



Several members of the order **Heteroptera** ('bugs') live either on or below the water surface. In contrast with terrestrial heteropterans, among which a considerable proportion of the species is herbivorous, water bugs are the predators of the water world (but for the water boatmen). The postembryonic development (i.e. that of the larvae after their hatching from the eggs) of the bugs is hemimetabolism. This means that larvae are the dead ringers of the imagos concerning both their appearance and their feeding habits. Nevertheless, some organs of the imagos, like the wings or the breathing tube (e.g. water scorpion), are absent or vestigial on the nymphs of some species. Heteropteran larvae reach maturity via five instars. A common feature of all heteropterans is the piercing–sucking mouthparts (rostrum or proboscis) adapted for sucking liquid foods. Antennae of water bugs living under the surface are rather short, hardly conspicuous. Eyesight of bugs is admirably good due to their large compound eyes. Their back is marked with peculiar ornamentation caused by the chitinised structures and appendages of the thorax. The shield-like pronotum partially covers also the mesothorax, the posterior end of which forms a triangular scutellum extending between the wings. The first wings originating from the mesothorax are modified into hemelytra. Hemelytron is a partially sclerotised wing with a hardened base and a membranous posterior region. Overlapping forewings held above each other result in the characteristic pattern of the wings. The entirely membranous second wings are used for flying; they are kept folded under the partially hardened first ones at rest (Andersen 1982; Aukema and Rieger 1995; Damborenea et al. 2019; Barnes 1980; Fitter and Manuel 1986; Illies 1978; Jansson 1986; Kriska and Tittizer 2009; McGavin 2001; McMafferty 1998; Savage 1989; Thorp and Rogers 2015; Nilsson 1996; Quigley 1977; Schwab 1999).

Velvet water bugs (Hebridae) are small, brownish insects up to 2 mm. The antennae of these either winged or wingless bugs consist of five segments. The semi-aquatic animals are found most frequently in peat mosses or other bryophytes living on the shores or in peat bogs. Terrestrial species live mostly on moist soil surfaces, whilst aquatic ones live on the water surface among floating water plants. The overwintering form is the imago.



Fig. 16.1 (a, b) Fighting water scorpions (*Nepa cinerea*, Nepidae) with parasitic water mite larvae

Water treaders (Mesoveliidae) are dark-striped, greenish water bugs up to 3.5 mm (Fig. 16.22c). The mostly wingless species bear four-segmented antennae. Legs are attached to the thorax near its ventral midline. The coxae of the hind legs are longer than the third thoracic segment. They are mainly observed on floating aquatic plants of still waters, in moist mosses or on decaying leaves. They overwinter with their eggs laid into the tissues of water plants.

The lifestyle of **water crickets (Veliidae)** is similar to that of the pond skaters (Figs. 16.2 and 16.21).



Fig. 16.2 (a, b) Water cricket (Veliidae) adult (8 mm) and larva (6 mm)

These insects of 5.8–9.4 mm inhabit the water surface of still pools of streaming waters, where they prey on small arthropods, often mosquitos of any stages of development (nymph, tumbler, imago).



Fig. 16.3 (a) Pond skaters (Gerridae) on the water surface. (b) Drinking pond skater

Unlike in case of pond skaters, the spacing between their legs is almost equal. The genus *Microvelia* (Fig. 16.21c) is delineated within the family. To this genus minute, wingless insects belong, up to 2.5 mm length. They also inhabit the water surface, where they capture aquatic springtails or aphids trapped in the surface. They may suck the body juices of larger dead insects, as well. Water crickets lay their eggs principally onto the natant leaves of water plants, and overwinter as imagos.

Pond skaters or wherrymen (Gerridae) (Figs. 16.3, 16.4, 16.22c and 16.23a, b) are also the predators of the surface. These animals ‘skate’ on the water surface with the strokes of their middle and hind legs.



Fig. 16.4 Pond skater (Gerridae) is capturing an emerging non-biting midge (Chironomidae) (a) and a crane fly (Tipulidae) (b)

They grab the insects fallen into the water with their front legs; then they suck out the body fluids of the prey. The body of wherrymen is protected against soaking and sinking under the surface by a fine fur of water-repellent hairs. The spacing between the front and the middle legs is unusually great. Their elongated jointed legs terminate in clawless projections; thus, their legs do not break through the surface water membrane despite the powerful strokes.



Fig. 16.5 (a, b) Water measurer (*Hydrometra stagnorum*) feeding on a Hymenoptera

Water measurers (Hydrometridae) (Figs. 16.5 and 16.22a, b) are slender insects up to 12 mm in length. The head of the mostly wingless bug is remarkably elongated comprising one quarter of the total body length. The head bears long antennae, bulging compound eyes and a quite long rostrum that is retracted under the head at rest. Owing to the furrowed chirping area located at the tip of the groove surrounding the sucking–piercing mouthparts, water measurers are capable of producing sound by rubbing their mouthparts. The brownish black bugs prowl about in groups of some individuals on the shore of still and slow-flowing waters, but often also on the open water surface.



Fig. 16.6 (a) Water scorpion (*Nepa cinerea*, Nepidae)—23 mm. (b) Water scorpion feeding on great silver water beetle (*Hydrophilus piceus*) larva

They pace cautiously with their thread-like legs in a motion as if they were continuously measuring the water surface; this is revealed by their common name. They principally feed on insects having fallen into the water or mosquitoes hatching from the tumbler. However, animals living in the water are also in danger of getting pierced onto their sharp probosces. Water fleas emerging to the surface are speared on the rostrum, and then the bug lifts the prey above the water and sucks the body sap out. Water measurers attach their eggs one by one onto waterside plants via small suckers. They overwinter as imagos.

Shore bugs (Saldidae) are oval animals, up to 1–2 mm, scampering about in the waterside vegetation, yet also venturing out onto the open water surface. Their diet resembles that of the genus *Microvelia*.

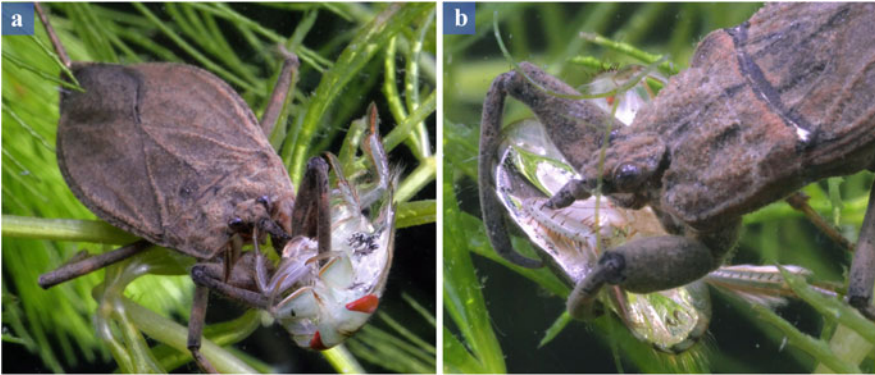


Fig. 16.7 (a, b) Water scorpion (*Nepa cinerea*, Nepidae) feeding on a saucer bug (*Ilyocoris cimicoides*, Naucoridae)

Their triangular heads bear large compound eyes providing rather good eyesight. If threatened, they try to escape on wings.

Water scorpion (*Nepa cinerea*) (Figs. 16.1, 16.6, 16.7, 16.8 and 16.24a, b) and **water stick insect** (*Ranatra linearis*) (Figs. 16.9, 16.10 and 16.23c) belong to the family **Nepidae** (**water scorpions**). Water scorpion is a water bug of leaf-shaped, flattened body, up to 23 mm. Its head bears two remarkably bulging compound eyes and a well-developed rostrum. Close to the head are the forelegs modified into raptorial legs. The foldable jackknife-like legs are moved horizontally.



Fig. 16.8 Water scorpion (*Nepa cinerea*) larva feeding on a fish



Fig. 16.9 Water stick insect (*Ranatra linearis*, Nepidae) capturing a lesser water boatman (Corixidae) (a) and a water slater (*Asellus aquaticus*) (b, c)

Second and third pairs of thoracic legs are for locomotion. With these bare legs lacking swimming hairs, the water scorpion can crawl by clinging to water plants, and it can also swim by strong strokes.



Fig. 16.10 (a, b) Water stick insect (*Ranatra linearis*, Nepidae) captured a platycnemid damselfly (Platycnemidae) larva and a side swimmers (*Gammarus* sp.)

The posterior end of the body terminates in a breathing tube consisting of two tubes of 10–12 mm attached to each other by chitinous hairs. When at rest, the water scorpion hides upside down among the dense vegetation or on the bank, and breathes from atmospheric air through its breathing tube. It pursues the prey tracking stealthily. It approaches the fry or insect larvae with considerably slow, almost inconspicuous movements. When the prey is within some millimetres, the water scorpion suddenly embraces the victim with its raptorial front legs. By pressing its proboscis to the body of the prey, it pierces the body wall with the sharp mouthparts.



Fig. 16.11 (a, b) Lesser water boatman (Corixidae)—10 mm

Although water scorpion rarely flies, it is widespread in slow-streaming brooks and lakes. Eggs are laid in rows of some centimetres into decaying plant materials, from where only the breathing appendages of the eggs protrude. The stick-like, cylindrical body of the light brown water stick insect is elongated, up to 35 mm.



Fig. 16.12 (a) Lesser water boatman (*Sigara* sp., Corixidae)—10 mm. (b) Lesser water boatman feeding on a water flea (*Daphnia magna*)

Body length is further increased by a breathing tube of 15 mm. This water bug of still waters hunts in a similar way as the water scorpion does, but its raptorial legs are moved vertically like those of the praying mantis (and not horizontally). Beside young fish and insect larvae, it successfully captures lesser water boatmen, what is quite notable, since water boatmen are amongst the fastest swimming aquatic insects.

The largest family of water bugs is that of the **lesser water boatmen (Corixidae)** (Figs. 16.11 and 16.12).



Fig. 16.13 Saucer bug (*Ilyocoris cimicoides*, Naucoridae) adult (a) and larva (b)—16 and 11 mm

In contrast with other water bugs, they have characteristically blunt rostra and short forelegs terminating in flattened, single-segmented tarsi. Corixids use these front legs for making shrill notes by drawing it across the furrowed chirping area of the head. The oval, slightly flattened boat-shaped body is propelled by the oar-like hind legs fringed with swimming hairs.



Fig. 16.14 Saucer bug (*Ilyocoris cimicoides*, Naucoridae) captured a broad-winged damselfly larva

They comprise a family of the fastest swimming aquatic insects. They are the only ones being capable of breaking through the water surface to take flight. Most lesser water boatmen feed on algae and plant debris, but one genus (*Cymatia*) is carnivorous. The first tarsi of the *Cymatia* species are reduced into cylindrical structures.

Scutellum of the species of the subfamily Corixinae is not discernible from a similar view. The dorsal shield of prothorax is marked with light brown zigzag lines. Their body length is between 3 and 15 mm.

The family **Micronectidae** contains animals smaller than 3 mm. Their triangular scutellum is clearly visible on their back from above (Nieser 2002).

Saucer bugs (Naucoridae) are streamlined animals with depressed bodies. They swim swiftly by the strokes of their middle and hind legs covered with dense swimming hairs. After a fierce pursuit, they capture their prey (aquatic insects and fry) with their raptorial forelegs terminating in sharp claws. With the sharp proboscis, stream dwelling bugs are also capable of piercing the human skin causing a burning pain.

These insects of still waters and brooks mostly occur among aquatic plants. They emerge quite rarely to the water surface to breath, since the silvery sheet of air on their ventral side can absorb enough dissolved oxygen from the surrounding water. A frequent species of different habitats is *Ilyocoris cimicoides* (Figs. 16.13, 16.14 and 16.25a)

Stream dwelling bugs (*Aphelocheirus aestivalis*) (Figs. 16.15 and 16.25b) of a strange lifestyle belongs to the family Aphelocheiridae. It inhabits well-oxygenated, clear upland and lowland rivers and brooks.



Fig. 16.15 (a–c) Stream dwelling bug (*Aphelocheirus aestivalis*, Aphelocheiridae)—12 mm

Though stream dwelling bug usually avoids the water surface, in brooks it is found even at a depth of some centimetres. The bug chiefly hides under stones or gravels on the bottom, in regions free from strong currents, where it can cling with its claws. This animal has an almost completely round and flattened body of 12 mm and no raptorial legs. Its rostrum is quite elongated, reaching the middle coxae on the ventral surface. It swims well with the synchronised strokes of the hind legs fringed with swimming hairs. Stream dwelling bug is dark brown on the dorsal and yellowish on the ventral side. Although it is mostly wingless, winged specimens are also regularly observed at the southernmost region of its distribution area. It takes up oxygen via diffusion with the aid of the air sheet covering its ventral side, which is used as a physical gill. The insect never has to renew the gas of the gill at the water's surface.

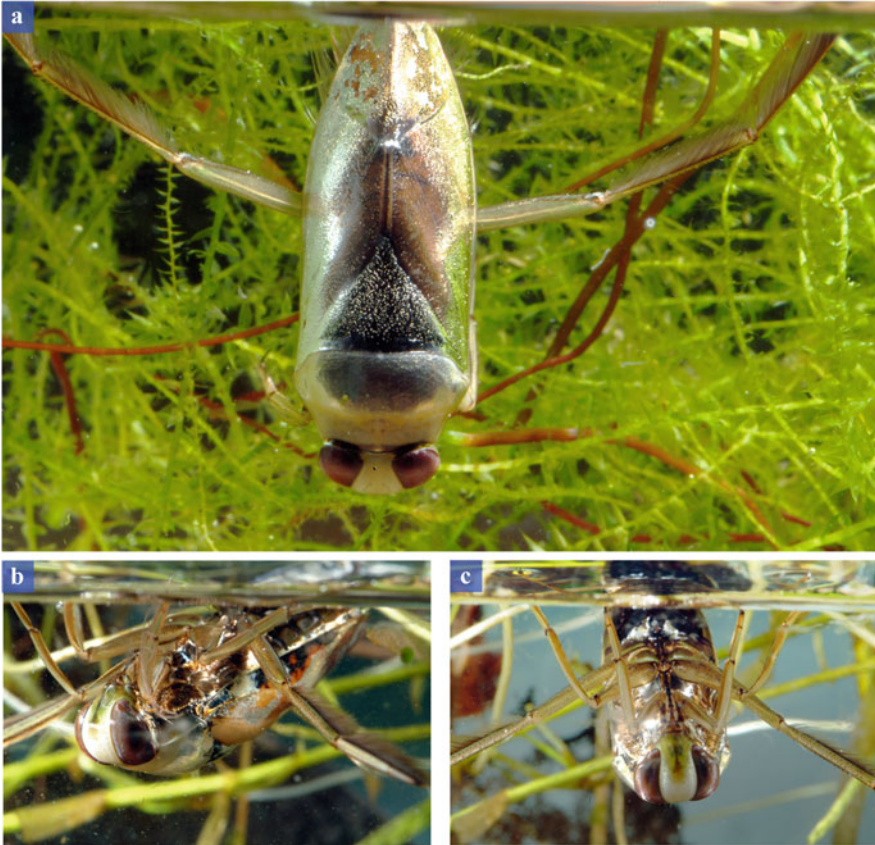


Fig. 16.16 (a, b, c) Backswimmer (Notonectidae) on the water surface—16 mm

Similarly to that of the saucer bug, the bite of the stream dwelling bug causes burning pain. This carnivorous animal preys on all smaller aquatic creatures.

Backswimmers or **greater water boatmen (Notonectidae)** (Figs. 16.16, 16.17, 16.18, 16.19 and 16.26) are the disreputable predators of freshwaters. The appearance of these insects is typical of a predator capturing its prey in a long chasing. Their boat-shaped bodies are perfectly streamlined without any protruding surfaces. Greater water boatmen swim swiftly by the strong strokes of their hind legs covered by swimming hairs. According to their common name, they swim upside down, i.e. the orientation of the body is the reverse of that of the lesser water boatmen. While the back of the lesser water boatman is flat and its ventral side is convex, the body structure of the greater water boatman is just the opposite. Body orientation influences also the dorsoventral colouration of the animal. The ventral side of most aquatic animals is lighter than the dorsal one, so that the predators attacking from the depth could not recognise them easily in front of the light background of the sky.



Fig. 16.17 (a–c) Backswimmer (Notonectidae) larva—14 mm

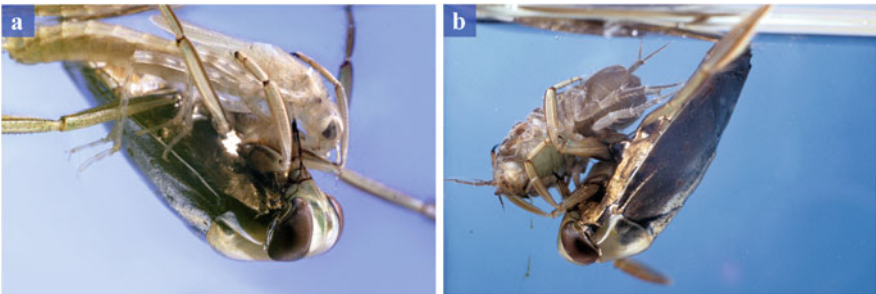


Fig. 16.18 Backswimmer (Notonectidae) feeding on a broad-winged damselfly (Coenagrionidae) larva (a) and a water slater (*Asellus aquaticus*) (b)

This phenomenon that is observed also on fish is just the other way round in case of the backswimmers: their back is lighter than their ventral side.



Fig. 16.19 Backswimmer (Notonectidae) feeding on a water slater (*Asellus aquaticus*) (a) and a side swimmer (Gammaridae) (b)

At rest, backswimmers attach to the water surface from below with their outspread hind legs, and they breathe through their respiratory openings of the body end. These openings are surrounded by a fine chitinous mesh to keep the water out of the tracheal system. Mature backswimmers propelling under the water surface chase after all moving creatures, often even their own kinds.



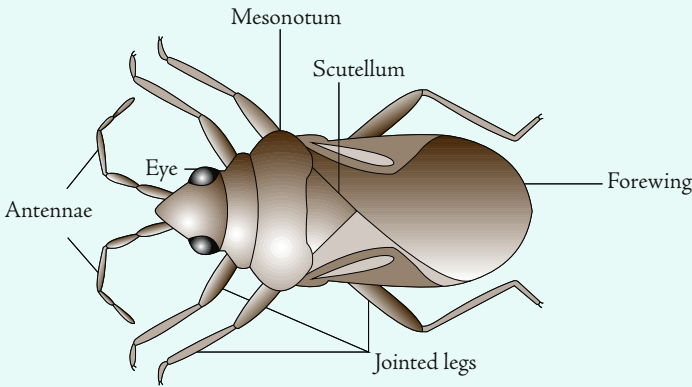
Fig. 16.20 Pygmy backswimmer (*Plea minutissima*, Pleidae)—3 mm

After capturing the prey (fry or insect larvae) with the forelegs, the bug tries to pierce the body wall with its proboscis. Having succeeded, it emerges to the water surface with the victim and the long-drawn process of feeding begins. The two most frequent species of backswimmers are the **small backswimmer** (*Notonecta viridis*) and the **common backswimmer** (*Notonecta glauca*). The eye anatomy, colour and polarisation sensing as well as the behaviour controlled by the polarotaxis of *Notonecta glauca* were studied in details by Rudolf Schwind (1983). Based on these results, he concluded the fact that aquatic insects and those inhabiting other moist surfaces are capable of sensing light polarisation, and these species find their habitat with the aid of the horizontally polarised light beams reflected from the water surface when they fly.

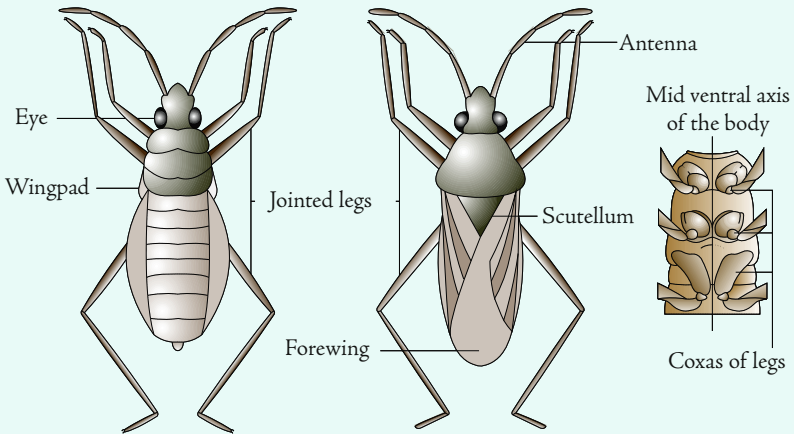
Lesser backswimmers (Pleidae) (Figs. 16.20 and 16.24c) are small, domed-bodied animals, up to 3 mm. Similarly to the greater water boatmen, they also swim upside down by the oar-like strokes of the hind legs fringed with swimming hairs. These animals of weedy lakes and brooks are mostly observed clinging to the stem of water pants. The carnivorous **pygmy backswimmer** (*Plea minutissima*) preys principally on water fleas.

Identification Key: Water Bugs—Heteroptera

- 1. Antennae conspicuous from above and longer than the width of the head; found on the water surface among vegetation, on the open surface or on the shore—2.
- Antennae not visible from above and shorter than the width of the head; found below the water surface—5.
- 2. Small bugs up to 3.5 mm long—3.
- Body longer than 3.5 mm—4.
- 3. **Description:** Body short and stout, grey, brown; head about as wide as long; ocelli present; antennae five-segmented, the distal three apical segments thinner than the proximal two; up to 2 mm long. **Feeding group:** Predators. **Habitat:** Marginal aquatic habitats, and water surface: **Velvet water bugs—Hebridae**



- **Description:** Body elongate oval, yellowish green with black markings; antennae four-segmented, basal segment longer than the head; all legs of Mesovelia inserted near the mid-ventral axis of the body; up to 3.5 mm. **Feeding group:** Predators. **Habitat:** Marginal aquatic habitats and water surface with floating vegetation: **Water treaders—Mesoveliidae (Fig. 16.22c)**



Mesoveliidae larva, imago (3.5 mm) and the ventral side of the body part

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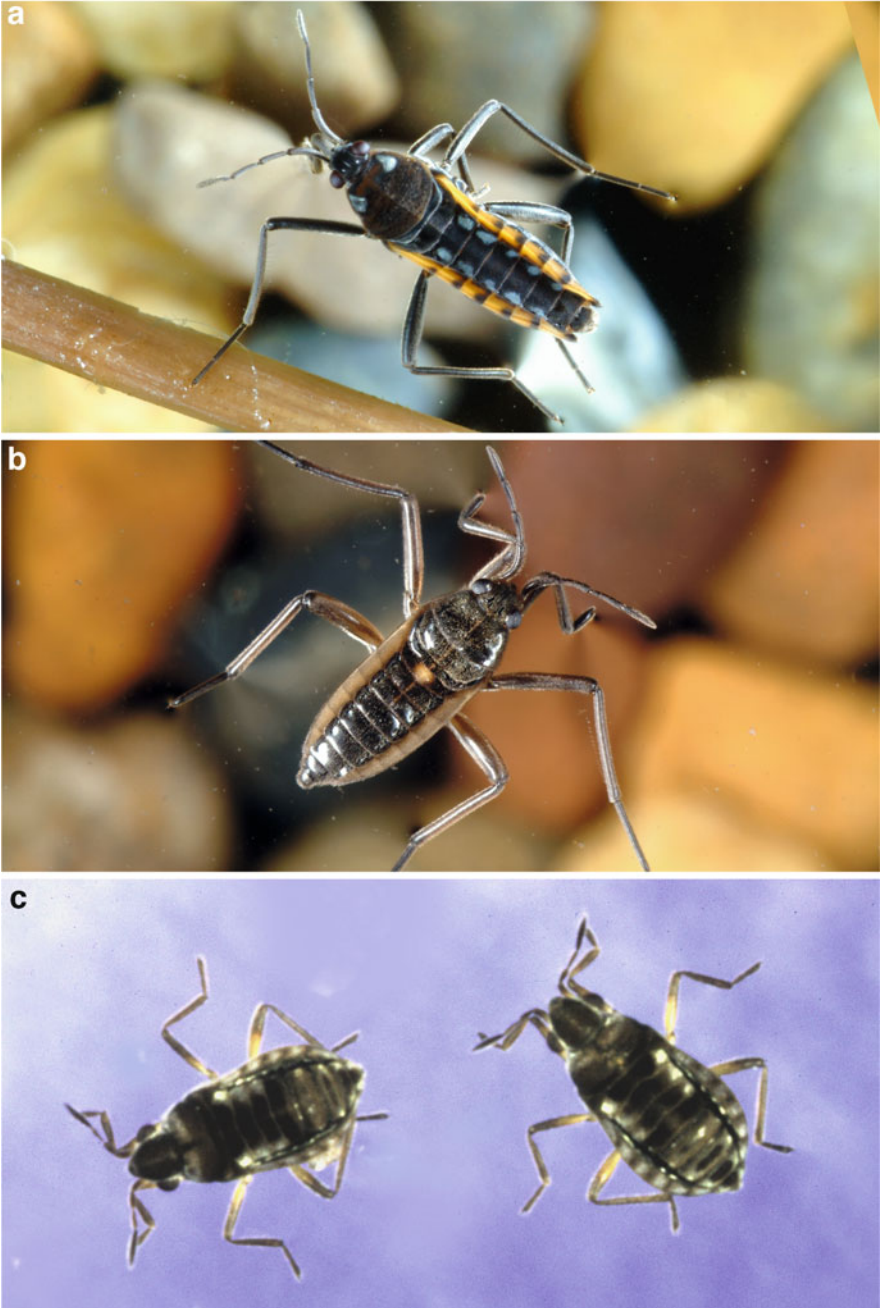
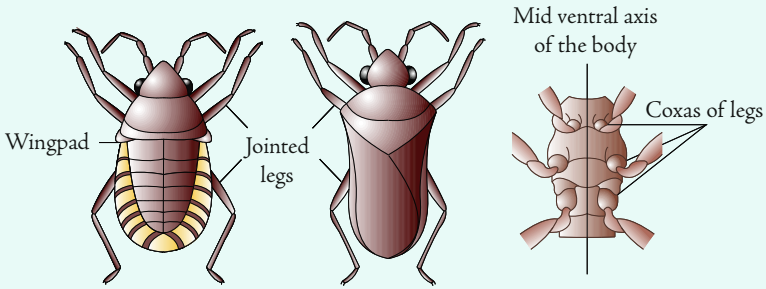


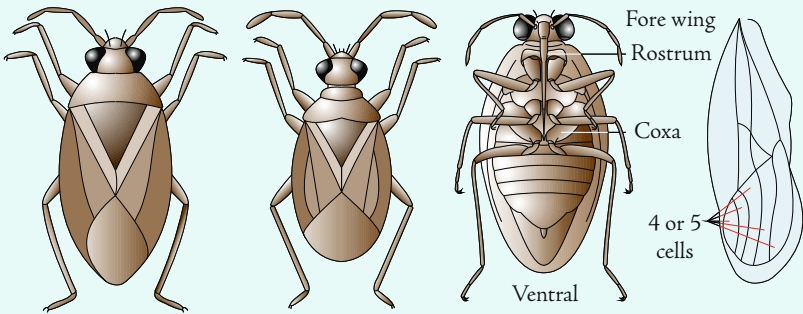
Fig. 16.21 (a, b) Water cricket (Veliidae) adult (a) and larva—8 and 6 mm. (b) *Microvelia reticulata* (Veliidae) specimens—2.5 mm

- **Description:** Body oval to elongate; brownish or blackish; legs, especially hind legs, inserted more laterally; antennae four-segmented; up to 2.5 mm long. **Feeding group:** Predators. **Habitat:** Marginal aquatic habitats, and water surface: **Water crickets—Veliidae—*Microvelia* sp.** (Fig. 16.21c)

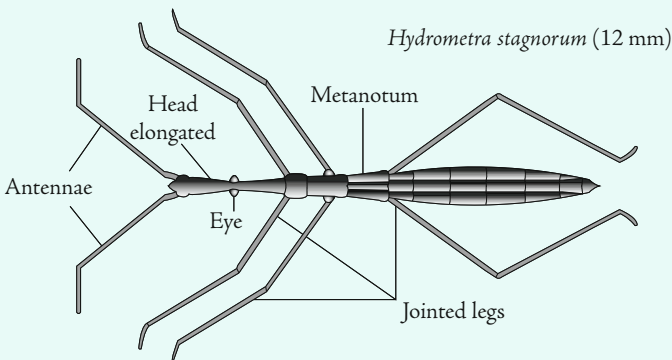


Microvelia larva and imago (2.5 mm)

- **Description:** Body oval; brownish or blackish; head triangular with large eyes; good flyers; membrane of forewing with 4–5 distinct similar cells; hind coxae large, transverse; up to 2 mm long. **Feeding group:** Predators. **Habitat:** Marginal aquatic habitats, and water surface: **Shore bugs—Saldidae**



- 4. **Description:** Body stick-like, rust-brown or blackish-brown; head greatly elongated; eyes situated far from the posterior margin of the head; antennae four-segmented; legs very long and slender; up to 12 mm long. **Feeding group:** Predators. **Habitat:** Marginal aquatic habitats, and water surface: **Water measurers—Hydrometridae** (Figs. 16.5 and 16.22a, b)



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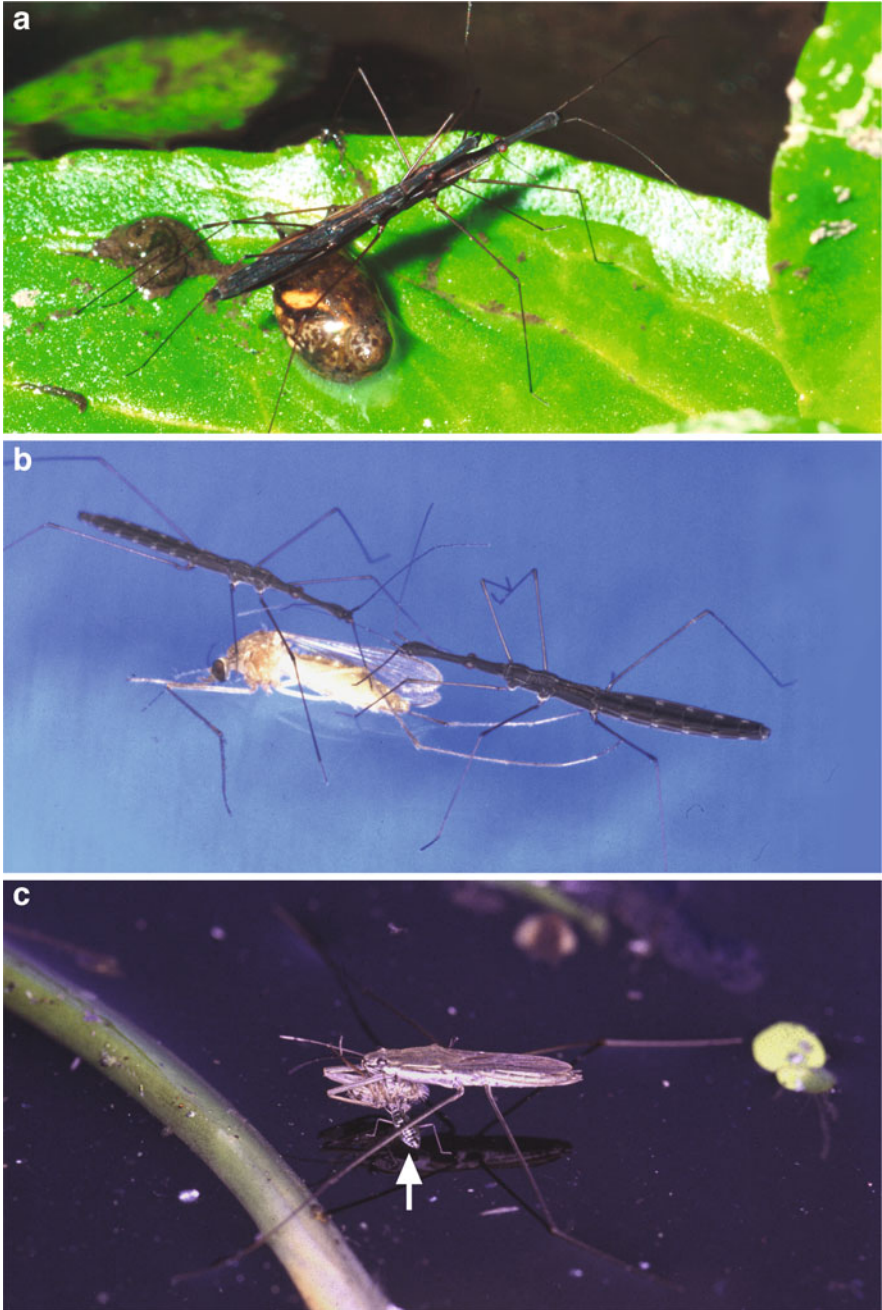
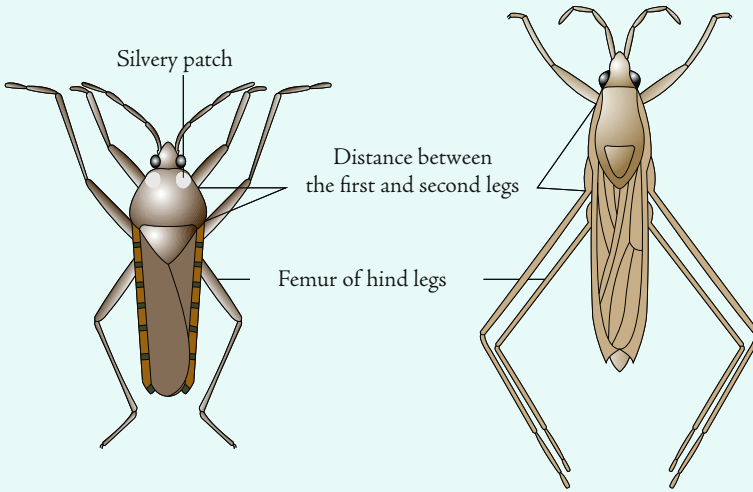


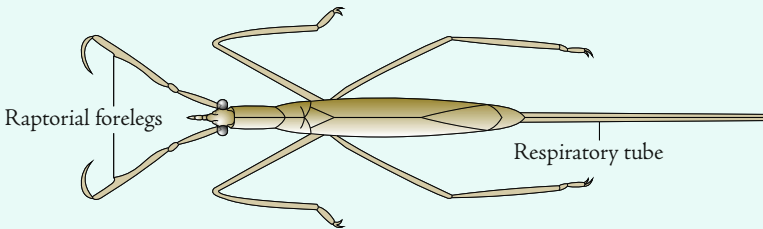
Fig. 16.22 (a) Copulating water measurers (*Hydrometra stagnorum*, Hydrometridae) (b) Water measurers (*Hydrometra stagnorum*, Hydrometridae) feeding on mosquito (Culicidae). (c) Feeding pond skater (Gerridae) and water cricket (*Mesovelia* sp., Mesoveliidae) (white arrow)—2.5 mm

- **Description:** Body oval to elongate, greyish or blackish, often with silvery patches of velvety hairs; head about as wide as long; antennae four-segmented and equal in thickness; femur of hind legs shorter than the abdomen; equal distance between the three pairs of legs; up to 8 mm long. **Feeding group:** Predators. **Habitat:** Marginal aquatic habitats, and water surface: **Water crickets—Veliidae—*Velia* sp.** (Figs. 16.2 and 16.21)
- **Description:** Body oval to elongate, brownish or blackish, densely clothed with hairs; head about as wide as long; antennae four-segmented; femur of hind legs extending beyond the abdomen; distance between first and second pairs of legs greater than between the second and third pairs; up to 17 mm long. **Feeding group:** Predators. **Habitat:** Marginal aquatic habitats, and water surface: **Pond skaters—Gerridae** (Figs. 16.3, 16.4, 16.22c and 16.23a, b)



Water cricket - Veliidae (8 mm) and pond skater - Gerridae (17 mm)

- 5. Forelegs raptorial; hind legs without swimming hairs; long caudal respiratory tube—6.
- Hind legs with swimming hairs; without caudal respiratory tube—7.
- 6. **Description:** Body elongate, stick-like, brownish; head prognathous; forelegs raptorial; up to 35 mm long. **Feeding group:** Predators. **Habitat:** Still waters with dense vegetation: **Water stick insect—*Ranatra linearis*** (Figs. 16.9, 16.10 and 16.23c)



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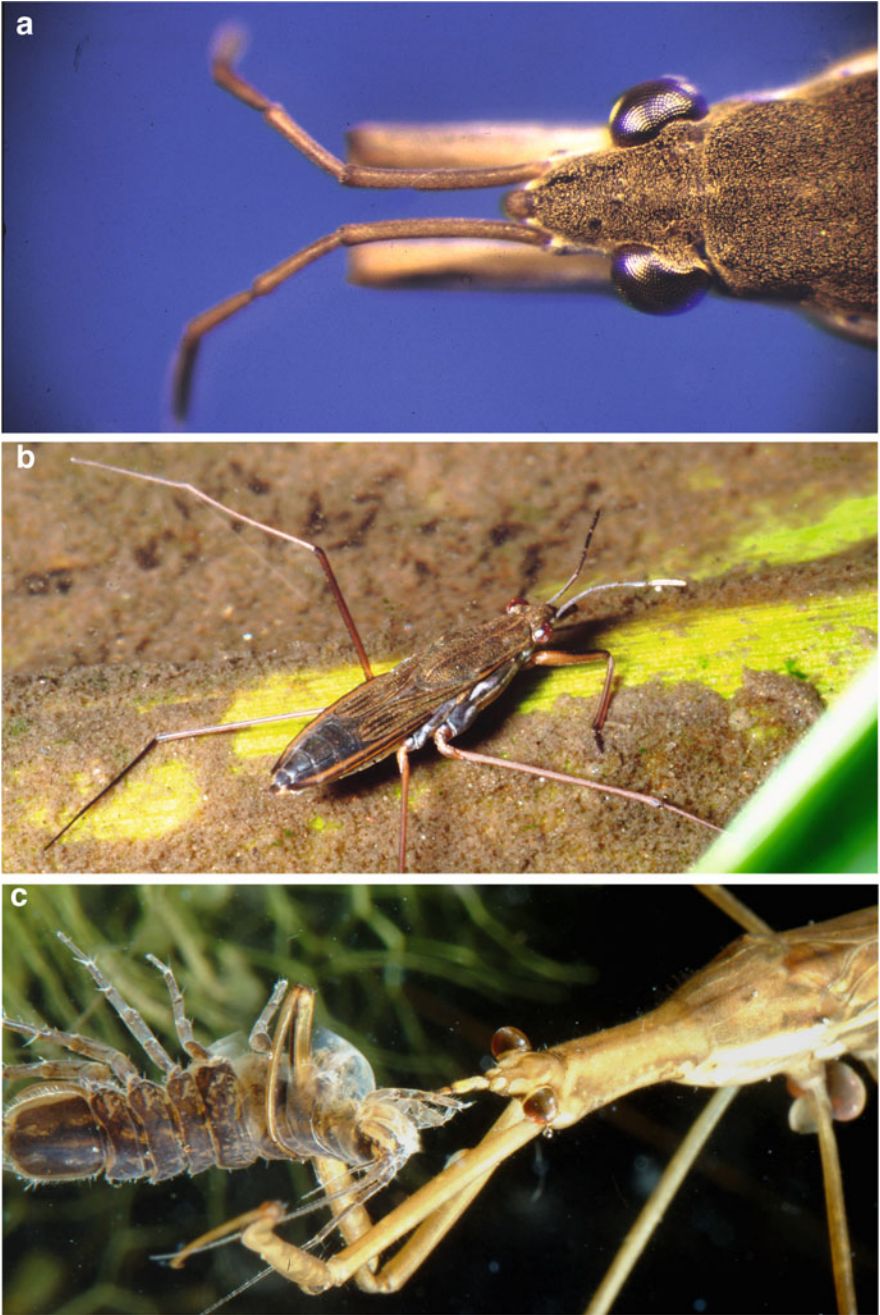
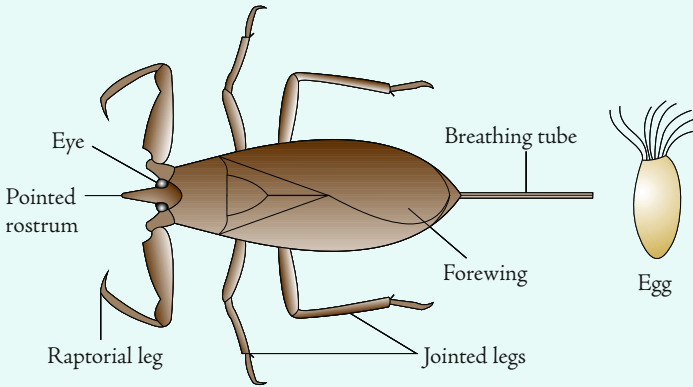
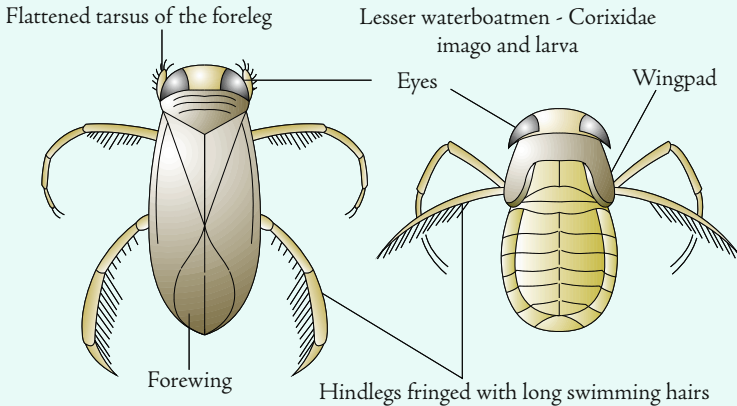


Fig. 16.23 (a) Anterior part of the pond skater's (Gerridae) body from dorsal view—12 mm. (b) Pond skater (Gerridae)—12 mm. (c) Water stick insect (*Ranatra linearis*, Nepidae) capturing a water slater (*Asellus aquaticus*, Asellidae)

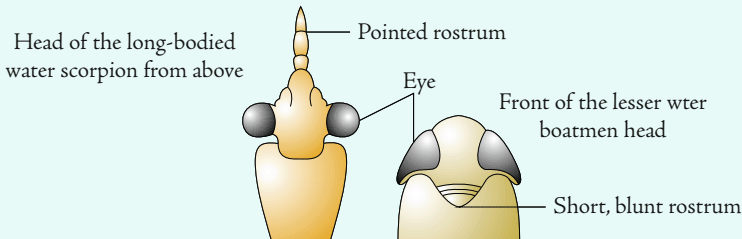
Description: Body flattened and elliptical, brown with reddish abdomen; head prognathous; forelegs raptorial; up to 23 mm long. **Feeding group:** Predators. **Habitat:** Still or slow-flowing waters in shore. **Water scorpion—*Nepa cinerea*** (Figs. 16.1, 16.6, 16.7, 16.8 and 16.24a, b)



7. **Description:** Body elongated-oval, dorsoventrally flattened; rostrum short, broadly triangular; pronotum and forewings usually patterned with transverse stripes and bands; fore tarsi usually one-segmented; hind legs fringed with long swimming hairs; up to 15 mm long. **Feeding group:** Predators, algal or detritus feeders or scrapers. **Habitat:** Still or slow-flowing waters: **Lesser water boatmen—Corixidae** (Figs. 16.11 and 16.12)



– Rostrum sharply pointed—8.



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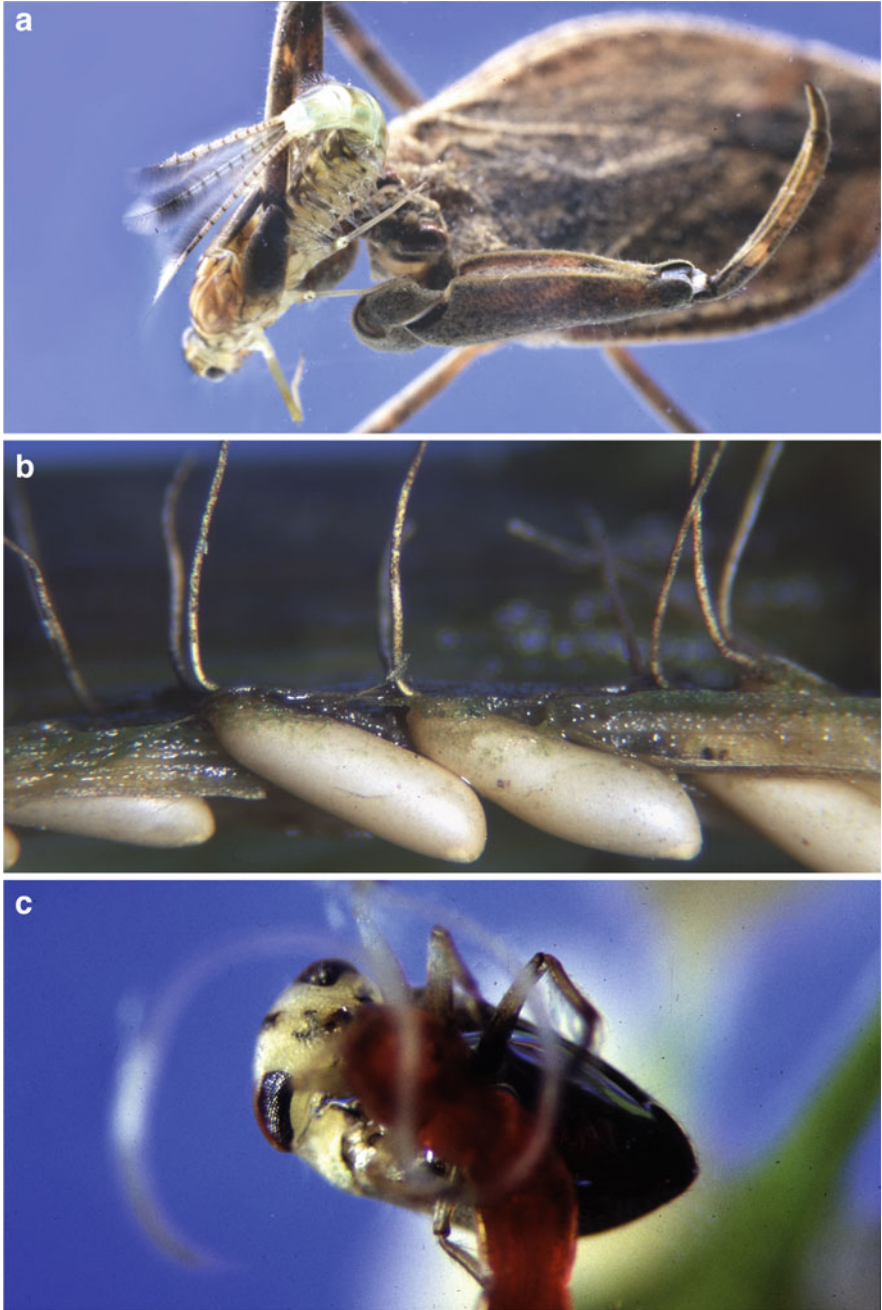
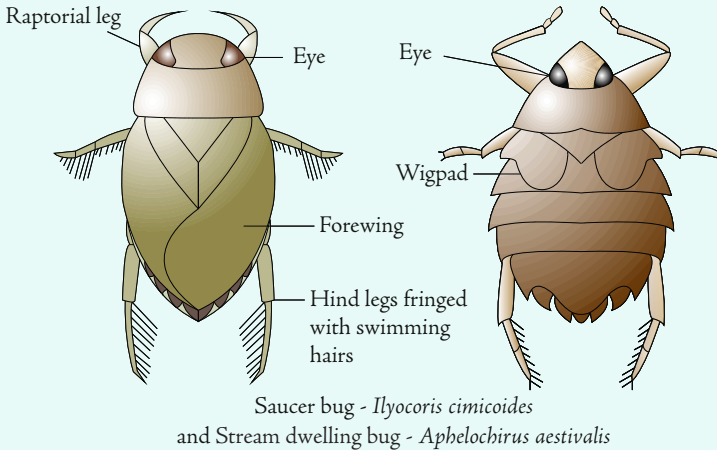
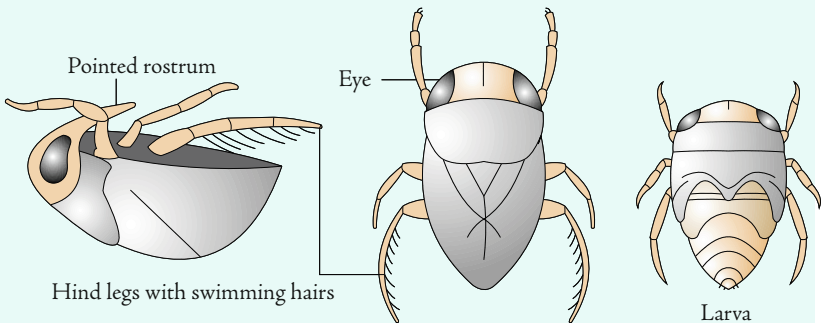


Fig. 16.24 (a) Water scorpion feeding on a *Cloeon dipterum* (Baetidae) larva. (b) Eggs of the water stick insect (*Ranatra linearis*, Nepidae) in the tissue of water plant—2 mm. (c) Pygmy backswimmer (*Plea minutissima*, Pleidae) feeding on a non-biting midge (Chironomidae) larva—3 mm

8. Body dorsoventrally flattened and elliptical; swimming with the dorsal side up—9.
 – Body boat-shaped; swimming with the ventral side up—10.
9. **Description:** Body dorsoventrally flattened and elliptical, head and pronotum brownish yellow, forewings dark olive-green in colour; rostrum reaching the base of the middle legs; forelegs broad and raptorial; up to 16 mm long. **Feeding group:** Predators. **Habitat:** Still or slow-flowing waters, in dense vegetation: **Saucer bugs—Naucoridae** (Figs. 16.13, 16.14 and 16.25a)
- **Description:** Body dorsoventrally flattened and circular, dark brown dorsally and yellowish ventrally; rostrum reaching the base of the hind legs; forelegs not raptorial; up to 12 mm long. **Feeding group:** Predators. **Habitat:** Fast running rivers and streams, clinging to stones: **Stream dwelling bugs—Aphelocheiridae** (Figs. 16.15 and 16.25b)



10. **Description:** Body strongly arched dorsally, whitish, yellowish-brown in colour; pronotum and hemelytra with strong punctate sculpture; swimming jerkily; small bug up to 3 mm. **Feeding group:** Predators. **Habitat:** Still or slow-flowing waters, in dense vegetation: **Lesser backswimmers—Pleidae** (Figs. 16.20 and 16.24c)

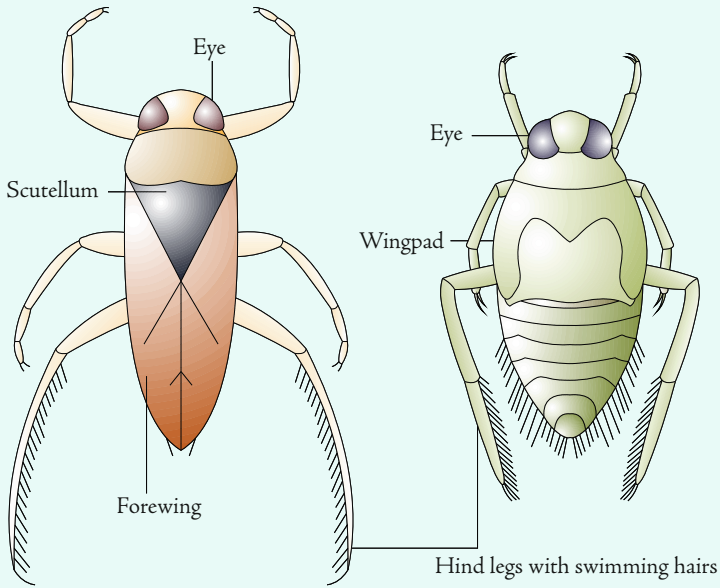


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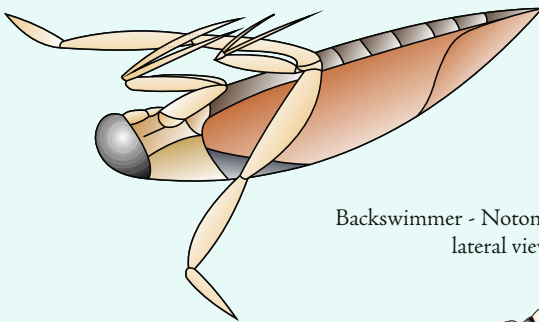


Fig. 16.25 (a) Larva of a saucer bug (*Ilyocoris cimicoides*, Naucoridae)—11 mm. (b) Stream dwelling bug (*Aphelocheirus aestivalis*, Aphelocheiridae) in ventral view—12 mm

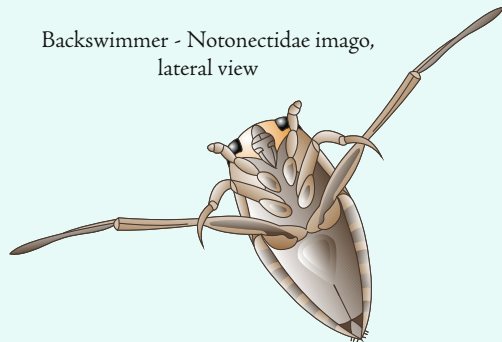
- **Description:** Body boat-shaped, strongly convex dorsally and flat ventrally; black, brown or yellowish; swimming with the ventral side up; pronotum and hemelytra smooth without strong punctate sculpture; hind legs fringed with long swimming hairs; abdomen with a broad median ventral keel; up to 16 mm. **Feeding group:** Predators. **Habitat:** Still or slow-flowing waters: **Backswimmers** or **greater water boatmen**—**Notonectidae** (Figs. 16.16, 16.17, 16.18, 16.19 and 16.26)



Backswimmer - Notonectidae imago and larva (16 mm)



Backswimmer - Notonectidae imago, lateral view



Backswimmer - Notonectidae on the water surface (ventral view)



Fig. 16.26 (a) Backswimmer (Notonectidae) on the water surface with dorsal side up—16 mm. (b) Cannibalism of backswimmer (Notonectidae) larvae

Water Bugs Videos



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