

Horse Fly head

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Horse Flies (Diptera: Tabanidae) can be very abundant in certain parts of Canada. One of the largest and most bothersome to human and larger mammals is *Hybomitra affinis*. As with most insects, the head appendages of females make for interesting subjects for microscopy. In a live fly the mouthparts are held vertically below the head and consist of a fascicle of six chitinous stylets (Figs. 1 st & 2) enclosed in an anterior fold of a fleshy labium which terminates in two labella (Figs. 1 la & 2) the fascicles and labium together are collectively called the proboscis. The proboscis is flanked laterally by a pair of maxillary palpi (mp) (Figs. 1, 2 & 3 mp). The stylets are the principle organs for piercing the skin of vertebrates in order to obtain a meal of blood.

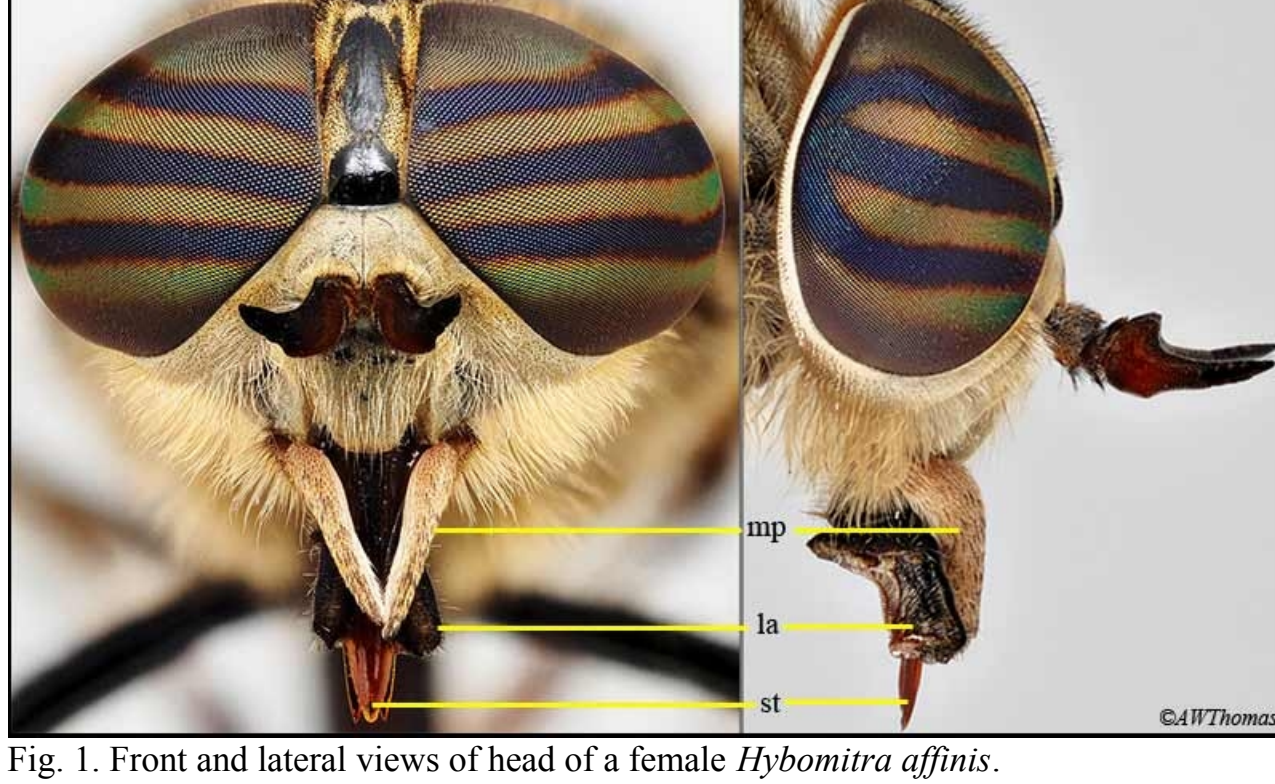


Fig. 1. Front and lateral views of head of a female *Hybomitra affinis*.

After removing the mouthparts and soaking overnight in 5% KOH the labium expanded and the stylets partially moved out of the labial fold (Figs. 2, 3); lb=labrum, mx =maxilla, hp=hypopharynx, md=mandible.

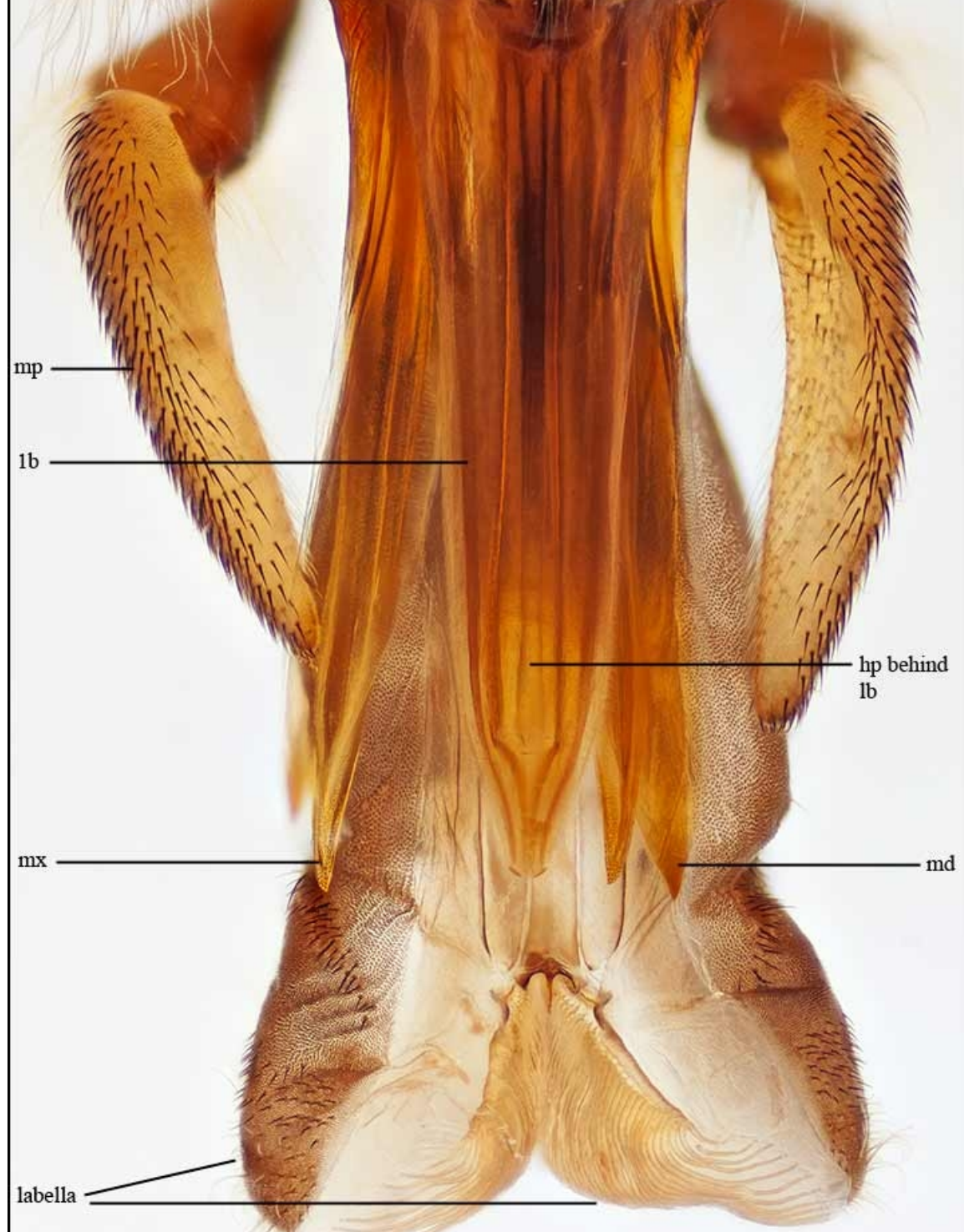


Fig. 2. Mouthparts of a female *Hybomitra affinis*; viewed from the front.

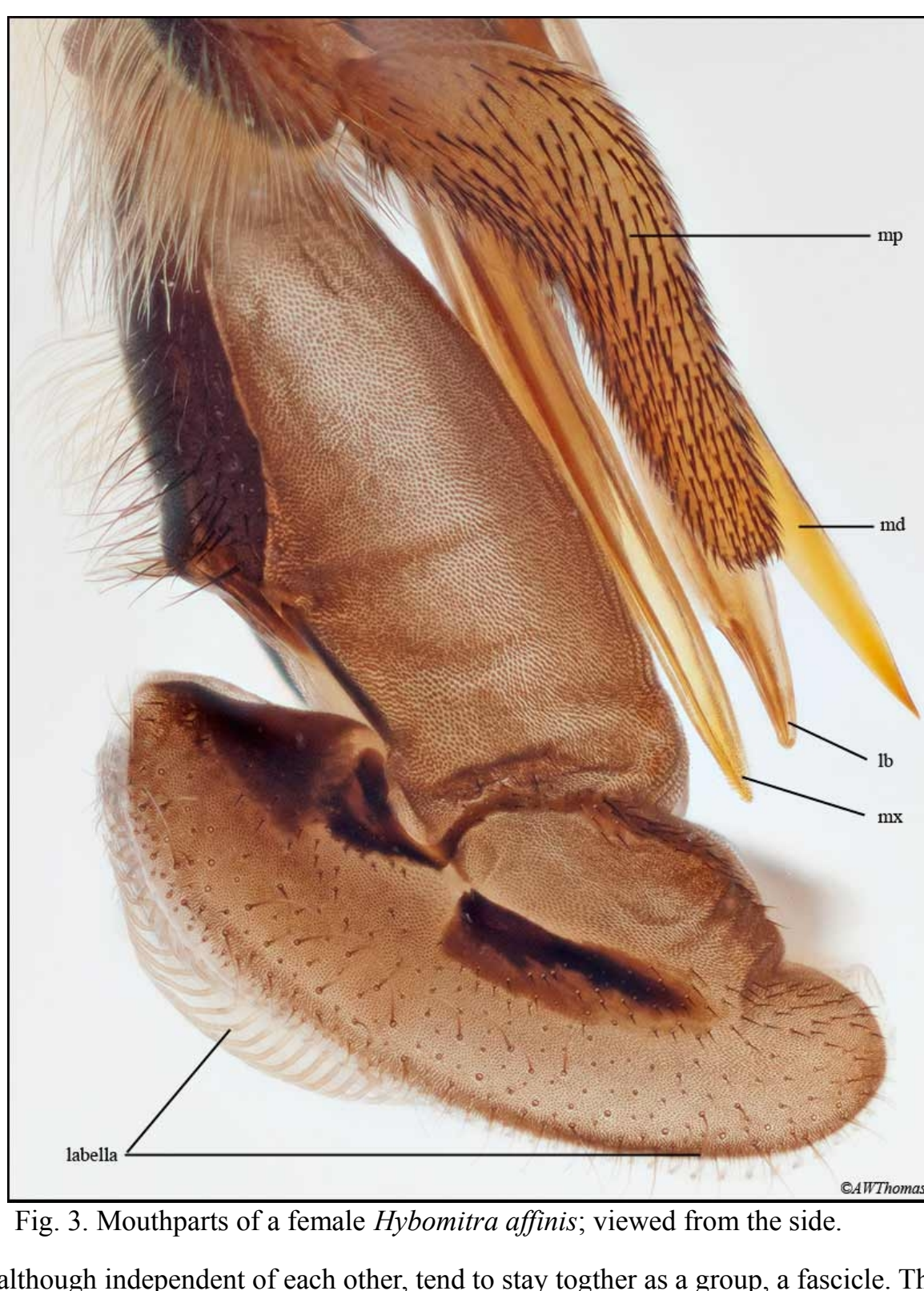


Fig. 3. Mouthparts of a female *Hybomitra affinis*; viewed from the side.

The stylets, although independent of each other, tend to stay together as a group, a fascicle. Their detail is best seen when separated at their bases (Fig. 4). There are six individual stylets in the group, two are median and unpaired while the other four consist of two pairs of lateral stylets. They sit in an anterior-posterior sequence; first and anteriorly is the single median labrum (Fig. 4 lb), followed by the paired mandibles (Fig. 4 md), followed by the paired blade-like stylets of the maxillae (Fig. 4 mx) between which lies the single hypopharynx (Fig. 4 hp).

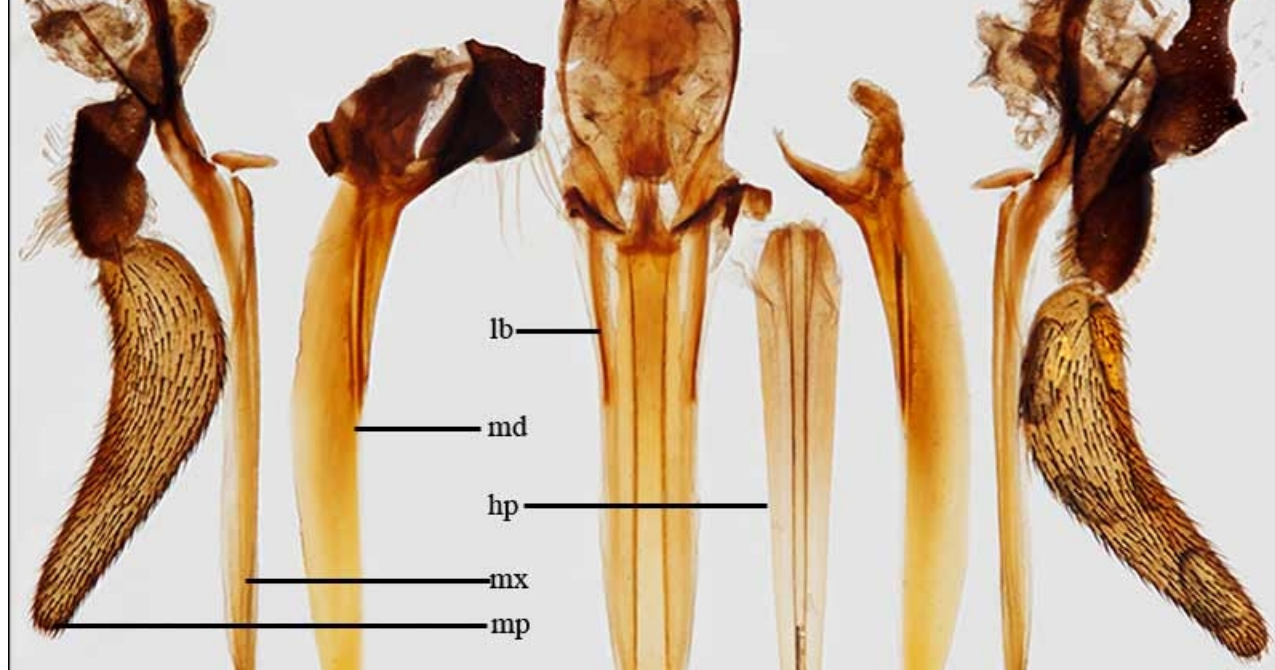


Fig. 4. Mouthpart stylets of female *Hybomira affinis*; plus the laterally flanking maxillary palpi (mp).

Blood-feeding is accomplished by retracting the labella, the two lobes at the base of the labium, to expose the fascicle of stylets. The long flattened sharp blades of the **Mandibles** (Fig. 5) are the first of the stylets that enter and cut through a vertebrate's skin. With its body firmly anchored to the hosts skin/fur/feathers/scales the female fly thrusts its head downwards forcing the mandibles into flesh. Muscles attached to the base of the mandibles move the blades in a side-to-side scissor-like action thus enlarging the initial wound.

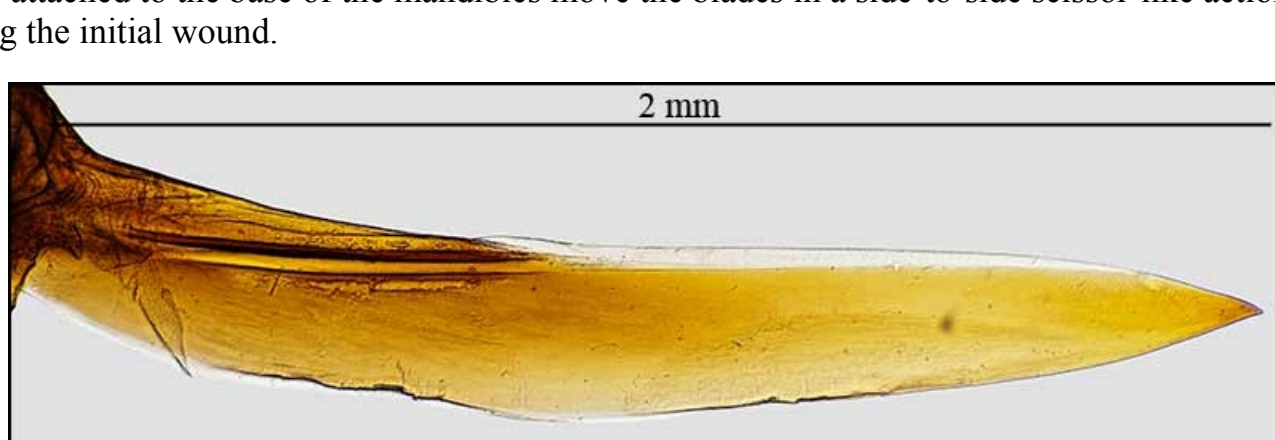


Fig. 5. Mandible of female *Hybomitra affinis*; upper edge faces labrum.

The inner facing edge of the mandible (Fig. 5 top edge, Fig. 6 left, right edge) is extremely thin, and presumably very sharp, whereas the outer facing edge (Fig. 5 bottom edge) is thicker with half its length having a saw-edge (Fig. 6 left edge), the saw teeth being small, 20 teeth/50µ.

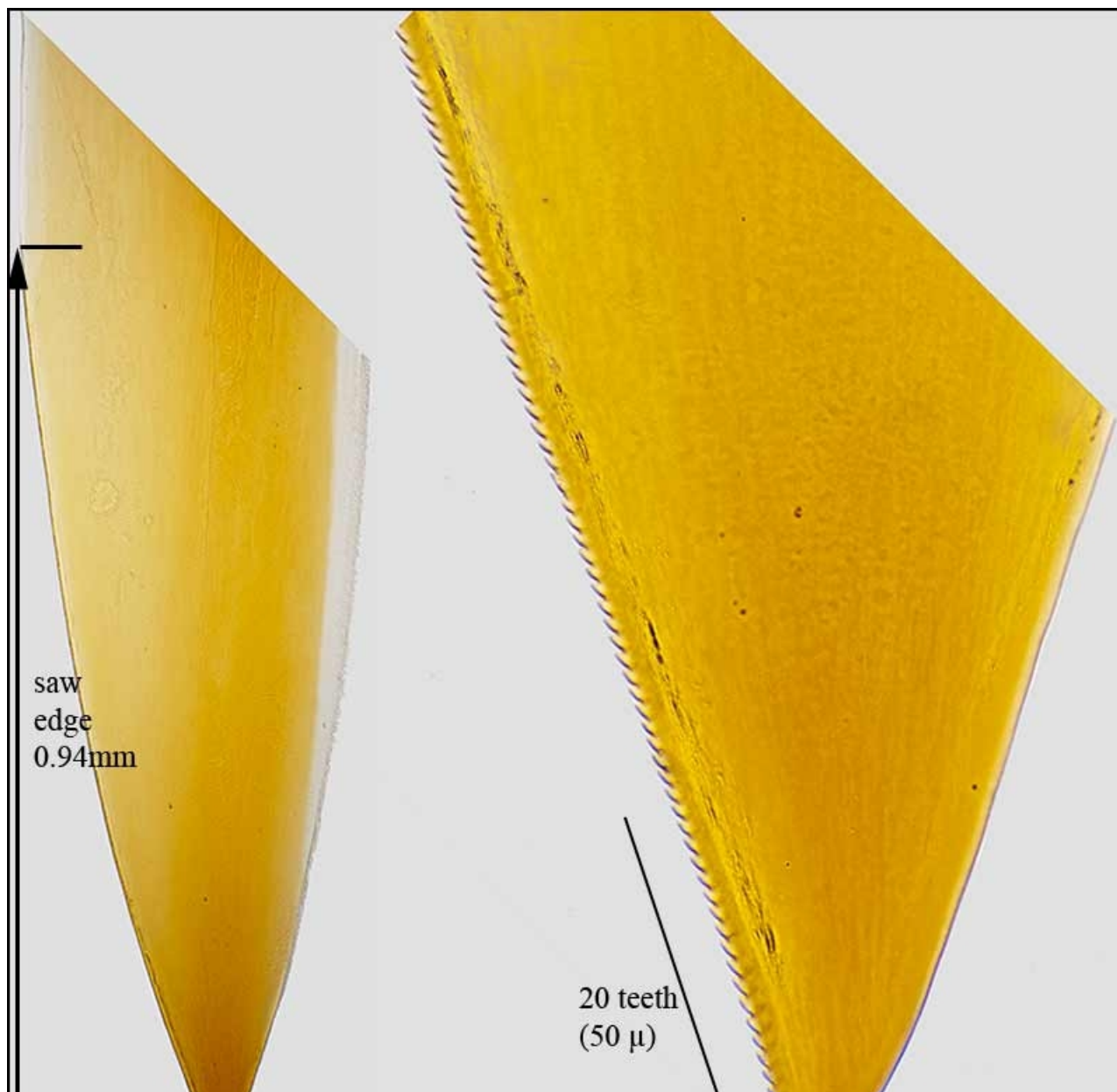


Fig. 6. Tip of mandible, left: 10x objective + 2.5x relay lens; right 60x objective + 2.5x relay lens.

The outer facing saw edge on the apical half of the mandible suggests that the initial skin-penetrating action is when the spread mandibles are thrust into and through skin. Then as they come together in the midline is the fine cutting edge slices through skin and flesh. Think of a pair of open scissors with the outer edges of the blades having a saw-tooth edge and the inner edge of the blades being very sharp. The paired mandibles move in a left-right (side to side) motion.

As the mandibles open up the skin the two **Maxillae** are thrust vertically into the wound. These stylets are narrower than the mandibles and are orientated with their edges towards anterior and posterior. At the extreme tip there are stout rasping teeth and these continue up the maxillae in two bands between which is a smooth concave channel. Beyond the tip the anterior edge is a smooth blade (right sides in Fig. 7) whereas the trailing posterior edge (left sides in Fig. 7) is finer (sharper?) with sharp-tipped spines. The action of the maxillae is up-down and their tips are well suited for ripping flesh and capillaries to start a flow of blood.



Fig. 7. Right maxilla viewed from side, sharp outer cutting edge on left; middle image 20x objective + 2.5x relay lens; right image 40x objective + 2.5x relay lens.

Once the vertebrates skin has been punctured and penetrated the **Hypopharynx** conveys an anticoagulant into the wound via a narrow tube from the salivary gland to prevent the blood clotting (Fig. 8).



Fig. 8. Hypopharynx; tip 40x objective + 2.5x relay lens.

The Labrum.

This dagger-like stylet is double-edged suggestive of a cutting function although its tip is blunt (Fig. 9). The labrum enters the initial wound created by the mandibles and maxillae and its lateral sharp edges help this insertion. On its posterior surface is a narrow channel terminating anteriorly in a finely drawn-out pipette (Fig. 9 right). The anterior surface of the hypopharynx is closely applied to the posterior surface of the labrum and together they form a channel through which the blood is sucked up into the mouth.

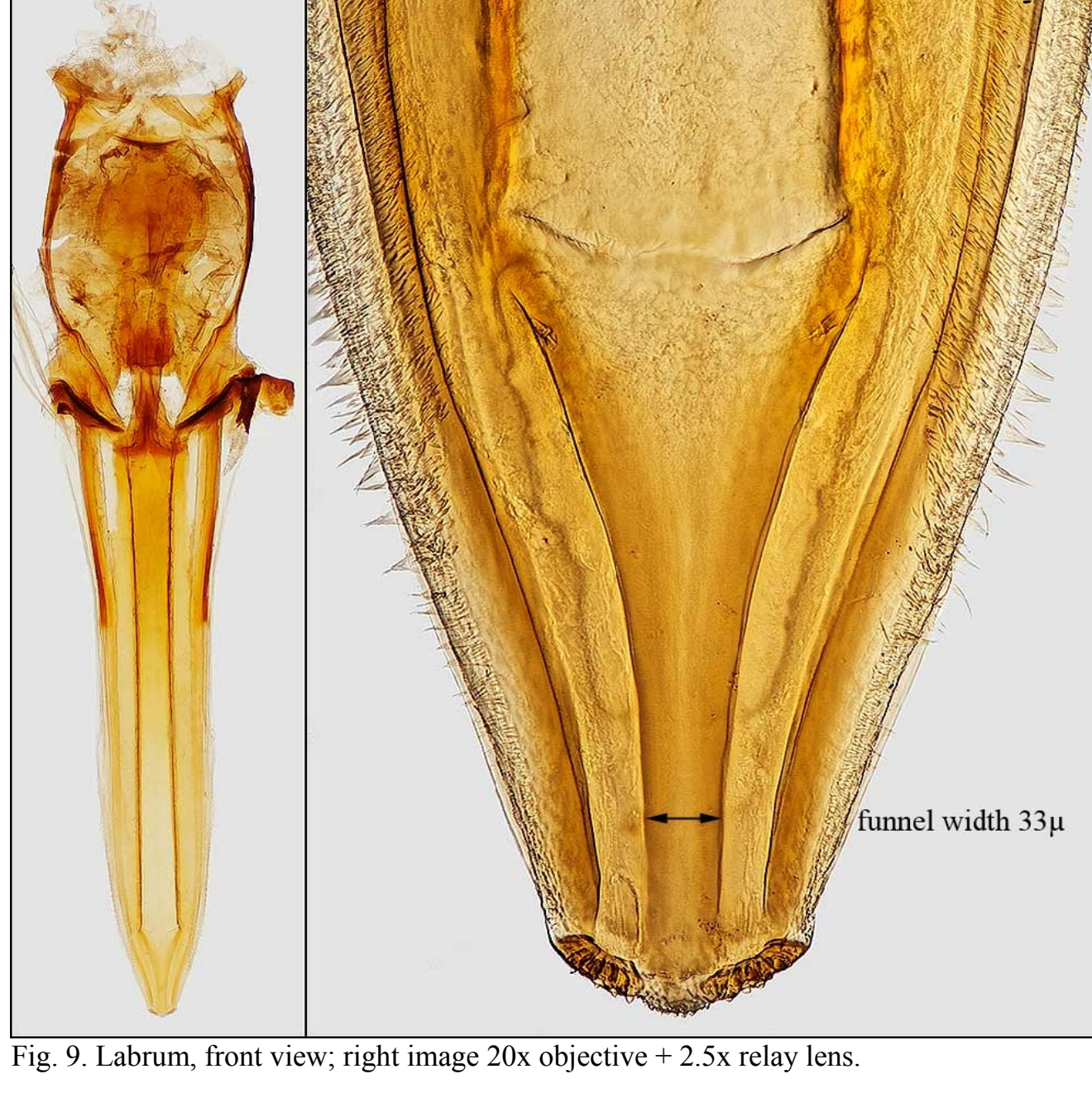


Fig. 9. Labrum, front view; right image 20x objective + 2.5x relay lens.

Microscope and Photographic Equipment

My basic equipment is an Olympus BH2 with 2x, 4x, 10x, 20x, 40x, 60x, and 100x objectives; Olympus 2.5x NFK relay lens. I also have the components for Phase Contrast, DIC and Polarization. Camera is a Nikon D90 with Nikon PB-6 bellows; Nikon flash in place of Olympus' halogen lamp. For reflected light images I use Nikon CF objectives, El-Nikkor enlarging lenses, and a MF 105mm Micro Nikkor. Most images are stacks of several frames processed by Zerene Stacker.

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