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Biodiversity and seasonal fluctuation of aquatic and semiaquatic insects in Rashid stream, kafr El Zayat (Gharbyia governorate)

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ABSTRACT

Rashid branch of Nile River is a principle stream in Kafr El Zayat (Gharbyia governorate) for drinking and irrigation to different essential crops. Five stations were selected for seasonal collection, resulted in 539 specimens, belonging to 7 orders and 22 families and 31 species. The total population density was higher during Spring (41.9%), then in Summer (25.1). Order Diptera was the most abundant (33.8%), represented by 5 families (Chironomidae, Culicidae, Ephydridae, Tabanidae & Stratiomyiidae) with the highest value during Spring season; then order Hemiptera (19.5%), represented by 5 families (Blestomatidae, Croxidae, Mesovillidae, Villidae & Notonectidae) with the highest value also during Spring season; followed by order Coleoptera (16.9%) with 6 families (Hydrophylidae, Dytiscidae, Noteridae, Hydranaeidae, Curculionidae & Staphylinidae), the highest representation was during Summer season; then order Odonata (16.7%), 2 families (Libellulidae & Coenagrionidae) , the highest representation was during Spring; order Ephemeroptera (9.5%), 2 families (Baetidae & Caenidae), the highest value was during Spring; lastly order Trichoptera and Orthoptera each with one family during Summer and Winter respectively. Family Tridactylidae and Staphylinidae are collected for the first time from streams in Egypt. Tables, Figures, Keys, diagnosis and notes on habitat, in addition to detailed colored photographs with diagnostic features to all collected species were introduced to facilitate the correct identification that permits the utilization of these aquatic insects as bioindicators in monitoring programs for reflecting the ecological contents and pollution level of aquatic ecosystem along this stream.

Key words: Aquatic insects, Biosystematic, Identification keys & Colored images.

INTRODUCTION

All over the world the ecological integrity of river system is being endangered by land-use changes (Miserendina *et al*., 2011). Human activities: domestic, industrial, agricultural, artificial drainage and other different potential impacts give negative effects on water quality, stream habitat then aquatic invertebrate biodiversity depending on concentration, duration of exposure (Angradi & Jicha, 2010). Water pollution generally decreased the dissolved oxygen, can be estimated by the analyses of water to determine the level of various organic pollutants such as heavy metals, nitrates and phosphates; or by other method, to use indicator species, with their different tolerance level to pollution. By observing the presence & absence of sensitive organisms from a habitat, the level of pollution can be estimated (Paparisto *et al*., 2008). Biological assessments of human and environmental impacts on water quality and aquatic organisms have been used since the early 1900s; since 1972, many research institutions have been developing various techniques to measure the health of

the country's water (Hu *et al*., 2007; Stein *et al*., 2008; Adham *et al*., 2009; Paparisto *et al*., 2010). From these techniques the use of macroinvertebrate which are an ideal indicators to assess water quality has become a standard addition to many countries; aquatic insects as bioindicators for water pollution is less expensive than the evaluation of physical and chemical parameters used in assessing quality (Arimoro & Ikomi, 2009; Trigal *et al.*, 2009; Lili *et al.*, 2010); aquatic insects also play an important ecological role in nitrogen remobilization by eating small organisms and being consumed by other animals and fishes (Shabrawy *et al.*, 2007).

Biomonitoring or biological monitoring is generally defined as "the systematic use of living organisms or their responses to determine the condition or changes of the environment". There is a limited knowledge on the taxonomy and ecological requirements of most aquatic insects especially immature stages in Egyptian fresh water ecosystem and lack of sufficient local taxonomic keys, these make identification difficult for non-specialist to family, genera and impossible for species. So the main goal of this work were : To provide baseline assessment of the structure, diversity, and group composition of aquatic insect communities in Rashid branch (Kafr El Zayat) in addition to their seasonal fluctuations and also to introduce identification guide to aquatic insects in this stream.

MATERIALS AND METHODS

Rashid branch in Kafr El Zayat is the essential source for both drinking and fishing as well as the principle stream for irrigation to many crops; its length is 5 Kilometer and width is 28 Meter inside Kafr El Zayat. Five stations were chosen along the stream for seasonal collection during 2010 &2011; these stations were pre and post the factory of fertilizer.

Water samples were collected seasonally from each site, benthic invertebrates were taken from the river stream with a kick- net in order to gain sufficient samples from largest depth of water; kicking and turning over rocks and logs were with the feet and hands. This technique gives consistent results (Armitage, 1978). The laboratory samples were washed in a 500-µm mesh sieve to remove sand and macroinvertebrates were then picked from the substrate with the aid of a forceps and microscope. Samples were collected from the net were and preserved in 70% ethanol. All insects were enumerated and indentified under binocular dissecting microscope using different Keys (Usinger, 1956; Salman, 1990; Zalat *et al*., 1992; Hebashy, 1993; Ahmed & Gadalla, 1999 & 2005; Sawaby, 2001; Geber and Gabrial, 2002; Gadalla & Ahmed, 2000; Keller *et al*., 2007; Ahmed *et al*., 2008; Tawfik, 2009).

RESULTS AND DISCUSSION

Biodiversity and Seasonal fluctuation:

From Table 1, Figs. 1 & 2: 539 specimens belonging to 7 Orders, 21 families and 31 species were collected from which 41.9% were abundant during Spring season then (25.1%) during Summer, (16.8%) in Winter and (16.5%) during Autumn. Order Diptera was the most abundant (33.8%), then Order Hemiptera (19.5%), followed by order Coleoptera (16.9%) & order Odonata (16.7%), then order Ephemeroptera (9.5%) and Lastly order Trichoptera and Orthoptera each with one family, of 3.3% & 0.4% respectively. From Tale 1 & Fig. 3: 182 specimens of 5 families were collected, Chironomidae was the richest of 94%, and the highest value during Spring season, then Family Culicidae, with the high concentration during Summer season, followed

by Ephydridae during Winter, Tabanidae during Summer & Spring then family Stratiomyiidae during Summer**.** As in the same table and Fig. 4: 105 hemipteran specimens belongs to 5 families were introduced Blestomatidae, was the most abundant (74.3%) during spring season, followed by Croxidae (20%), Mesovillidae, Villidae and Notonectidae; then Order Coleoptera, with 6 families, with the highest Hydrophilid family (41.8%) during Summer, Dytiscidae (37.4%), Notoridae, Hydraenidae, Curculionidae and Staphylinidae; then Order Odonata, represented by 2 families, the highest was Coenagrionidae during spring, as Shown in the Table and Fig. 5; Followed by Ephemeroptera, the highest value represented by Baetidae during Spring.

Table 1: Seasonal distribution, insect biodiversity and Family richness of Rashid branch in Kafr El Zayat (Gharbyia Governorate).

Collected Orders	Families	Summer	Autumn	Winter	Spring	Total	%
I- Trichoptera	Limniphilidae	15	3	0	0	18	3.3%
	%	83%	17%	0	0		
2-Ephemeroptera	Baetidae	4	0	0	46	50	98%
	Caenidae	0	o	0	1	1	2%
	Total	4	0	0	47	51	9.5%
	%	7.80%	0	0	92.20%		
3-Orthoptera		0	2	0	0	2	0.4%
4-Odonata: Zygoptera	Coenagrionidae	22	18	1	25	66	73.30%
Anisoptera	Libellulidae	1	19	1	3	24	26.70%
	Total	23	37	2	28	90	16.7%
	%	25.60%	41.10%	2.20%	31.10%		
5-Hemiptera	Notonectidae	0	0	0	1	1	1%
	Croxidae	0	0	3	18	21	20%
	Blestomatidae	21	11	9	37	78	74.30%
	Villidae	2	0	0	0	2	1.90%
	Mesovillidae	3	0	0	0	3	2.80%
	Total	26	11	12	56	105	19.5%
	%	24.80%	10.50%	11.40%	53.30%		
6- Diptera	Chironomidae	33	29	51	58	171	94%
	Culicidae	4	0	0	1	5	2.75%
	Tabanidae	1	0	0	1	2	1.1%
	Stratiomyiidae	1	0	0	0	1	0.6%
	Ephydridae	0	1	2	0	3	1.6%
	Total	39	30	53	60	182	33.8%
	%	21.4%	16.5%	29.1%	33%		
7- Coleoptera	Hydrophilidae	15	2	12	9	38	41.80%
	Noteridae	3	0	1	4	8	8.80%
	Dytiscidae	9	16	6	3	34	37.40%
	Hydraenidae	2	2	1	0	5	5.50%
	Curculionidae	2	2	0	0	4	4.40%
	Staphylinidae	0	2	0	0	2	2.20%
	Total	31	24	20	16	91	16.9%
	%	34%	26.40%	22%	17.60%		
	Total	160	105	107	267	639	
	%	25.10%	16.50%	16.80%	41.90%		

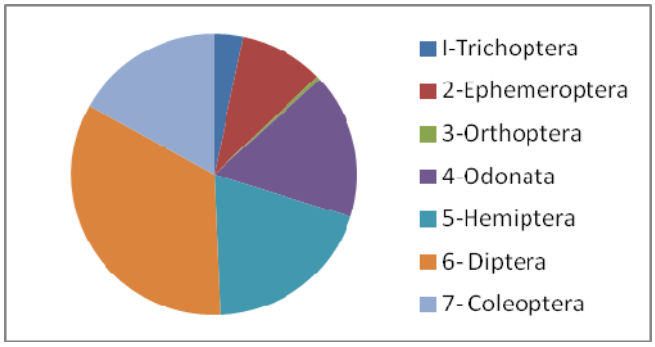


Fig. 1: Relative distribution and biodiversity of the total collected insects of Kafr El Zayat stream.

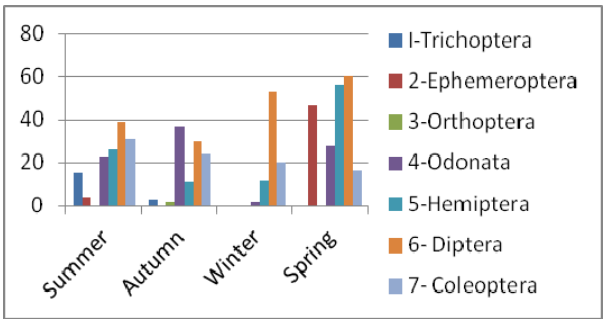


Fig. 2: Seasonal abundance and biodiversity of the collected insects from Kafr El Zayat stream

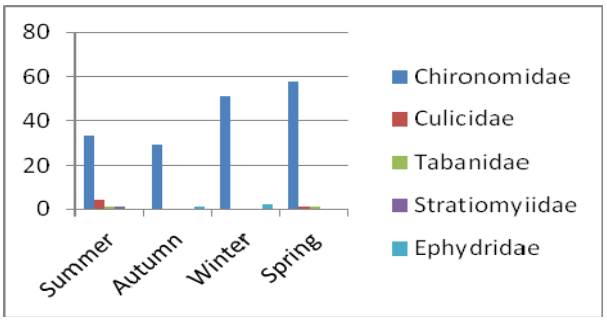


Fig. 3: Seasonal biodiversity and family richness of Order Diptera from Kafr El Zayat stream

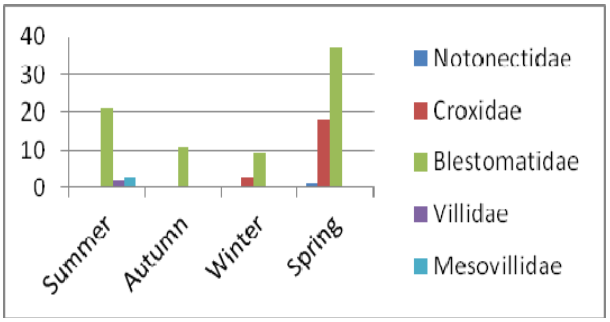


Fig. 4: Seasonal biodiversity and family richness of Order Hemiptera from Kafr El Zayat stream

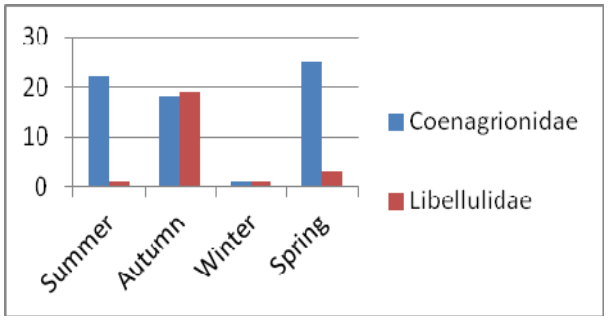


Fig. 5: Seasonal biodiversity and family richness of Order Odonata from Kafr El Zayat stream

In Table & Fig. 6 and lastly Order Trichoptera and Order Orthoptera each with one family of 3.3% & 0.4%, with the highest representation during Summer and Autumn season respectively. The collected species were identified taxonomically as following:

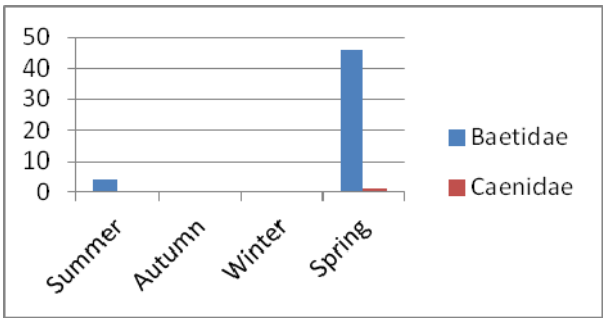


Fig. 6: Seasonal biodiversity and family richness of Order Ephemeroptera from Kafr El Zayat stream

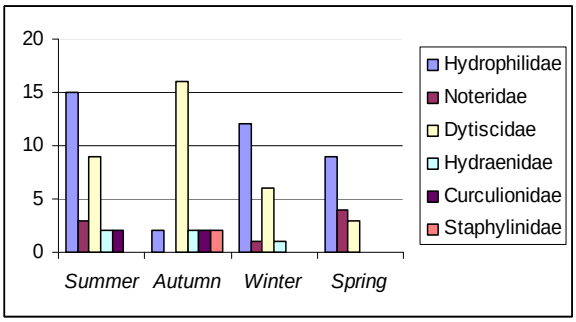


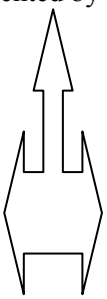
Fig. 7: Seasonal biodiversity and family richness of Order Coleoptera from Kafr El Zayat stream

Order: Ephemeroptera

Ephemeroptera naiads is true aquatic, occur in great abundance in standing and running water habitate, ranging from 1-4mm, with plate-like or leaf-like seven abdominal lateral gills on first seven abdominal segments, with three long tails rarely two, their body elongate with two visible wing pads, antennae long filiform, chewing in naiads; have three pairs of segmented legs with one claw at the end of each leg; they feed on plant and animal food (McCafferty, 2011). Adult female collected over the water surface nearly at depositing its eggs (in one or two clusters); with large compound eyes, antennae bristle-like and inconspicuous, mouthparts vestigial , wings membranous, fore wing large and triangular, hind wing small and rounded. Abdomen 11-segmented, terminating in a median caudal filament between many segmented cerci; in some cases, only the cerci are well developed, the terminal filament being represented by a short rudiment or entirely absent (Fig. 8); subimago instar, which possesses fully functional wings and immature reproductive organs may be also found flying above water. This order is represented by the following two families.

Baetidae

Gills on abdominal segment from 1 to7 are similar, gill on 2nd abdominal segment neither operculate nor semioperculate; antennae more than three times of width of head; fore tibia and tarsus without these spines. Fig. (9) *Cloeon dipterum* L.



Caenidae

Gills on abdominal segment 2 fringed with long setae on outer margin and overlapping on dorsal surface, covering the gills on segments3-6. Antennae less than three times of width of head; fore tibia and tarsus with row of stout spines. Fig . (10)
Caenis horaria L.

Order: Odonata

Odonata naiads were usually found in every type of aquatic ecosystem, stick to branches or roots of sub-merged bushes or erect grasses. Naiads are characterized by their peculiar horny structure or the mask which corresponds to the lower lip (labium) of the adult insects used for capturing prey, where they are predators on mosquito larvae and pupae, in turn fall a prey to frogs, fishes and birds. Respiration occurs by expansion and contraction of abdominal muscles that move water in and out of the rectal chamber across gills; this also permits larvae to achieve rapid speed in water (Hussain & Ahmed, 2003).

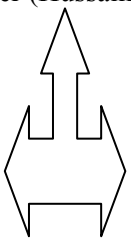
Suborder: Anisoptera, (Dragonflies)

Naiads short and stoutly, breath by rectal gills, end in wedge shaped extensions.

Family Libellulidae

Naiads body broad oval, musk spoon shaed, covering entire face beneath, mental and lateral setae present, with shallow crenations (Figs.11-13), legs moderate in length.

- Dorsal surface of abdomen with spots or patches, spines-shaped setae present in ventral surface of 8th abdominal segment with row of distinct spines (Figs.11&12).
  Crocothemis erythreae Brulle
- Dorsal surface of abdomen without spots or patches, ventral surface of 8th abdominal segment without spines Paraproct longer than epiproct and
- less than the length of the last three abdominal segments, abdomen with mid dorsal spines on segments 4-8 (Fig.13), lateral spines of 9th abdominal segment longer than cerci. *Sympetrum striolatum* (Charpentier)



Suborder: Zygoptera (Damselflies)

Naiads long and slender, breath by three leaf-like gills (anal or caudal gills) at the base of abdomen.

Family Coenagrionidae

Mentum soon or triangular in shape, mental and palpal setae resent, legs short or moderate in length, caudal gells lamellar, anal aendages three and pointed (Figs. 14-17).

- Antennae 6 segments, gills pigmented, gill margins spiny, secondry tracheae great in number, four labial setae present Figs. (14-17).
  Enallagma civile Calif
- Antennae 7 segments, gills not pigmented, caudal lamellate terminating in a sharp tapered point, six labial setae present on mentum Figs. (18&19)
  Ischnura senegalensis (Ramber)

Order: Orthoptera
Family tridactylidae

They are small pigmy crickets, with 5mm long, with normal fore legs, minute hind tarsi, large flat tibial spur, short posterior metatarsus, enlarged hind femora. Intermediate tibia not dilated, broad at basis and pointed at the apex, caudal metatarsus well developed; if elytra present, contain very rudimentary stridulatory vulves (Fig. 20). …… *Tridactylus savignyi* Guer

This family is revised by Cassab & Abdel-Wahab, 1973; 2 species were recorded under one genus, this species, *Tridactylus savignyi* Guer and *T.variegatus* Latr. They can be distinguished by the second tibia that are dilated, spindle-shaped and arched at inferior margin in the second species.

This species prefer sugar cane and grasses, collected from Nag Hamadi, Rodah, Kitchner Island, Luxor & Aswan. Family Tridactylidae is unfamiliar little insects burrowing in the loose saturated sand bordering water and are able to swim by swimming plates on the ends of hind tibiae (Usinger, 1956).

O: Hemiptera

This order includes true aquatic & semiaquatic bugs (Semiaquatic bugs live in moist habitates, either terrestrial or on the surface film of various types of fresh water, Ahmed & Gadalla, 1999).

Antennae shorter than head, inserted beneath eyes not visible from above

⇩

Belostomatida

Front legs usually enlarged, for seizing, apical appendages present; length 18 mm or long (Figs. 21&24).

⇩

Corixidae

The head is triangular and bears a pair of large compound eyes, ocelli absent. Head overlaps margin of pronotum; rostrum very short, broad, unsegmented; front tarsi scoop shaped (Figs. 29&30).

⇩

Notonecttidae

Slender elongate bugs, Body convex above; eyes large; beak four segments; hind tibiae and tarsi ciliate without distinct claws length 8-12mm. Female head rounded apically, male pointed (Figs.31&32); this back swimmers can attack animals larger than themselves by sucking the juices from its prey (Sawaby, 2001).

Anisops saradea Herrich Schaeffer

Antennae as long as head or longer, inserted in front of eyes, usually plainly visible from above, fore wing usually with thick veins.

⇩

Mesoveliidae

Body length about four times as long as body width, 1.8-2mm; eye large, scutellum well development; tarsi with 3 segments; venter of head without groove. They prefer watere with rich vegetation; this family is represented in Egypt by only this species (Gadalla & Ahmed, 2000) (Figs.25 &26).

Mesovelia vittigera Horvath

⇩

Veliidae

Wingless elongate oval bugs, black to grey in color. Hind femur short, not surpassing abdominal end; metasternum with a pair of closely spaced scent gland opening; face usually with a median, longitudinal sulcus or shiny glabrous line, strong mouthpart; with preapical claws and thus are able to move about without breaking the surface film, so inhabit more protected roofs near the shore (Usinger, 1956). (Figs. 27 & 28)

Microvelia popovi Brown

Family Belostomatidae

1- Large bugs, body convex or oval, 30 mm or more in length, Body convex; pronotum with lateral dark spots, fore tarsi with one claw (*Limngeton* Mayr), 2nd and 3rd antennal segment prolonged, compound eyes prominent and shiny; the beak three segmented, basal one widest and covered with pubescence. Length 50 mm (Figs.21&22)……..……..……..…*Limngeton fieberi* Mayr

2- Small bugs, body flattened, less than 26mm. in length (Sphaerodema Lapouge), Antennae with branched appearance; basal segment of beak very short and sharply pointed. All tarsi three segmented, ending in a pair of claws. Length 15-17 mm (Figs.23&24)…….……..….*Sphaerodema urinator* (Dufour)

Family Corixidae

Antennae three segmented, scutellum visible, pronotum & hemelytra with simple color, without mosaic pattern…….…..Micronecta Kirkaldy

1- Body length 3.2mm, hemielytra more densely punctured; free lobe of left side of 8th abdominal tergite broad, concave at apical margin, shaft of male left paramere nearly straight (Fig.29)……..……...…… *Micronecta plicata* (Costa)

2- Body length 2-2.5mm, hemielytra sparingly punctured; free lobe of left part of 8th abdominal tergite narrow, not concave at apical margin, shaft of male left paramere curved (Fig.30)……..…… *Micronecta isis* Horvath

Order: Trichoptera

Family Hydroptlidae

Adult body is slender, elongate, Moth-like, hairy head, with long thread-like antennae (covered with light and dark hairs) chewing mouthparts and ocelli absent. Legs relatively long and slender, wings membranous, with dense hairs, held roof-like over abdomen at rest, hind wing little shorter than forewing, sometimes with scales, can found above the water surface. Larvae caterpillar-like, often in case, posterior end of abdomen bearing 2 claws or long prologs, abdominal segments with filamentous gills. Antennae very thick, with light and dark hairs, ocelli absent, head hairy, (Figs.33&34). The following species is known from the Oases of Egypt (Mosely, 2010). *Hydroptila aegyptia* Ulmer, 1963.

Order: Diptera

Aquatic immature stages varies in shape, larvae maggot like, without thoracic legs, body selender, with 11 or 12 segments, tubercles may be present on one or more body segments, but most often are on the terminal segment surrounding the caudal spiracles as gills, breathing siphon or various projections.

Suborder Nematocera
Larval head distinct
Pupa active and free
Family: Chionomidae
Family: Culicidae

Suborder Brachycera
Larval head sunken into thorax
Pupa nonactive and free
Tabanidae
Stratiomyidae

Suborder Cyclorrhapha
Larval head notdistinct
Pupa in coccon
Ehydridae

Suborder: Nematocera

Family Chironomidae: Non-biting midges, mosquito-like but lacking proboscis, Larvae are up to 1.5 cm in length, red in colour (due to myoglobin, oxygen storing molecules which facilitate respiration in aquatic environment). Body usually thin, slightly curved and segmented. They have one pair of tiny fleshy prolegs below the head and one pair at the back end, eleventh body segment with two pairs of blood gills. Thoracic segments distinct, the end sometimes has tiny tufts or extensions.

Key to species

1- Adult male with patches on legs, wing bare (Fig.35), anal point with small lateral notches, larvae with light color and light equal teeth (Fig.36)……..…….…… *Polypedilum aegypyium* Kieffer

-Adult male with unicolors legs, wing with nearly 5 dark patches (Fig.37), anal point without notch. Larvae with dark color & tooth, mentum without equal teeth, 1st & 2nd lateral teeth are longer (Fig.38)……..……*Chironomus calipterus* Kieffer

According to Cranston & judd (1989): *Polypedilum* (*Tripodura*) *aegypyium* Kieffer and *Chironomus calipterus* Kieffer are widely distributed in Palearctic region (North Africa) and Afrotropical region, extended to Arabian Peninsula, wing is diagnostic character for adult that collected above the water surfaces. Ahmed *et al*. (2008) collected *Chironomus calipterus* Kieffer from El-Tall El Keber wastewater, gave pictorial key for collected chironomid species.

Family Culicidae: Slender flies with elongated proboscis, antennae pilose in female, plumose in male, wings fringed with scales larvae and pupae are aquatic (Figs.39 &40). Siphon distinct in larvae, thoracic segments fused and dilated, forming a complex single segment that is wider than any of abdominal segments, terminal segment with an anal setal fan; pupa with conspicuous thoracic respiratory tube opened at tip.

Suborder: Brachycera

Family Stratiomyidae

Body flattened with slit-like breathing openings surrounded by hairs. Antennae situated anterolaterally on head capsule and directed anterioly or somewhat ventrally, prologs wanting, mandibles replaced by vertically moving mouth hooks Terminal respiratory tube much longer than broad, antennae short (Fig. 41)……..……..*Stratiomys discalls* Loew.

This species was collected also from Ismailia region by Zalat *et al*. (1992) with other aquatic insects.

Family Tabanidae

Aquatic larvae are elongated cylindrical, with tapering both ends, reach 41mm long, 6.5mm wide. Apart from head and siphon, the body is composed of eleven segments. The integument is transparent and minutely striated. Larvae are predaceous. (Fig. 42)……..……..*Tabanus taeniola* P.de B.

The larvae of this species was collected and described externally and internally by El-Ziady & Hefnawy, (1976).

Suborder: Cyclorrhapha

Family Ephydridae (shore flies)

Head not distinct, reduced in size and structure, often retractile into thorax, cephalic structure a "cephalopharyngeal" skeleton, mandibles usually with hooked apical tooth and lacking inner teeth, maxillary palps and antenna small or absent, abdomen 8-segmented, anterior spiracles absent, posterior spiracles separated, may or

may not be spine-like, larvae with eight pairs of prologs, each with strong claw (Fig. 43), pupae without respiratory organ...…….....……...*Ephydra macellaria* Egger

The larvae and pupae of this species were collected by El-Sherif *et al.,* (1976), they were slow swimmer, pupae were mostly attached to the basal parts of the plant under water surface

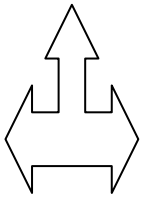
Order: Coleoptera

The largest order with minute to large insects; winged or wingless; fore wings of elytra type; hind wings membranous, folded beneath elytra or often reduced; mouthparts chewing; aquatic forms with modified characters as tapering ends, legs swimming or walking with stiff bristles or fringes; larvae with different forms and difficult to recognized.

Aquatic beetles are most numerous in shallow standing or slowly flowing waters (Ahmed, 2004). They divided into two suborders:

Suborder: Adehaga

1st abdominal sternum completely divided by hind coxa, the antennae usually long filiform.



Suborder: Polyhaga

1st abdominal sternum not completely divided by hind coxa, the antennae usually clubed.

Suborder Adephaga

Family Noteridae: Body black oval convex, 2-3mm in length, head with a small and linear puncturated impression from each side against eyes, elytra with yellow marking, scutellum usually covered by pronotum and elytra, hind coxa with extensive hairs (Figs. 44&45) ……...…..……*Canthydrus notula* Erichson

Family Dytiscidae: (Diving Beetle): Body elongate oval, 2-44mm in length; head transverse and inserted into pronotum to level of eyes, without ocelli; pronotum large normally widest at base, and as broad as base of elytra; scutellum exposed and visible, hind leg flattened, fringed with hairs. Larvae (Fig, 46) elongate, head with a Y-shaped suture, antennae slender, labial palpi distinct and segmented, have six jointed legs, with 2 simple claws. The body segmented with a narrow collar behind the head. Pronotum longer than meso-or metanotum,; abdomen with 8 segments, apex of segment 8 frequently elongated into a siphon, may have filaments but not hooks.

1 -Pronotum with two longitudinal furrows at two third from mid-line to lateral margin, ligula present, 3-4mm, abdomen with medium &two lateral brown longitudinal spots each side (Fig. 47)……...…..……Bidessus angularis (Klug)

-Pronotum without these furrows, ligula absent, broad very small, 2-2.5 mm, prosternal process broadly rounded at tip, brown shining, slightly convex, antennae simple, slender (Fig. 48)…….……..… *Hydrovatus sordidus* Sharp

Suborder Polyphaga

Family Hydraenidae (Minute Moss Beetles): Tiny beetles, 2-5 mm, antennae with 5 pubescent segments, maxillary palpi are usually longer than antennae, which are inconspicuous and often concealed beneath the head, pronotum with middle square groove, broader than the head, elytra with lomgitudinal rows of large punctures; abdomen with 6 or 7 abdominal segments, usually triangular sternite lies between the hind coxae. (Figs. 49&50) …….……..……..…*Octhebius marinus* (Paykull)

Family Hydrophilidae (Figs.51-56): Body in general oblong-oval to broadly oval, 1-40 mm long, strongly convex dorsally and flattened or concave ventrally, antennae short, 6-10- segmented with a densely setose, 3– segmented club, maxillary palp

longer than antennae and slender, resembling antennae, transverse suture of head and the posterior median one form Y shape, pronotum almost always widest at base, or very near base, elytra broader at base than pronotum, widest near the middle head and pronotum not granulate, usually simple punctuate, hind legs swimming, tarsi 5-5-5 or 5-4-4. strongly convex dorsally and flattened or concave ventrally

1-Elongated black species, more than 10mm (Fig. 56), underside with mid-line keel, prosternum carinate……..…….……*Sternolophus solieri* Lapouge

-Lesser species, less than 10mm, underside without that keel…….……..……2

2-Pronotum with shallow depression, with two sharply defined ridges, lateral margins strongly dentate (Figs. 51-53)……...…….*Sperchus cerisyi* Guerin

-Pronotum without these characters, smaller species 3-7mm, maxillary palp slender, much longer than antenna next ……...……...……3

3- Head brwnish, pronotum, elytra yellowish, last abdominal segment with small semicircular bay at tip (Fig. 54)……..……..*Enochrus parvulus* Reiche & Saulcy

-Head, pronotum and elytra dark brown, palps all yellow, last abdominal segment without this end (Fig. 55)..……...…..……..…*Enochrus bicolor* Fab.

Family Curculionidae) (Figs. 57-59): Adult with a distinct prolonged snout; mouthparts chewing, located at tip of snout; antennae clubbed and elbowed, arising from side of snout, palpi vestigial; Elytra truncate, parallel-sided, body usually covered with small scales, larvae legless. *Baris granulipennis* (Tournier).

This genus contains water weevils that are widely distributed. The semiaquatic adults feed on leaves of rice and other aquatic grasses; this family was collected by Osman (2004) from Red sea island Protectorates.

Family Staphylinidae (Rove Beetles) (Fig. 60): Elongated, slender insects, antennae usually 10- 11-segmented, thread-like, sometimes clubbed, and first segment usually elongate. Elytra usually short and truncate, leaving 3to 6 abdominal segments exposed; tarsi 3-segmented, anterior and middle tibiae spinose, elytra separated from pronotum by short pedicel or neck. The larvae are variable in form, but mainly long and slender; they live in habitats similar to those of adults……...…..*Bledius niloticus* Erichson

This family are so diverse, can be found anywhere; species of genus *Bledius* Samouelle, generally occur in colonies and occur especially in coastal areas and along river banks; some species of this genus are very difficult to determine; some species are found under seaweed on rocks or beneath stones on the shore below the level of high water (Tottenham, 1954). Rove beetles like some other aquatic insects are known to emit pygidial gland secretions that reduce surface tension making it possible for them to move on the water surface (Marquez and Asian, 2010).

Aquatic insects are parts of water ecosystem, so there is a correlation between the richness and abundance of them and the environmental quality; most abundant chironomid are very tolerant to heavy metal pollution, then culicid larvae (*Culex*), Trichoptera and Ephemeroptera; baetid mayflies adapted to live in running water, resistant to organic pollution (nitrate and ammonia) and low levels of oxygen. Aquatic bugs especially Blestomatidae and Odonata naiads easily collected in adequate quantities that allow their utilization as bioindicators. Most aquatic beetles were collected from all habitats, so may authors demonstrated the importance of aquatic beetles as bioindicators to chemical impacts through their direct toxic action and indirect effects such as PH and osmotic pressure (Hu *et al*., 2007; Paparisto *et al.*, 2008 & 2010; Trigal *et al.,* 2009; Arimoro and Ikomi, 2009; Angradi and Jicha, 2010; LiLi *et al*., 2010; Miserendino *et al*., 2011)

These results will be use later with the chemical analyses of water to ensure the best bioindicators to pollution level as they will be less expensive.

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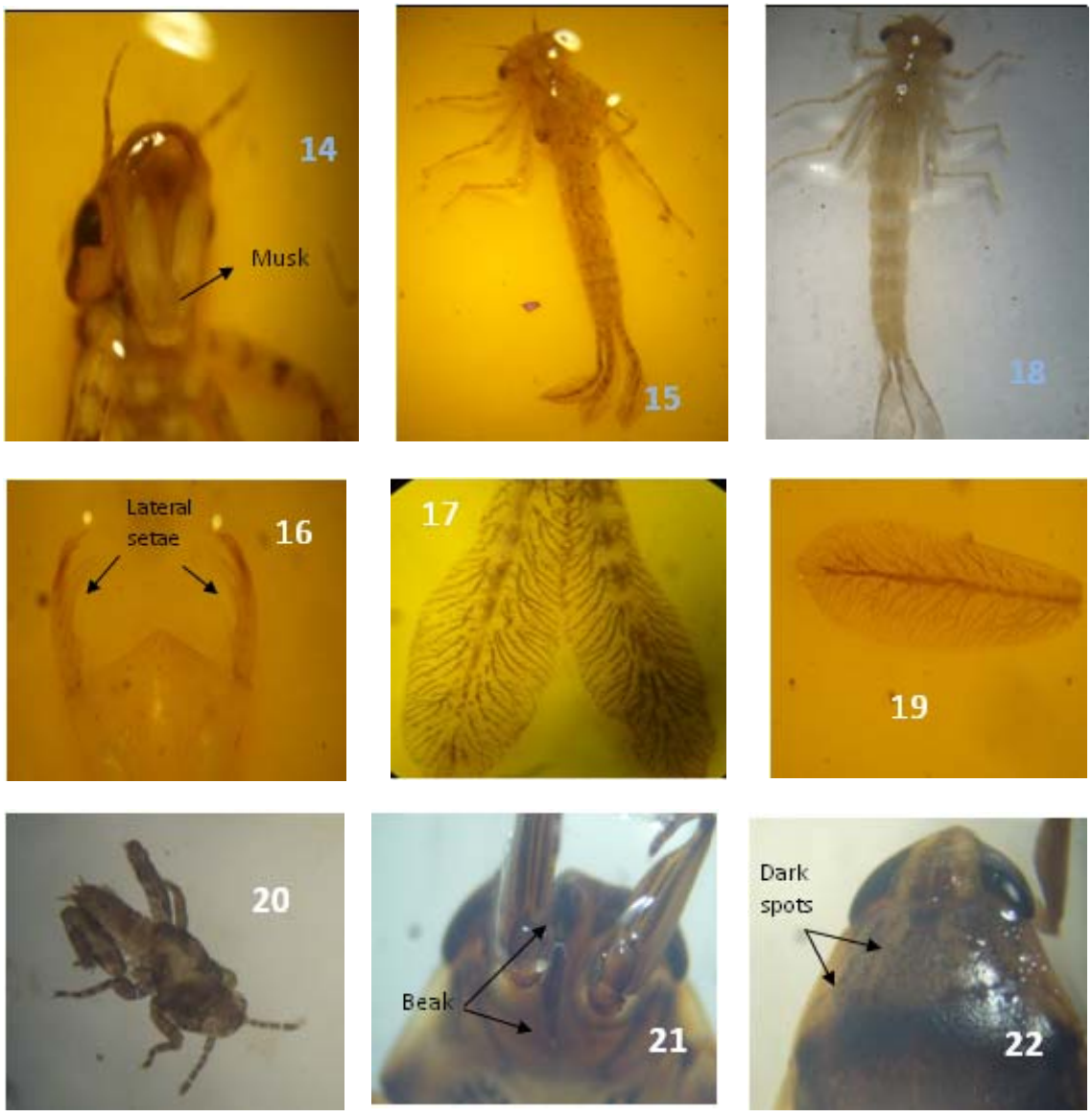
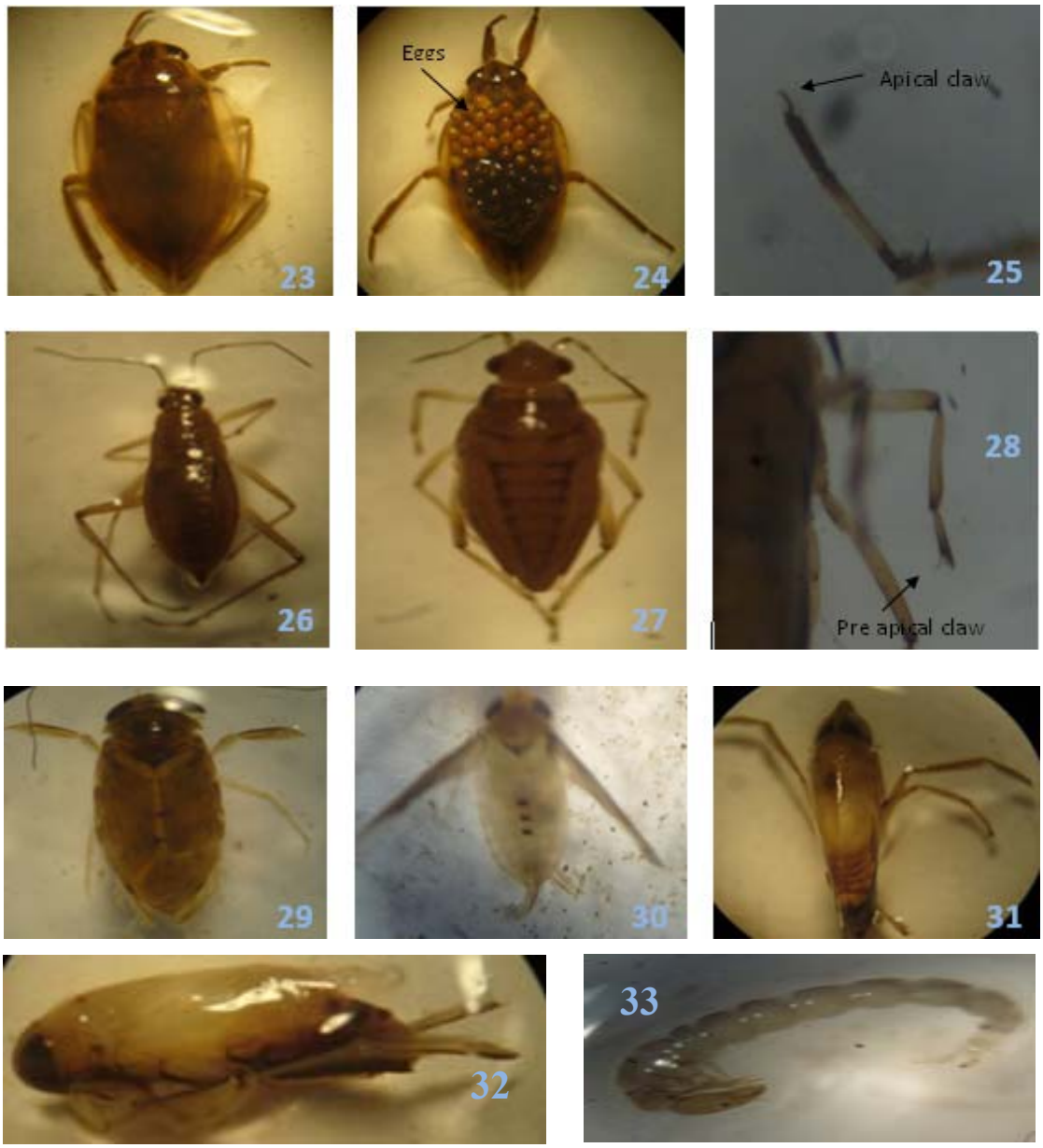
Figs. (8-10): Ephemeroptera (8): Adult, (9): Baetidae, *Cloeon dipterum* L., Naiad, (10): Caenidae *Caenis horaria* L., Naiad; Figs. (11&13): Odonata, Anisoptera, Libellulidae, Figs. (11&12): *Crocothemis erythreae* Brulle, (11): Naiad, (12): Musk, Fig. (13): *Sympetrum striolatum* Charpentier naiad.



Figs. (14-19): Zygoptera naiad, (14-17): *Enallagma civile* Calif, (14): Head ventrally, (15): Naiad, (16): Labium, (17): Lamella; Figs. (18&19): *Ischnura senegalensis* (Rambur), (18): Naiad, (19): Lamela; Fig.(20): Orthopera, Tridactylidae, *Tridactylus savignyi* Guer; Figs. (21-24): Hemiptera, Blestomatidae, (21&22): *Limngeton fiebri Mayi* head ventraly and dorsaly.



Figs. (23&24): *Sphaerodema urinator* (Dufour), (23): Female, (24): Male; Figs. (25&26): Mesoveliidae *Mesovelia vittigera*; Figs. (27&28) Vellidae *Microvelia popovi;* Figs. (29&30): Corixidae, (29): *Micronecta plicata* (Costa), (30): *Micronecta isis* Horvath; Figs. (31&32): Notonectidae, *Anisops sardea* Herrich Schaeffer, (31): Male, (32): Female; Fig. (33): Trichoptera, Hydroptilidae, *Hydroptila aegyptia* Ulmer larva.

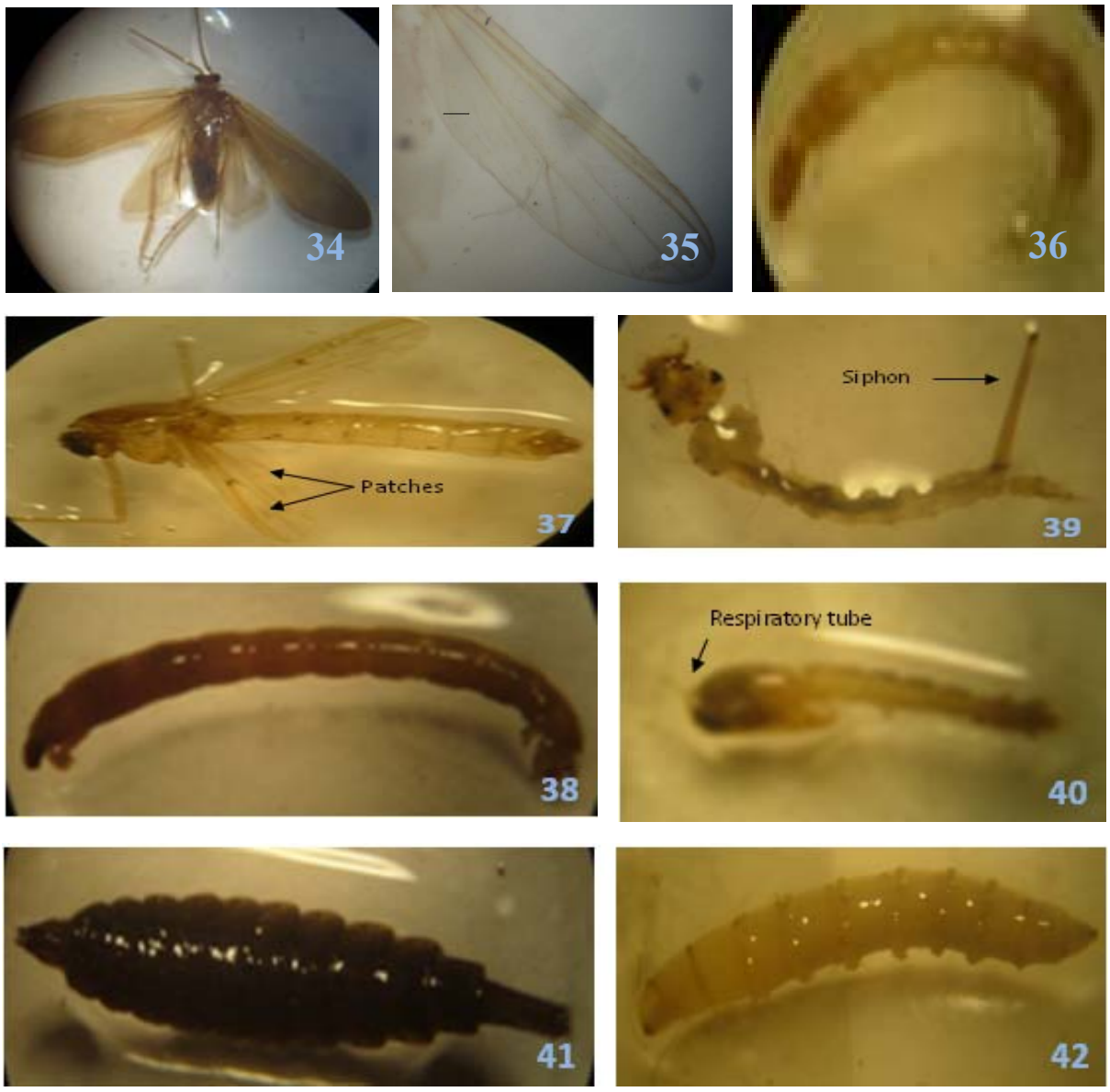


Fig. (34): Trichoptera, Hydroptilidae, *Hydroptila aegyptia* Ulmer, adult; Figs. (35-38): Chironomidae, (35&36): *Polypedilum aegypyium* Kieffer, (35): Adult, (36): Larva, (37&38): *Chironomus calipterus* Kieffer, (37): Adult, (38): Larvae; Figs. (39-40): Culicidae *Culex pipiens* L., (39): Larva, (40): Pupa; Fig. (41): Stratiomyidae *Stratiomys discalis Low*; Fig. (42): Tabanidae, *Tabanus taeniola P.deB.*

Fig. (43): Ephydridae, *Ephydra macellaria* Egger, Fig. (44&45): Noteridae *Canthydrus notula* Erichson; Figs. (46-48): Dytiscidae, (46): Dytiscid larvae, (47): *Bidessus angularis* (Klug), (48): *Hydrovatus sordidus* Sharp; Figs. (49 & 50): Hydraenidae, *Octhebius marinus* Paykull..

Fig. (51-56): Hydrophilidae, (51-53): *Spercheus cerisyi* Guerin, (54)*: Enochrus parvulus Reiche & Saulcy*, (55): *Enochrus bicolor bicolor* Fab; (56): *Sternotophus Solieri* Lapouge ; (57-59): Curculionidae *Baris spitzyi nesapia* Faust, (57): Dorsally, (58): Laterally, (59): Antenna; (60): Staphilinidae : *Bledius niloticus* Erichson.

ARABIC SUMMERY

التنوع الحيوى، والتغيرات الموسمية للحشرات المائية و البرمائية فى فرع رشيد بكفر الزيات (محافظة الغربية)

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يعتبر نهر النيل فرع رشيد بكفر الزيات (محافظة الغربية) هو المصدر المائي الأساسى للشرب والرى لمختلف المحاصيل الرئيسية ولذلك تم اختيار خمسة مواقع بطول النهر فى هذه المنطقة مارا بمصنع الأسمدة بكفر الزيات للجمع الموسمى للحشرات خلال عامى 2010 و2011 .

تم تجميع 539 عينة ، تنتمى الى 7 رتب و 22 فصيلة و 31 نوع وكانت أكثر العينات تواجدا فى فصل الربيع(41.9%) ثم فصل الصيف (25.1%)، وأوضحت النتائج الآتى:

كانت الحشرات التابعة لرتبة ذات الجناحين هى الأكثر شيوعا وكانت ممثلة بخمس عائلات هى Order Diptera (Chironomidae, Culicidae, Ephydridae, Tabanidae &Stratiomyiidae).

ثم رتبة نصفية الأجنحة وممثلة ايضا بخمس عائلات وهى Hemiptera (Blestomatidae, Croxidae, Mesovillidae, Villidae & Notonectidae).

ثم رتبة غمدية الأجنحة وكان تمثيلها بست عائلات مع أعلى تواجد لها فى فصل الصيف وكانت كالآتى Coleoptera (Hydrophylidae, Dytiscidae, Noteridae, Hydaenidae, Curculionidae & Staphylinidae).

تم رتبة الرعاشات ومثلت بعائلتين وهما Odonata (Libellulidae & Coenagrionidae).

ورتبة ذبابة مايو التى مثلت بعائلتين وهما Ephemeroptera (Baetidae & Caenidae).

واخيرا كانت رتبتى Trichoptera & Orthoptera

ومثلت كلا منهما بعائلة واحدة وكان أكثر تواجد لهما فى فصلي الصيف والشتاء على التوالى وأظهرت النتائج تجميع العينات التابعة للعائلتين Tridactylidae and Staphylinidae

لأول مرة من المصارف المائية فى مصر

تم تقديم جداول ورسومات لتوضيح النتائج مع مفاتيح تعريفية وأوصاف مختصرة للأنواع مع نبذة عن حياتها، بالاضافة الى صور ملونة بالصفات التصنيفية الهامة للمساهمة فى تعريف الحشرات المائية وخاصة الأطوار الغير كاملة و التى تتميز بصعوبة تعريفها على مستوى العائلات لغير المتخصصين، وأشد صعوبة لمستوى الأجناس والأنواع.

سيتم لاحقا تطبيق هذه النتائج كدلائل لمعرفة جودة المياه ومقارنتها بالتحليل الكيميائى للماء للتأكيد على استخدام الحشرات المائية فى الكشف عن نسبة التلوث.