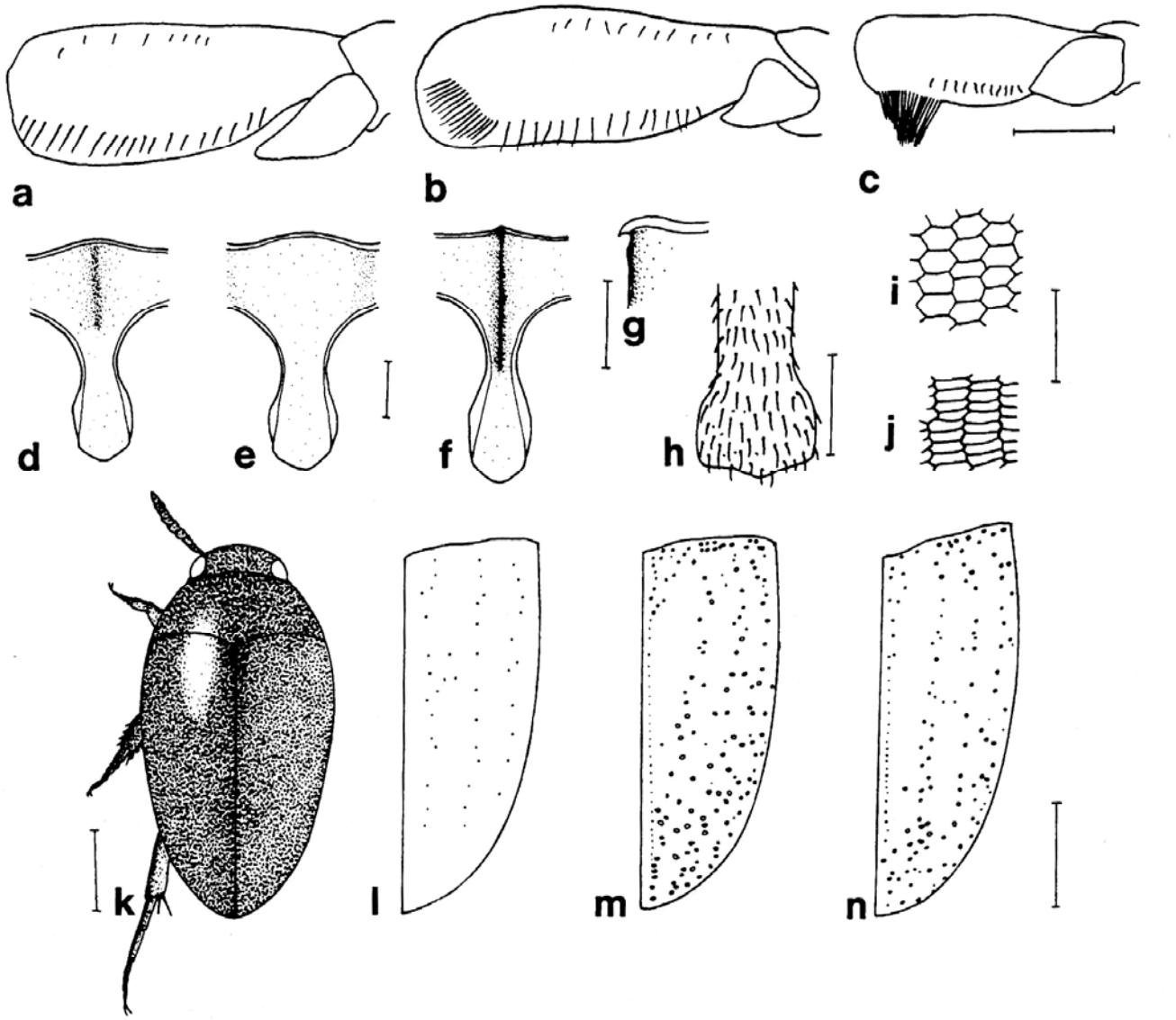


Fig. 5: Ventral view of hind femora of *Noterus clavicornis* (**a**), *N. laevis* (**b**) and *Canthydrus diophthalmus* (**c**). Central part of prosternum with prosternal process of *N. crassicornis* (**d**, female; **e**, male), *N. clavicornis* (**f**; **g**: enlarged side view of anterior part of prosternum) and *Canthydrus diophthalmus* (**h**, caudal part of prosternal process). Pronotal microsculpture of *N. laevis* (**i**) and *N. clavicornis* (**j**). Habitus of *N. clavicornis* (**k**) and dorsal views of right elytron of *N. laevis* (**l**), *N. clavicornis* (**m**) and *N. crassicornis* (**n**).
Scales: d-f, g, k, l-n: 1 mm; a-c; h: 0.25 mm; i-j: 0.05 mm.
After HOLMEN (1987; d-f, j, m, n) and FRANCISCOLO (1979; a-c, h); g, i, k, l, originals.

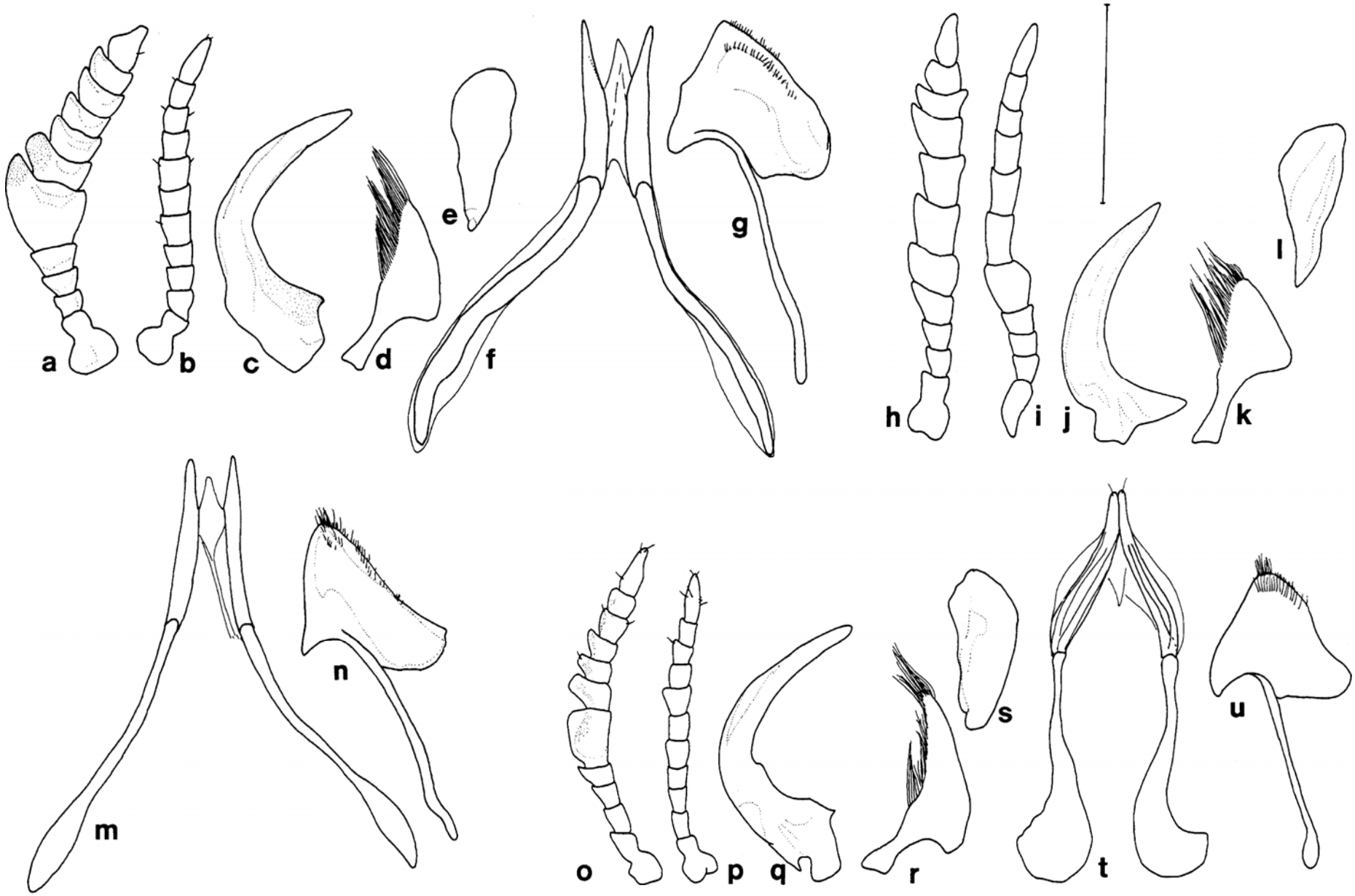


Fig. 6: Male (**a, h, o**) and female (**b, i, p**) antennae, aedeagi (side view, **c, j, q**), right (**d, k, r**) and left (**e, l, s**) parameres, gonocoxae and tergal halves (**f, m, t**) and gonocoxosternites (**g, n, u**) of *Noterus laevis* (**a-g**), *N. clavicornis* (**h-n**) and *N. crassicornis* (**o-u**). **Scales**: a-u: 0.5 mm; a-u, originals.

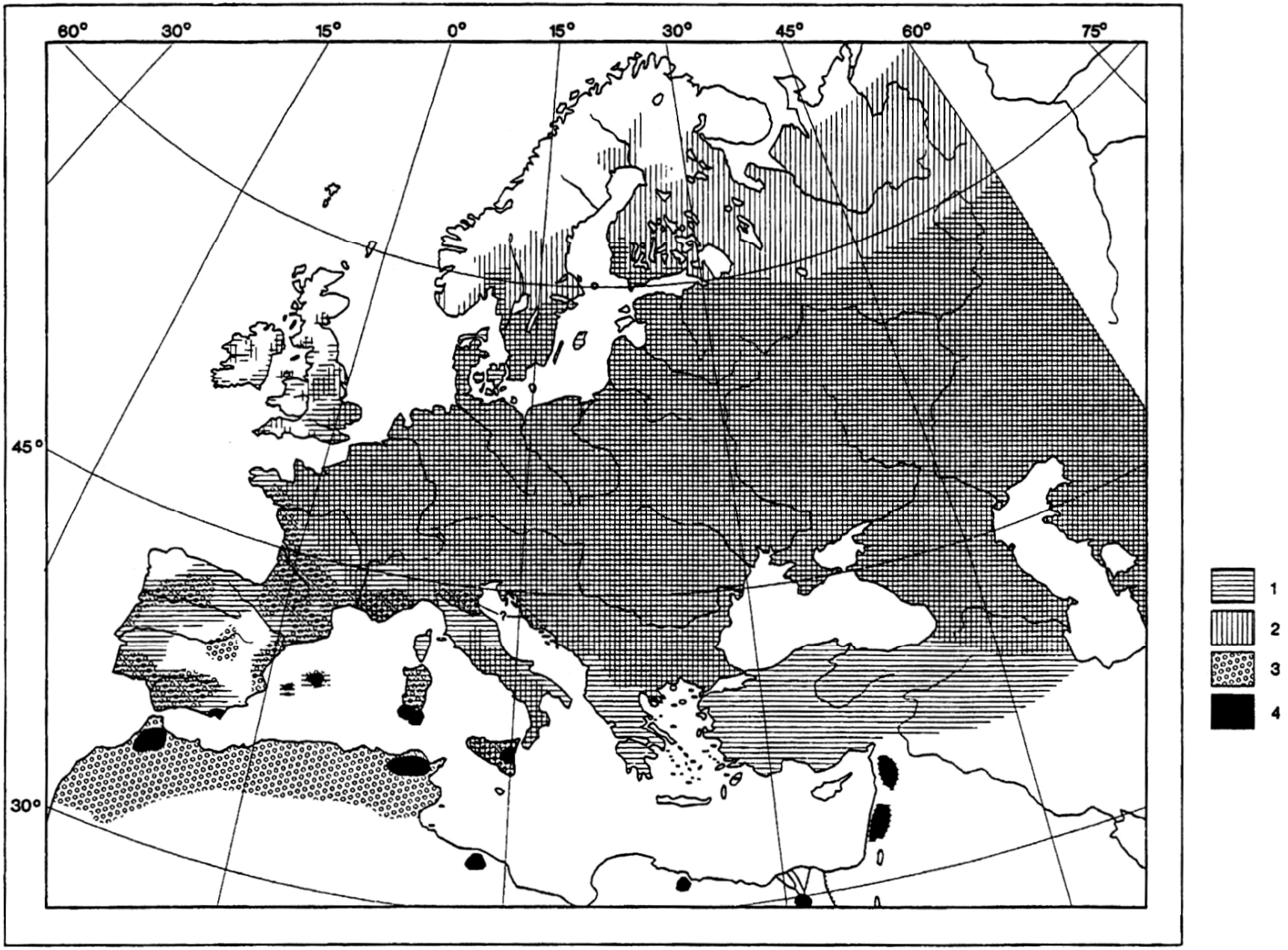


Fig. 11: European distribution of *Noterus clavicornis* (1), *N. crassicornis* (2), *N. laevis* (3) and *Canthydrus diophthalmus* (4).

Tab. 1: Auftreten von Futterfragmenten in Kröpfen von verschieden alten *Noterus crassicornis*. Die Anzahl gefundener Futterfragmente in einer bestimmten Zahl von Kröpfen wird als n und der Prozentsatz der jeweiligen Auftrittsfrequenz als % definiert.

	Weibchen										Männchen							
Altersstufe	2		3/1		3/2		3/3		?		1		2		3		?	
Sezierte Individuen	5		20		6		6		4		1		7		34		2	
Davon leere Kröpfe	3		3		0		0		1		0		0		4		0	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
undefinierbar	0	0.0	1	5.9	0	0.0	0	0	0	0.0	0	0.0	0	0.0	7	23.3	1	50.0
Daphnien	2	100.0	6	35.3	2	33.3	4	66.7	1	33.3	0	0.0	5	71.4	8	26.7	0	0.0
Chironomidae	0	0.0	6	35.3	0	0.0	1	16.7	1	33.3	0	0.0	2	28.6	3	10.0	1	50.0
Oligochaeta	2	100.0	11	64.7	4	66.7	4	66.7	1	33.3	1	100.0	4	57.1	14	46.7	1	50.0
Copepoda	1	50.0	7	41.2	3	50.0	3	50.0	2	66.7	0	0.0	5	71.4	9	30.0	0	0.0
Ephemeroptera	1	50.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Ciliophora	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	3.3	0	0.0
Rotatoria	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	3.3	0	0.0
Dinoflagellaten	0	0.0	2	11.8	0	0.0	1	16.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Ostracoda	0	0.0	1	5.9	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Andere Insecta	1	50.0	2	11.8	0	0.0	0	0.0	2	66.7	0	0.0	0	0.0	2	6.7	1	50.0
Acari	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	3.3	0	0.0
Rostpilzsporen	0	0.0	1	5.9	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Algenmaterial	1	50.0	3	17.6	2	33.3	1	16.7	1	33.3	1	100.0	1	14.3	3	10.0	0	0.0

Tab. 2: **Auftreten von Futterfragmenten in Kröpfen von verschieden alten *Noterus clavicornis*. Die Anzahl gefundener Futterfragmente in einer bestimmten Zahl von Kröpfen wird als n und der Prozentsatz der jeweiligen Auftrittsfrequenz als % definiert.**

	Weibchen												Männchen					
Altersstufe	1		2		3/1		3/2		3/3		?		1		2		3	
Sezierte Individuen	7		7		3		20		10		6		1		9		26	
Davon leere Kröpfe	1		0		0		0		0		0		0		0		1	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
undefinierbar	4	66.7	2	95.2	1	33.3	4	20.0	1	10.0	1	16.7	0	0.0	3	33.3	6	24.0
Daphnien	5	83.3	4	57.1	1	33.3	12	60.0	8	80.0	5	83.3	0	0.0	6	66.7	11	44.0
Chironomidae	2	33.3	4	57.1	2	66.7	6	30.0	6	60.0	3	50.0	0	0.0	3	33.3	10	40.0
Oligochaeta	5	83.3	7	100.0	2	66.7	15	75.0	8	80.0	4	66.7	1	100.0	8	88.9	19	76.0
Copepoda	2	33.3	1	14.3	0	0.0	4	20.0	2	20.0	2	33.3	0	0.0	2	22.2	2	8.0
Ephemeroptera	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Ciliophora	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Rotatoria	0	0.0	0	0.0	0	0.0	2	10.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Dinoflagellaten	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	11.1	0	0.0
Ostracoda	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Andere Insecta	2	33.3	3	42.9	1	33.3	4	20.0	2	20.0	2	33.3	1	100.0	3	33.3	5	20.0
Acari	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	11.1	0	0.0
Rostpilzsporen	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Algenmaterial	4	66.7	4	57.1	0	0.0	3	15.0	2	20.0	3	50.0	0	0.0	3	33.3	7	28.0

Tab. 3: Auftreten von Futterfragmenten in Kröpfen von weiblichen bzw. männlichen *Noterus crassicornis* und *N. clavicornis*. Die Anzahl gefundener Futterfragmente in einer bestimmten Zahl von Kröpfen wird als n und der Prozentsatz der jeweiligen Auftrittsfrequenz als % definiert.

	Noterus crassicornis						*Noterus clavicornis*					
	Weibchen		Männchen		Gesamt		Weibchen		Männchen		Gesamt	
Sezierte Individuen	41		44		85		53		36		89	
Davon leere Kröpfe	7		4		11		1		1		2	
	n	%	n	%	n	%	n	%	n	%	n	%
undefinierbar	1	2.9	8	20.0	9	12.2	13	25.0	9	25.7	22	25.3
Daphnien	15	44.1	13	32.5	28	37.8	35	67.3	17	48.6	52	59.8
Chironomidae	8	23.5	6	15.0	14	18.9	23	44.2	13	37.1	36	41.3
Oligochaeta	22	64.7	20	50.0	42	56.8	41	78.8	28	80.0	69	79.3
Copepoda	16	47.1	14	35.0	30	40.5	11	21.2	4	11.4	15	17.2
Ephemeroptera	1	2.9	0	0.0	1	0.1	0	0.0	0	0.0	0	0.0
Ciliophora	0	0.0	1	2.5	1	0.1	0	0.0	0	0.0	0	0.0
Rotatoria	0	0.0	1	2.5	1	0.1	2	3.8	0	0.0	2	2.3
Dinoflagellaten	3	8.8	1	2.5	4	5.4	0	0.0	1	2.9	1	1.1
Ostracoda	1	2.9	0	0.0	1	0.1	0	0.0	0	0.0	0	0.0
Andere Insecta	5	14.7	3	7.5	8	10.8	14	26.9	9	25.7	23	26.4
Acari	0	0.0	1	2.5	1	0.1	0	0.0	1	2.9	1	1.1
Rostpilzsporen	1	2.9	0	0.0	1	0.1	0	0.0	0	0.0	0	0.0
Algenmaterial	8	23.5	6	15.0	14	18.9	15	28.8	10	28.6	25	28.7

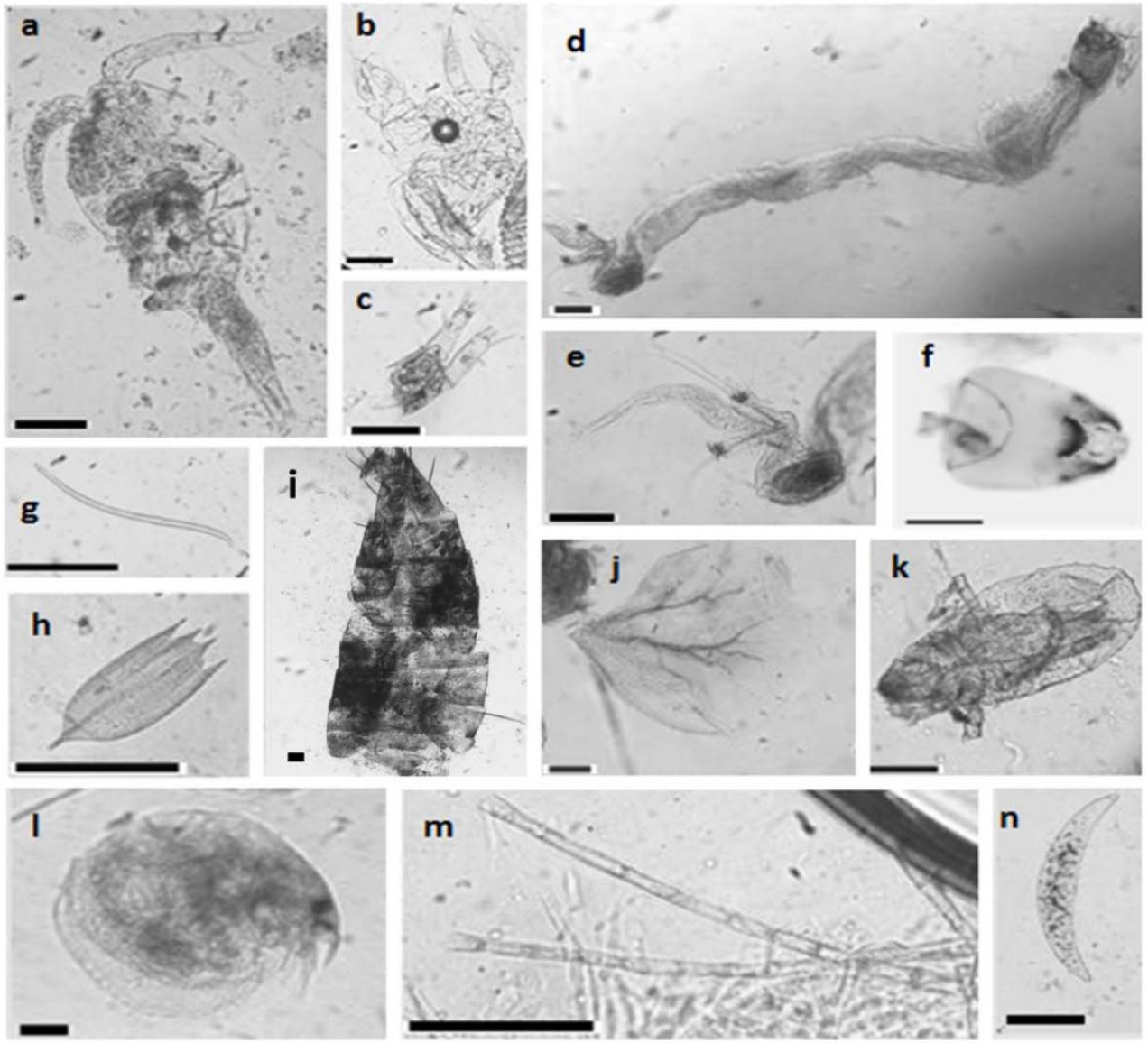
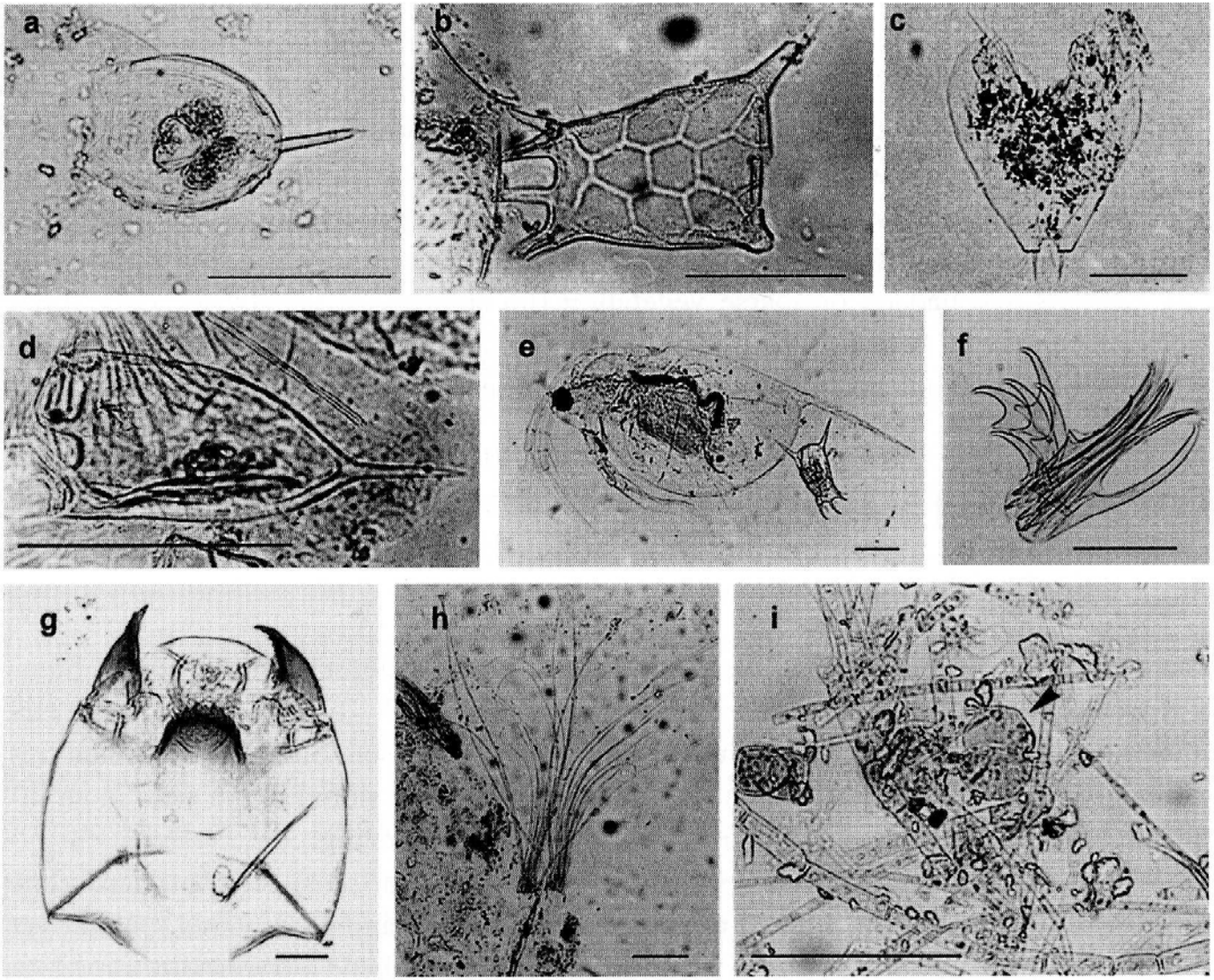
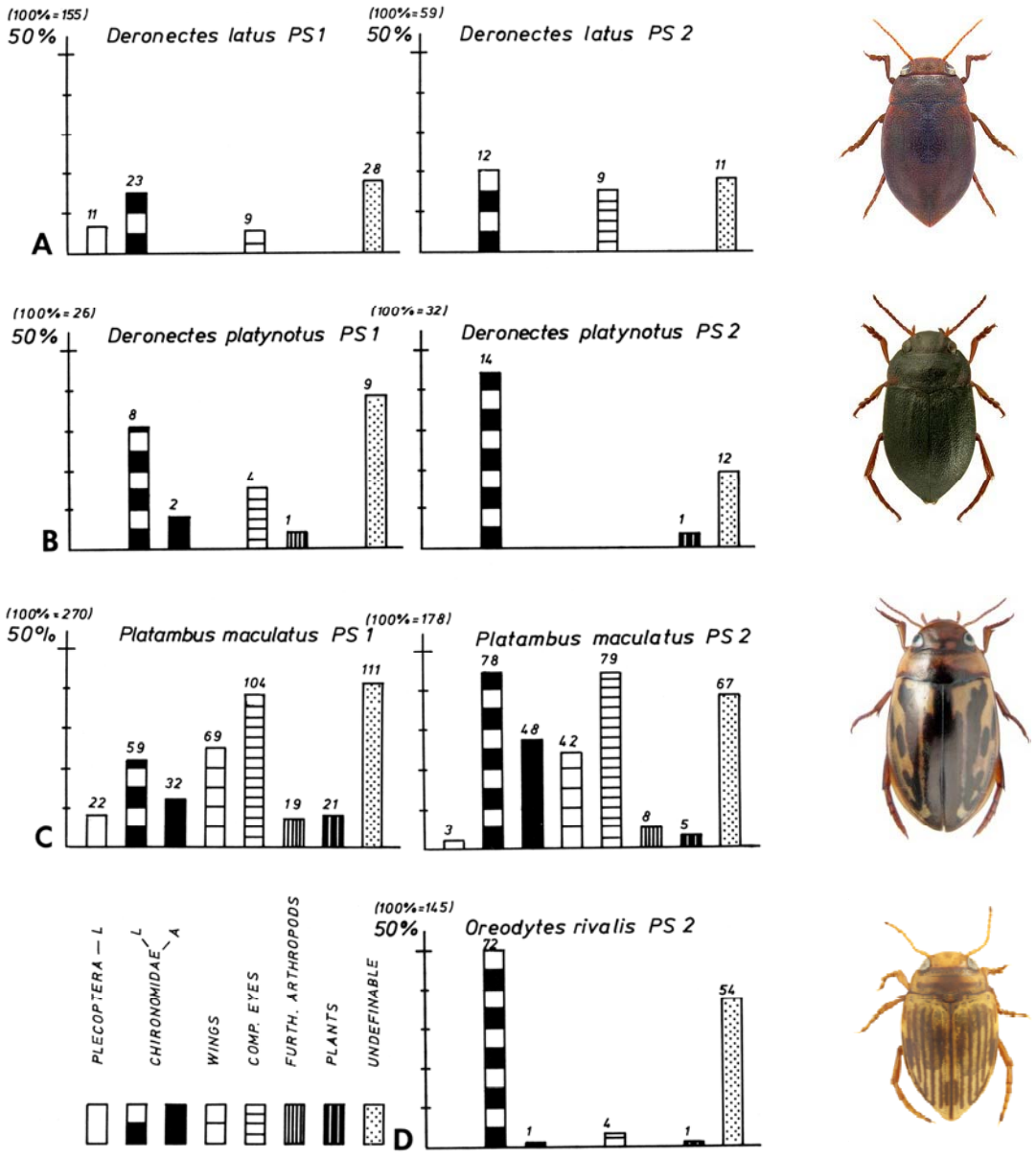


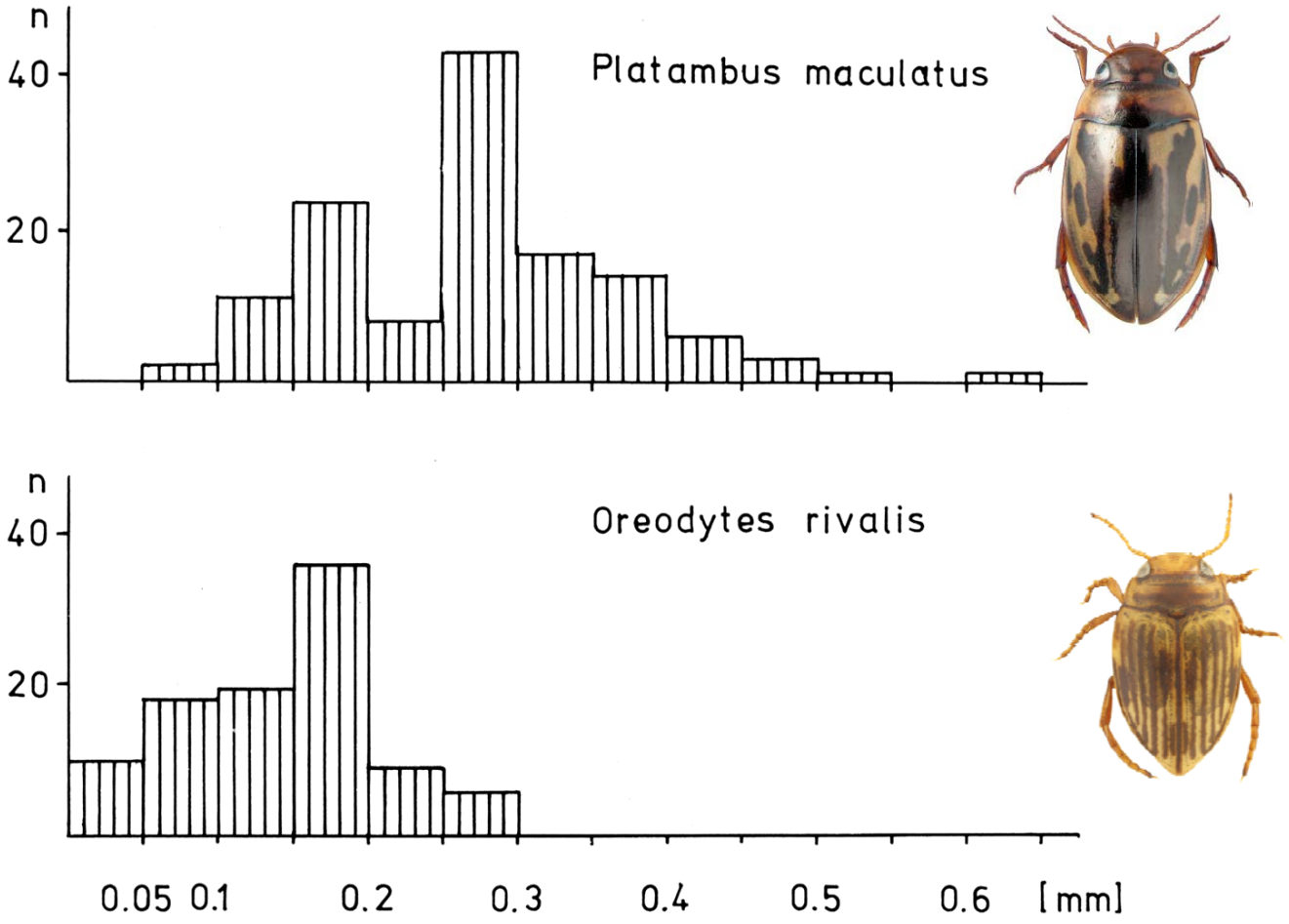
Abb. 8: Futterfragmente, die in den Proventriculi von Vertretern der Gattung *Noterus* gefunden wurden. a – c: Copepoda (a: Aufsicht auf ein nahezu unversehrtes Tier, b: Teil des Metasoms mit Schwimmbeinen, c: Urosom), d – f: Chironomidae- Larven (d: Aufsicht auf ein nahezu unversehrtes Tier, e: Abdominalsegment mit Parapoden und Analpapillen, f: Kopfkapsel), g: Oligochaetenborste, h: Rotatoria, *Keratella* spec., i: Andere Insecta, j: Tracheenkieme einer Ephemeroptera- Larve, k: Acari, l: Daphnia, m: fädige Alge, n: Zieralgen, *Closterium* spec.. Skalierungsbalken: 0.1 mm.



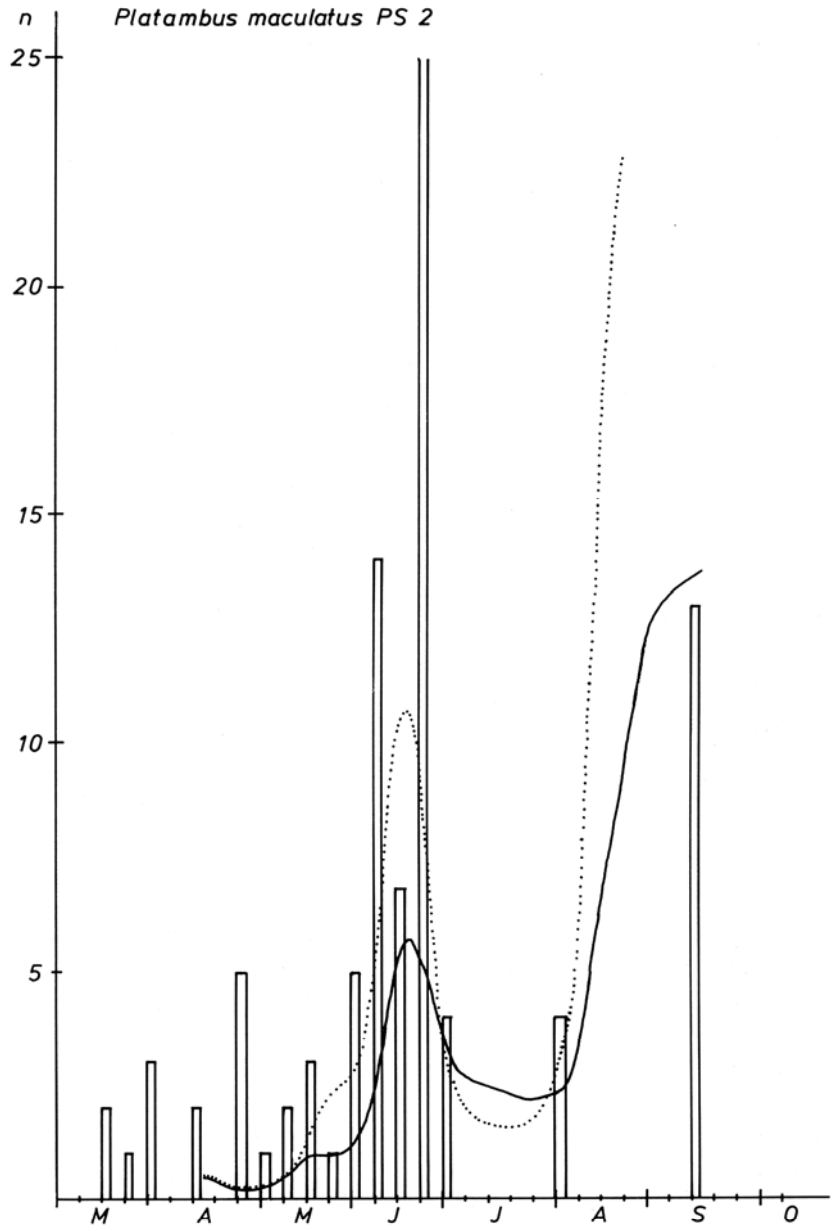
Fragments of food items found in the crops of pioneer water beetles: **a** – Rotatoria, *Lecane* spec., **b** – Rotatoria, *Keratella* spec. 1, **c** – nauplius larvae of Copepoda, **d** – Rotatoria, *Keratella* spec. 2, **e** – Intact Cladocera and *Keratella* spec., **f** – claws of parapods of Chironomidae, **g** – head capsule of Chironomidae, **h** – Chironomidae abdominal procerci, **i** – filamentous and other algae. Scale bars: 0.1 mm.



Comparative analysis of the crop contents of *Deronectes latus*, *D. platynotus*, *Platambus maculatus*, *Oreodytes rivalis* at the localities PS 1 (left) and PS 2 (right) of Inde brook. The heights of the columns symbolize the percentage of crops where a specific fragment category (as indicated below) was found. In every case the total number of dissected beetles is indicated. (For further explanations see text.)



Head length and number of ingested chironomid head capsules found in the crops of *Platambus maculatus* and *Oreodytes rivalis*.



Phenology of chironomid larvae (columns; Y-axis × 10) at the Inde brook locality PS 2 as compared with the seasonal varying number of ingested chironomid larvae (dotted line) or the number of *Platambus maculatus*-crops containing chironomid larvae (black line).

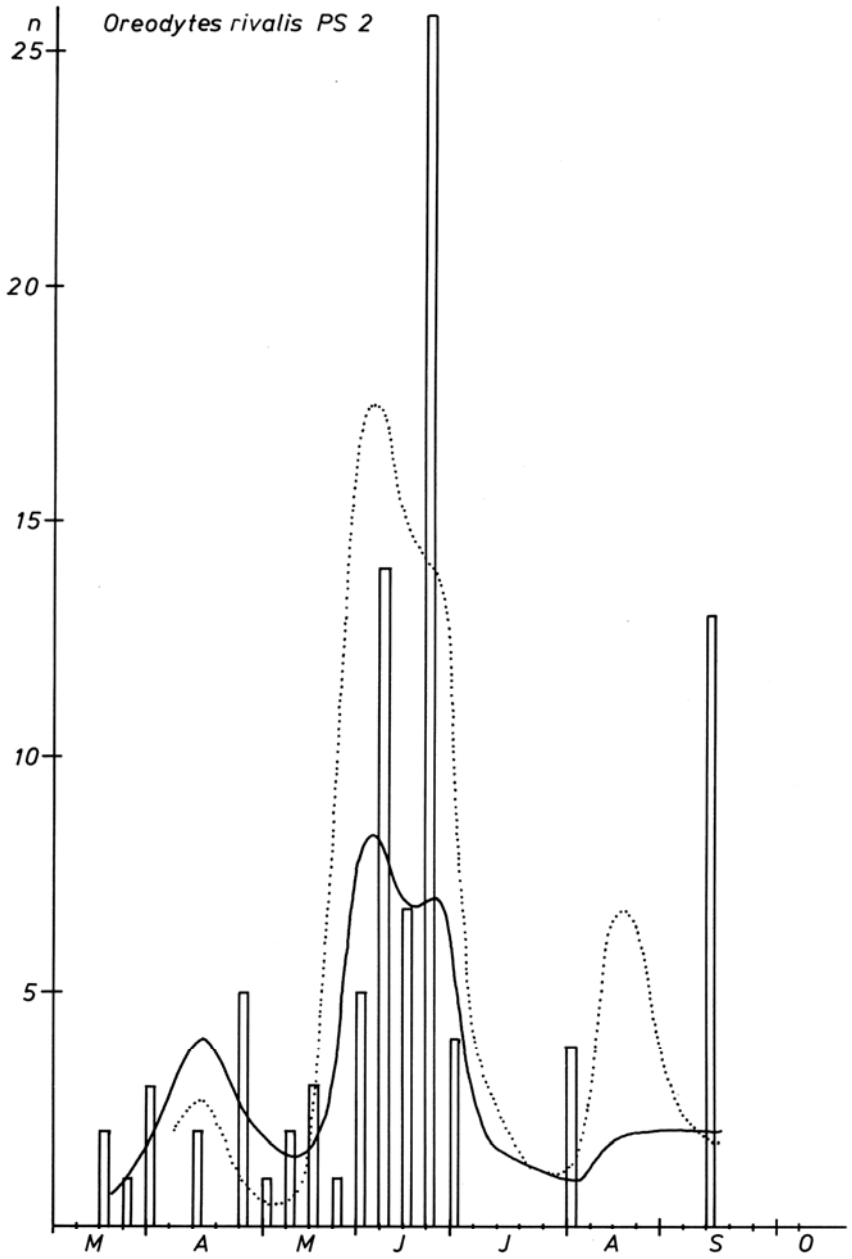
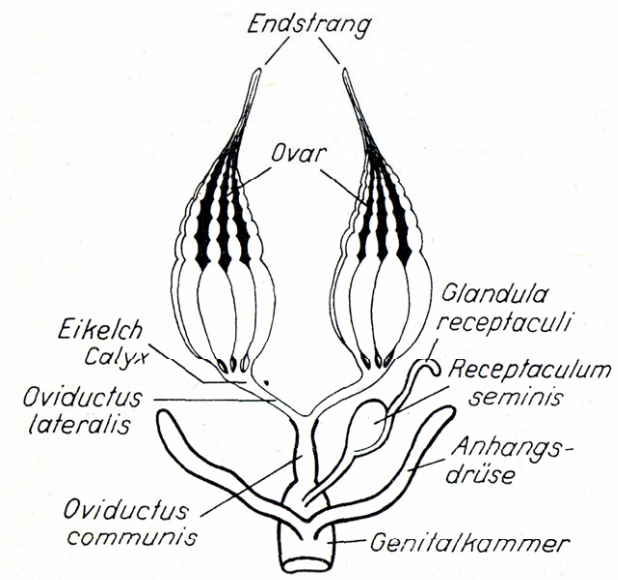


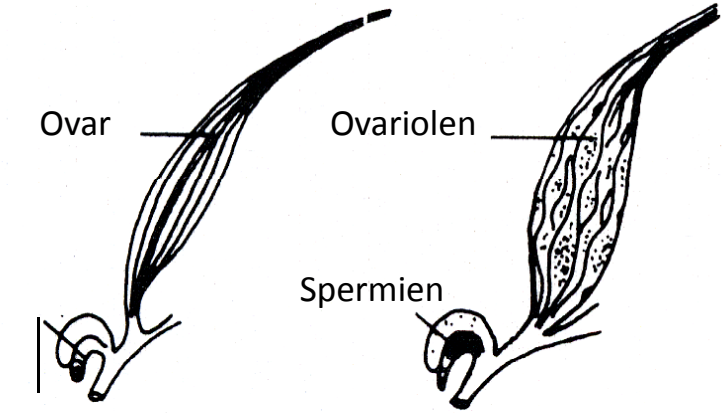
Fig. 16: Phenology of chironomid larvae (columns; Y-axis × 10) at the Inde brook locality PS 2 as compared with the seasonal varying number of ingested chironomid larvae (dotted line) or the number of *Oreodytes rivalis*-crops containing chironomid larvae (black line).

Weiblicher Geschlechtsapparat (schematisch).

Die ektodermalen Teile sind stark umrandet

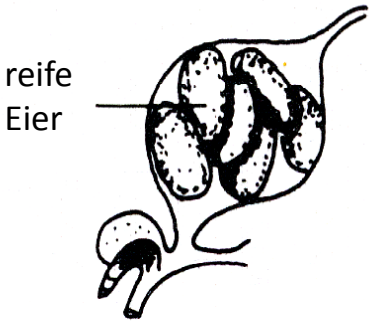


Weiblicher Geschlechtsapparat unterschiedlicher Altersstadien beim Wasserkäfer *Agabus bipustulatus*

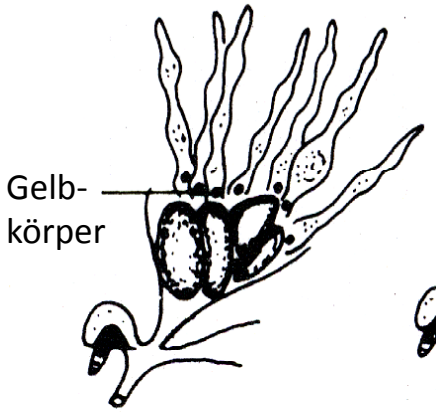


noch unbegattetes Jungweibchen

Jungweibchen nach der Kopula



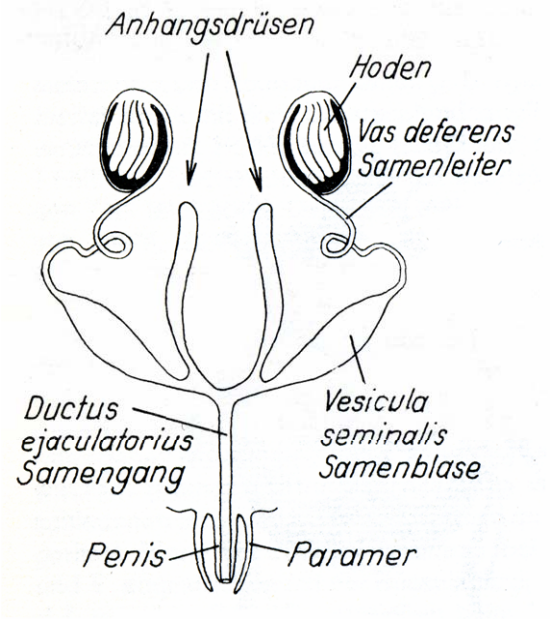
ausgewachsenes Weibchen mit reifen Eiern



ausgewachsenes Weibchen während der Eiablage. Es sind sowohl reife Eier als auch Gelbkörper vorhanden

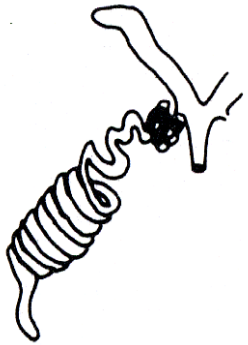
altes Weibchen nach der Eiablage

Männlicher Geschlechtsapparat (links: schematisch; rechts: Wasserkäfer)

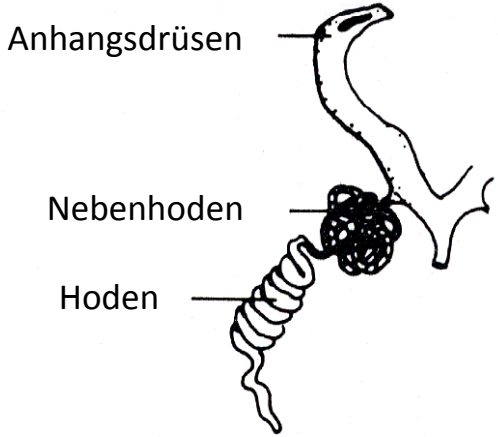


Männlicher Geschlechtsapparat unterschiedlicher Altersstadien beim Wasserkäfer *Agabus bipustulatus*

Jungtier (frisch-geschlüpft)

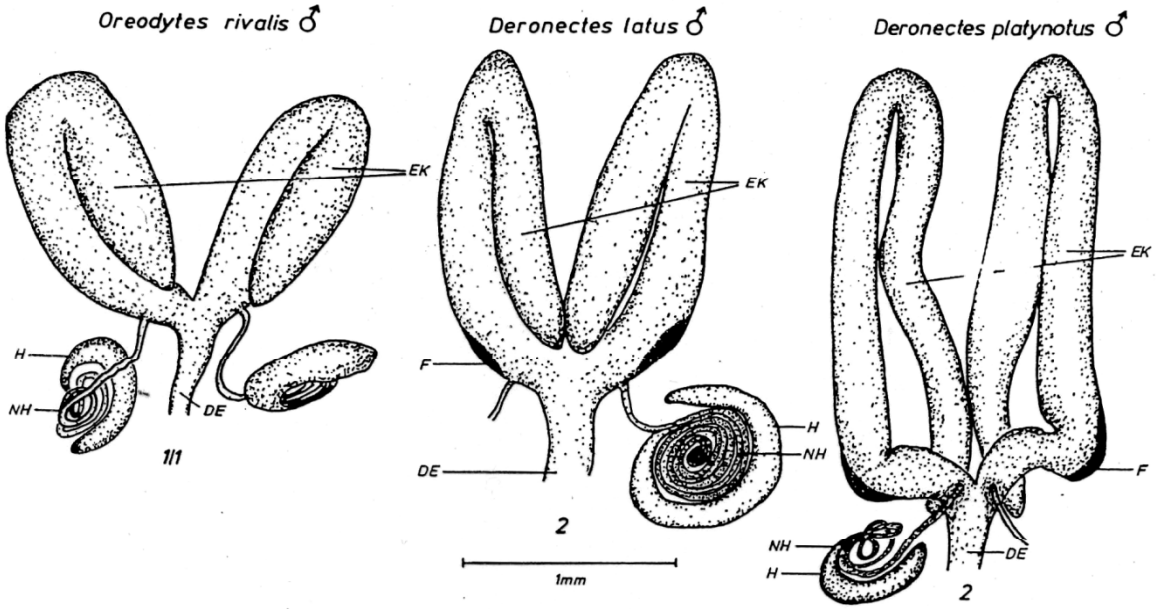


älteres Tier mit reifenden Spermien

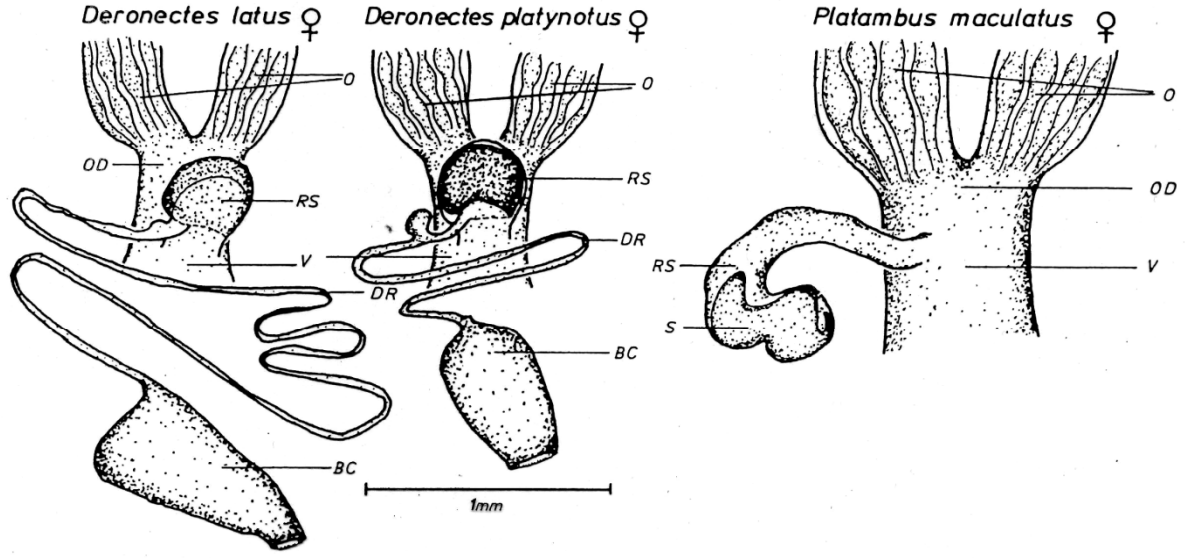


reife Spermien sind im Nebenhoden gespeichert; Männchen vor der Kopula

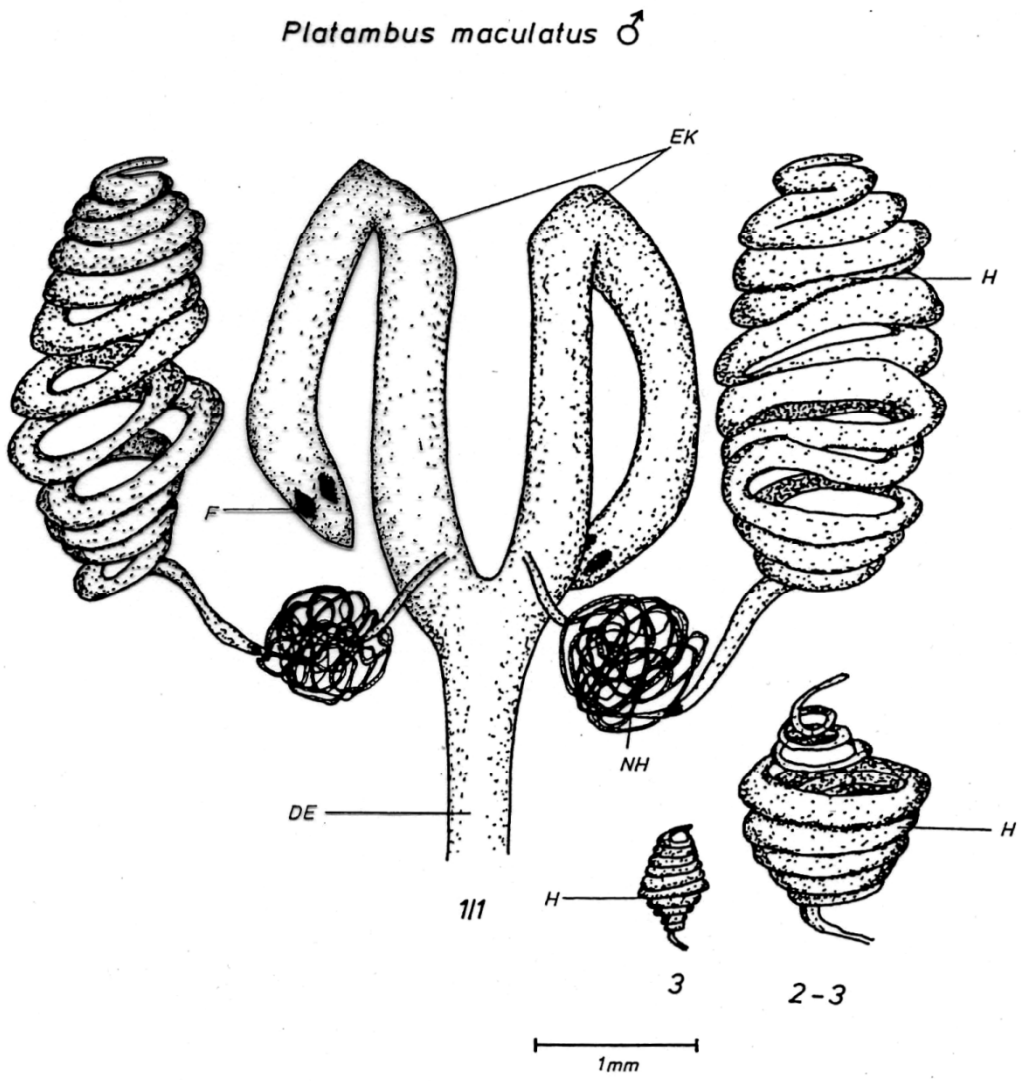
Männchen nach der Kopula



Structure of internal male genitalia of *Oreodytes rivalis; Deronectes latus* and *D. platynotus* (EK: accessory glands; DE: ejaculatory duct; NH: spermatic duct ("Nebenhoden"); H: testes ("Hoden"); F: yellow spots).

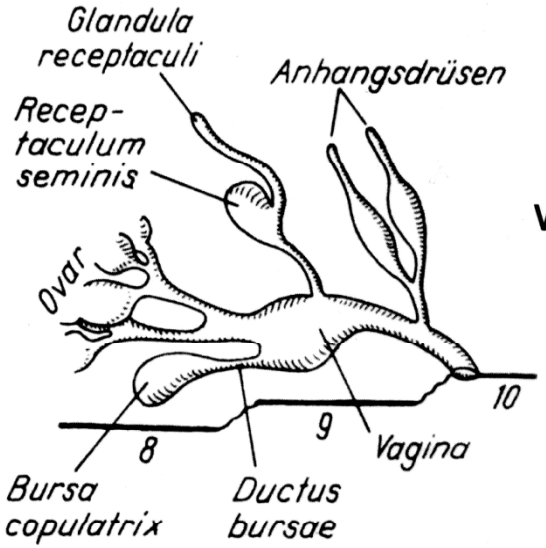


Structure of internal genital structures of females of *Deronectes latus, D. platynotus* and *Platambus maculatus* (0: ovaries with ovarioles; OD: oviduct; V: vagina; RS: receptaculum seminis; BC: bursa copulathrix; DR: ductus receptaculus; S: sperms).

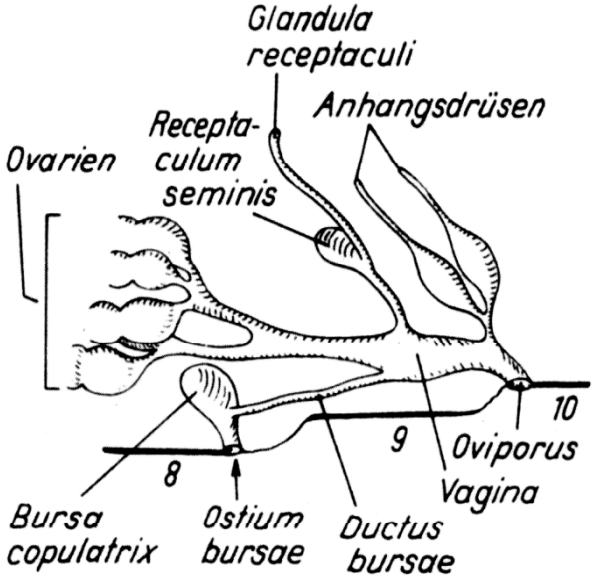


Structure of internal male genitalia of *Platambus maculatus* and found age classes 1/1, 2–3 and 3. Within stages 2–3 and 3 only apical parts of the testes are figured (EK: accessory glands; DE: ejaculatory duct; NH: spermatic duct; H: testes; F: yellow spots).

weibliche Geschlechtsdrüsen

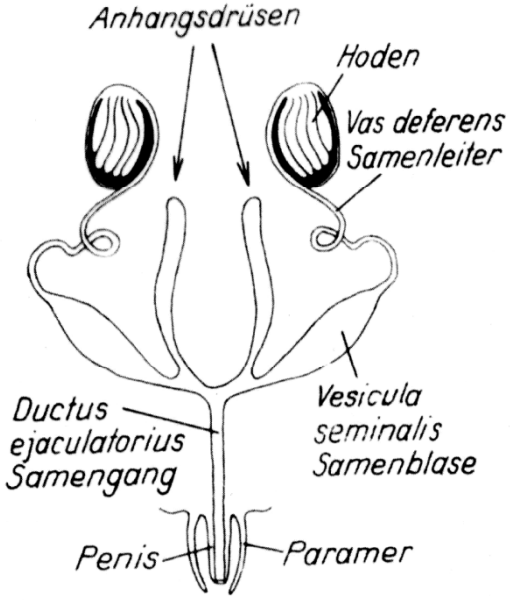


Geschlechtswege eines Schmetterlings-♀ mit einfacher Geschlechtsöffnung (schematisch). Nach Weber und Eidmann

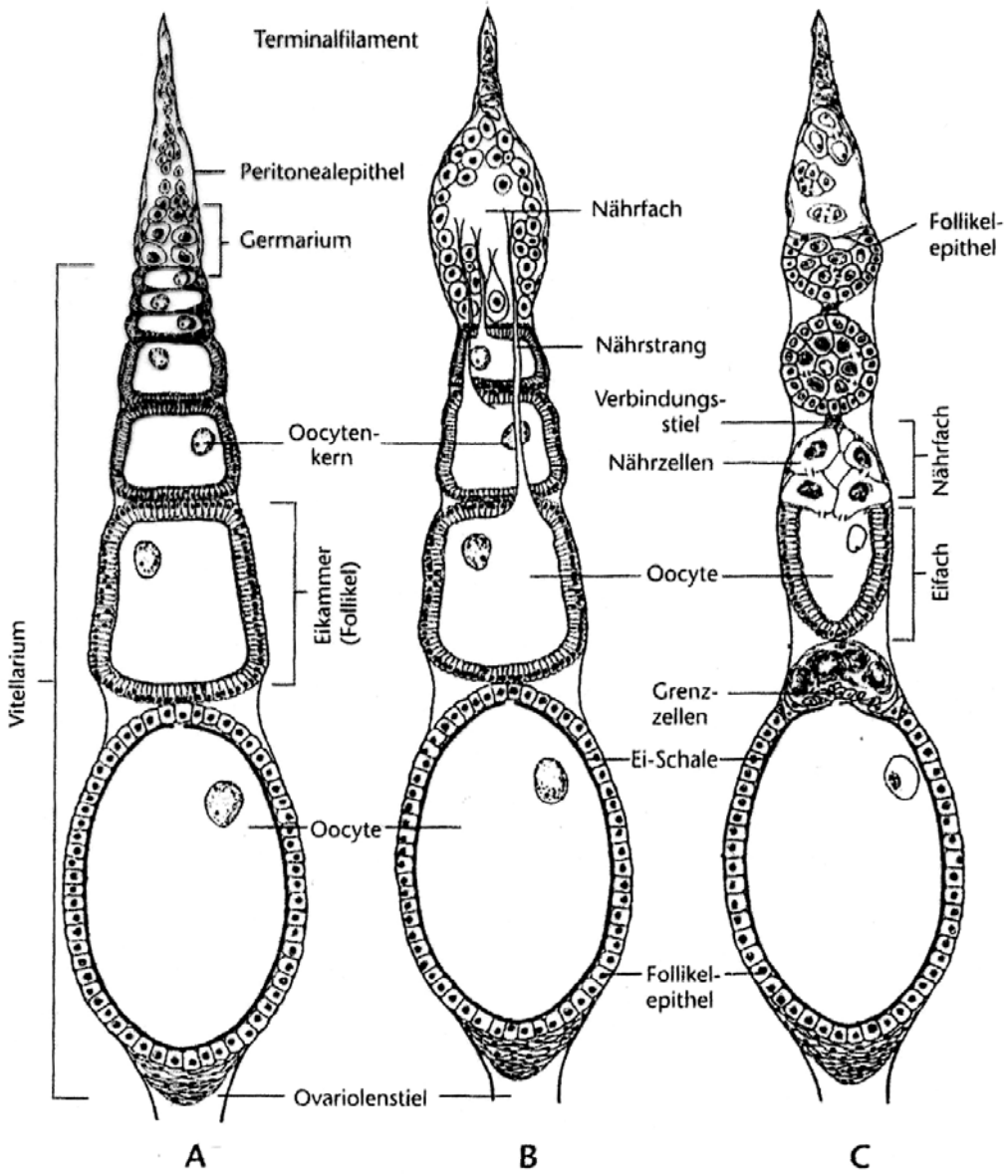


Geschlechtswege eines Schmetterlings-♀ mit 2 Geschlechtsöffnungen (schematisch). Nach Weber und Eidmann

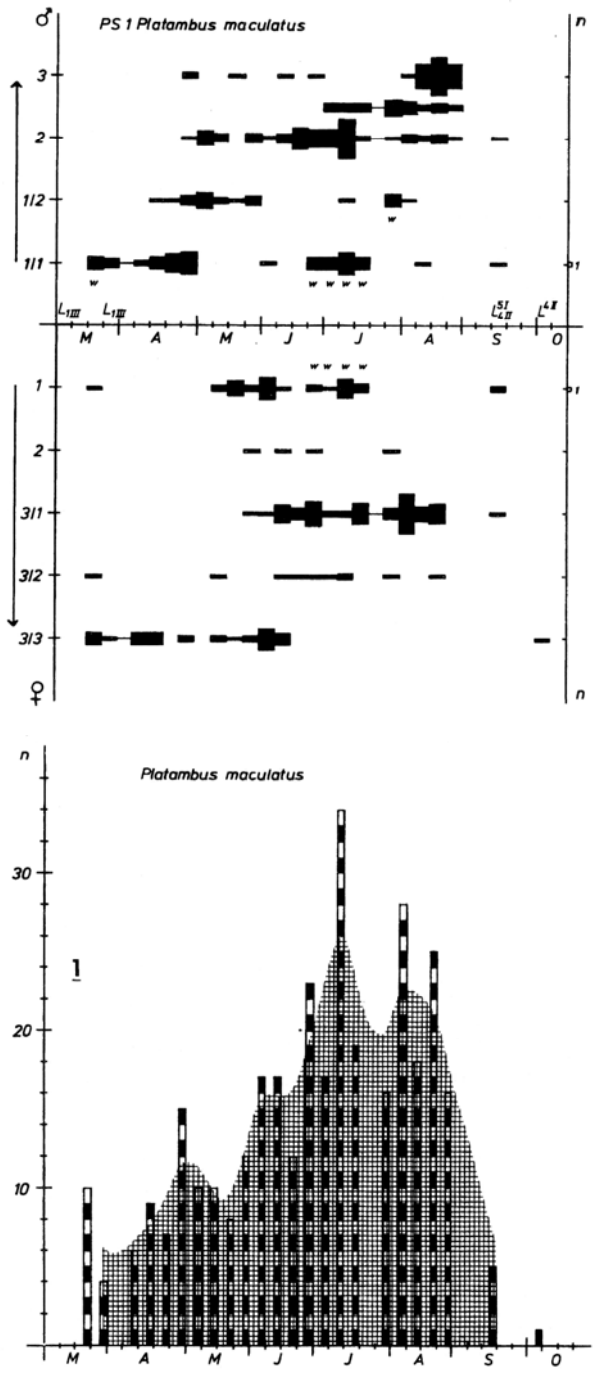
männliche Geschlechtsdrüsen



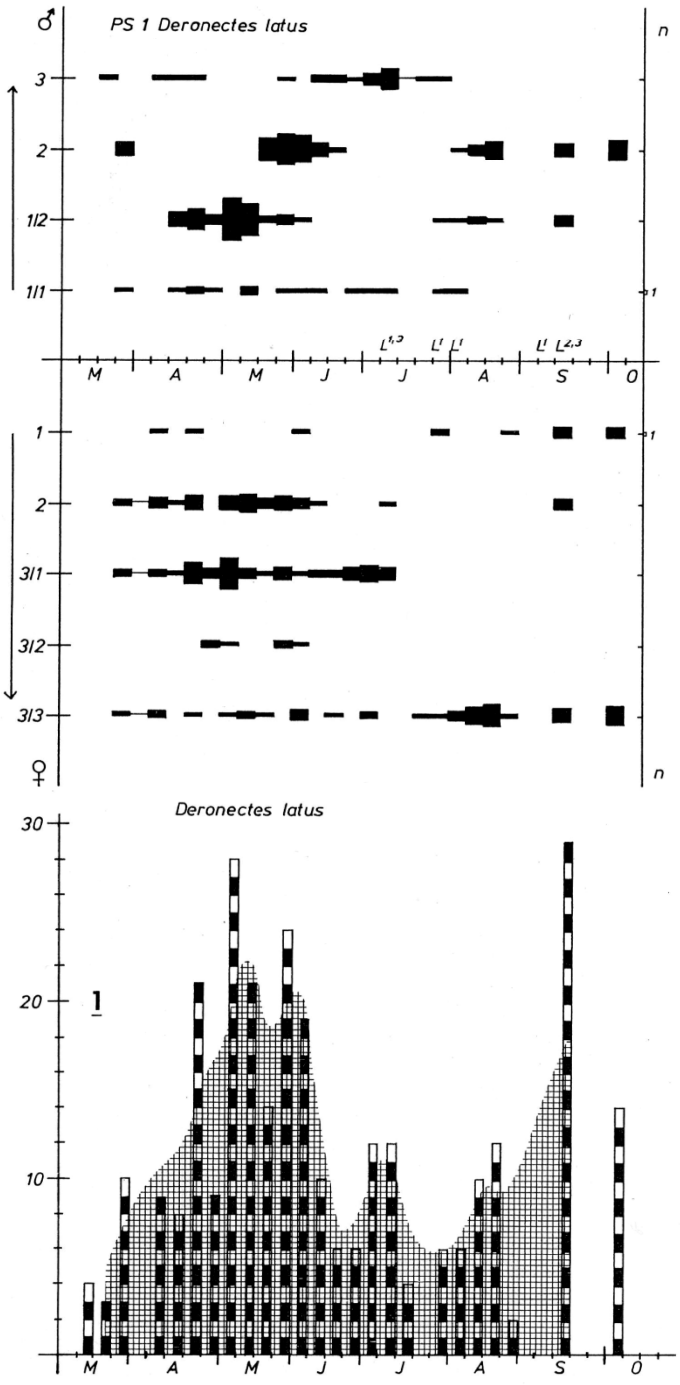
männlicher Geschlechtsapparat (schematisch). Nach Snodgras und Eidmann.



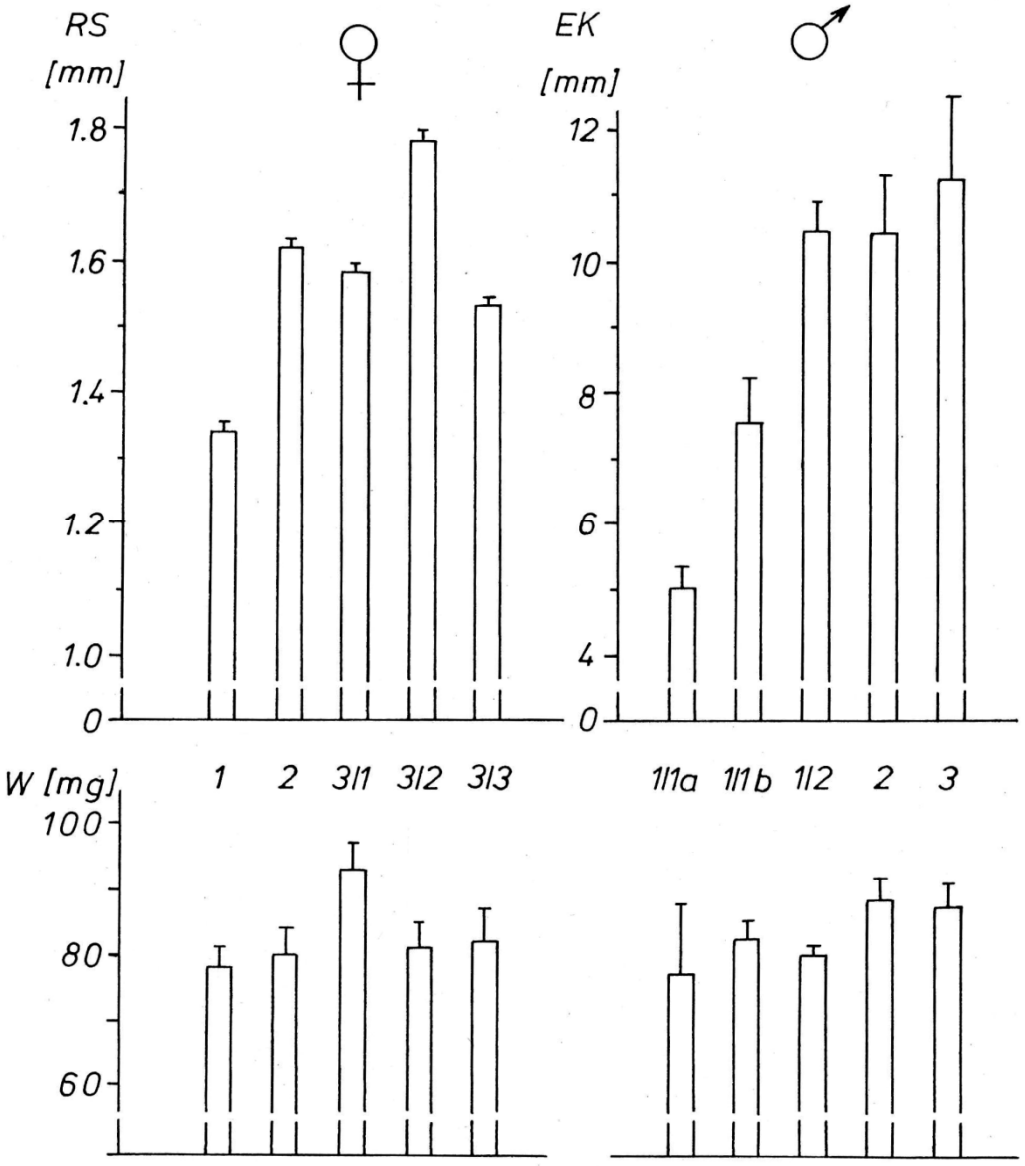
. **Ovariolentypen.** **A** panoistische, **B** telotroph-meroistische, **C** polytroph-meroistische Ovariole. (Nach F. E. Schwalm 1988, verändert)



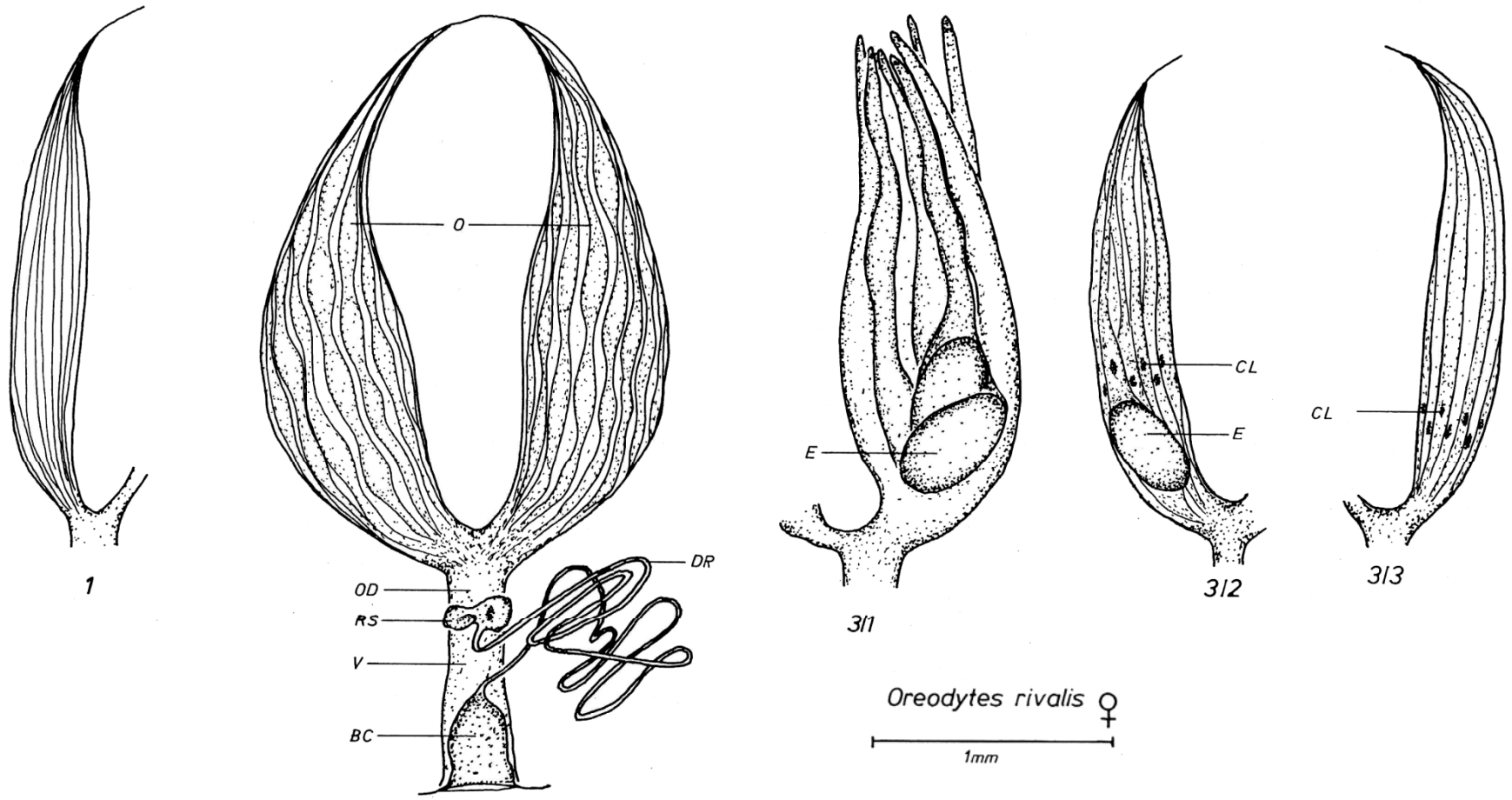
Age structure (above) and phenology (below) of *Platambus maculatus* at locality PS 1 (Inde brook). The presence of soft, immature adults is indicated by the sign "w" which is placed above and underneath the horizontal bars. When four second stage larvae and five first stage larvae of *Platambus maculatus* were found at the same locality this was indicated by: $L_{4\ II}^{5\ I}$. Between male age classes 2 and 3 the intermediate stage 2–3 is figured by horizontal columns. For further explanations see figure 7.



Age structure (above) and phenology (below) of *Deronectes latus* at locality PS 1 (Inde brook). For further explanations see figure 7.



Quantitative data (mean; S.D.) from male and female specimens of *Agabus bipustulatus* belonging to age classes 1, 1/1a, 1/1b, 1/2, 2, 3, 3/1, 3/2, 3/3 (X-axis). Above: length of receptaculum seminis (RS) and accessory glands (EK); below: fresh weights (W). Number of specimens investigated: ♀: stage **1**:5, **2**:6, **3/1**:6, **3/2**:32, **3/3**:51; ♂:**1/1a**:3, **1/1b**:4, **1/2**:6, **2**:21, **3**:50.



Structure of internal female genitalia of *Oreodytes rivalis* and found age classes 1, 2, 3/1, 3/2, 3/3 (O: ovaries; OD: oviduct; V: vagina; RS: receptaculum seminis; BC: bursa copulathrix; DR: ductus receptaculus; E: mature eggs; CL: corpora lutea).