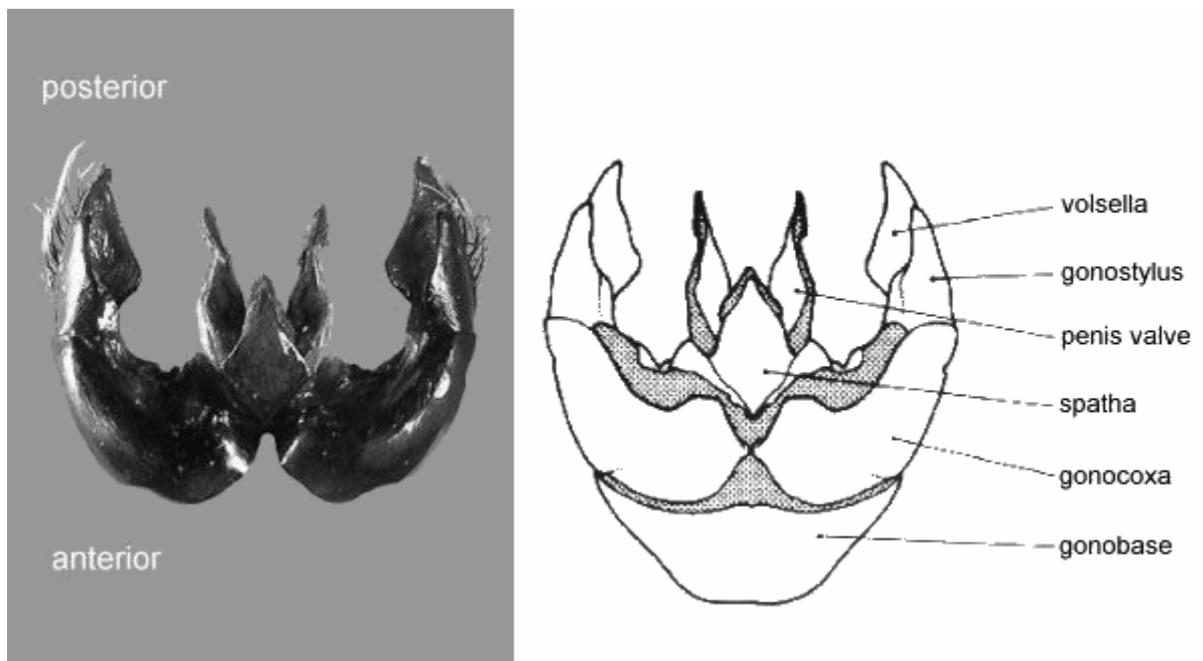


Key to simplified subgenera of the genus *Bombus* for male bumblebees

Paul H. Williams

with photomontage images by Andrew Polaszek.

The keys have been simplified as far as possible to make them easier to use. This key is based largely on morphological characters of the male genitalia (parts labelled below), because these characters are more reliable and more clearly distinctive than other morphological characters:



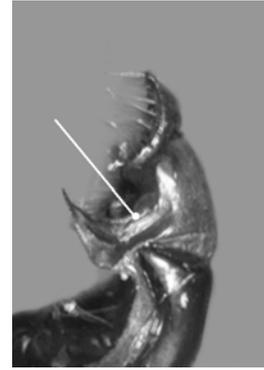
This version revised 20.ii.2008, based on Appendix 2 in:

Williams PH, Cameron SA, Hines HM, Cederberg B, and Rasmont P. 2008. A simplified subgeneric classification of the bumblebees (genus *Bombus*). *Apidologie* 39: 1-29.

key to subgenera for male bumblebees

- 1 Gonostylus with the inner proximal process without medium-length branched hairs (right, arrow); volsella and gonostylus usually strongly sclerotised and mid or dark brown in colour; volsella often but not always with a process or hooks on its inner margin; penis valve head either straight, or curved inwards, or curved outwards.

⇒ 2



- Gonostylus with the inner proximal process associated with many medium-length branched hairs (right, arrow); volsella and gonostylus usually weakly sclerotised and pale yellowish in colour; volsella always without a process or hooks on its inner margin; penis valve head always nearly straight. (Holarctic, Oriental).

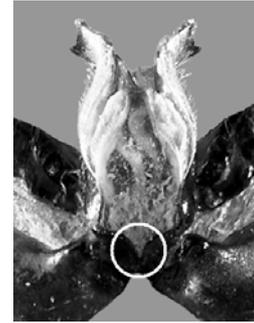
⇒ *Psithyrus*



key to subgenera for male bumblebees

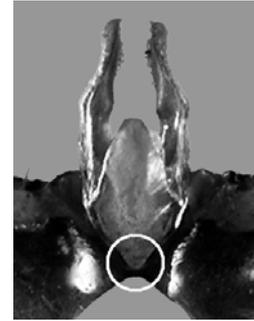
- 2 (1) Antenna medium to long, reaching back at least to the anterior margin of the tegula at the wing base; penis spatha narrowly and sharply pointed at its proximal end (right, circled), or if rounded then the spatha is broader than long (*B. (Th.) digressus*, from Central America); penis valve head either straight, or curved inwards, or curved outwards; eye either enlarged or not enlarged relative to the females.

⇒ 4



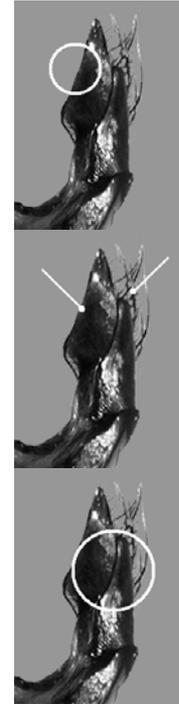
- Antenna short, not quite reaching back to the anterior margin of the tegula at the wing base; penis spatha rounded at its proximal end (right, circled); penis valve head always straight; eye always strongly enlarged relative to the females.

⇒ 3



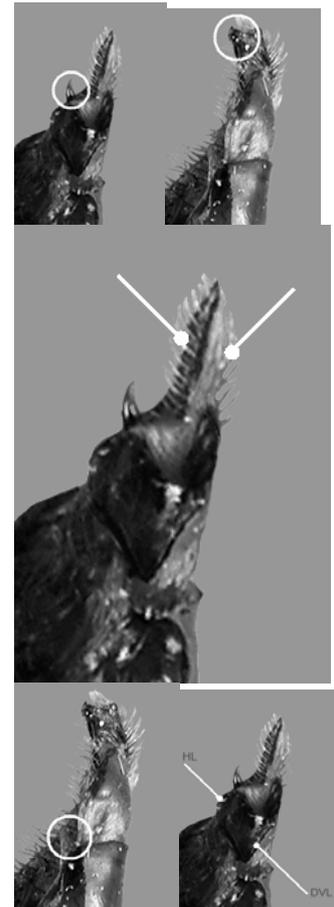
- 3 (2) Volsella without a process or hook on its inner margin (above right, circled); volsella with long hairs on its outer distal margin but no hairs on its inner distal margin (middle right, arrows); gonostylus simple and finger-like, without an inner proximal process, at most with a broad low proximal swelling (below right, circled). (Palearctic).

⇒ **Mendacibombus**



- Volsella with a process or hook on its inner margin, either near the mid point of its length (above near right, circled) or near its distal end (above far right, circled); volsella with only short hairs on its outer and inner distal margins (middle right, arrows); gonostylus either with an inner proximal process (below near right, circled), or divided into dorso-ventral and horizontal lamellae (below far right, arrows). (Holarctic).

⇒ **Bombias**



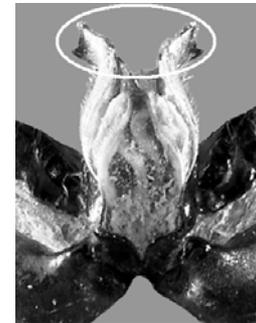
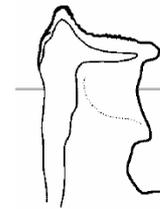
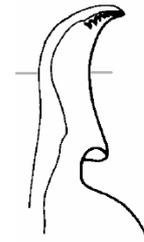
key to subgenera for male bumblebees

- 4 (2) Penis valve narrow dorso-ventrally, at least in its distal third, which is slightly ventrally curved (right, between the lines); antenna either of medium length or longer, reaching to or beyond the tegula at the wing base.

⇒ 5

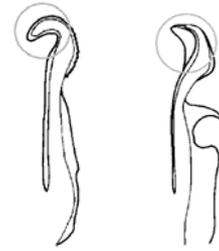
- Penis valve greatly broadened dorso-ventrally so as to form half of a broad tube (above right, between the lines), the distal end flared outwards as half of a broad funnel (below right, within the oval); antenna of medium length, not reaching back as far as the posterior margin of the tegula at the wing base. (Holarctic, Oriental).

⇒ *Bombus* s.str.



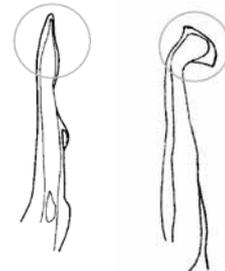
- 5 (4) Penis valve head from the dorsal aspect turned inwards distally as a distinct broad hook, either dorso-ventrally flattened in the form of a sickle (above near right, circled), or as an incurved spoon (above far right, circled), or if the hook is strongly reduced (middle right, circled) then the penis valve shaft has the ventral angle near its mid-point absent (similar to below right, arrow) although there is still a ventral rounded angle at the proximal end of the penis valve head (*B. (Cu.) funebris* and *B. (Cu.) rubicundus*, from the Andes).

⇒ 10



- Penis valve head from the dorsal aspect distally either nearly straight (near right, circled) or turned slightly outwards (far right, circled), at most with only a tiny inwardly curved narrow point.

⇒ 6



- 6 (5) Gonostylus with a distinct inner proximal process separate from the distal lobe (right, circled), or if there is only one lobe or process then either it is reduced to a freely articulating transverse curved inner spine-like plate and the gonocoxa has the inner distal corner extended as a finger-like process that is more than twice as long as broad (*B. (Th.) imitator*, from southern China), or the gonocoxa just before the distal margin has a deep oval sharply-defined mid-dorsal concavity and the spatha is nearly twice as broad as long (*B. (Th.) digressus*, from Central America).

⇒ 7



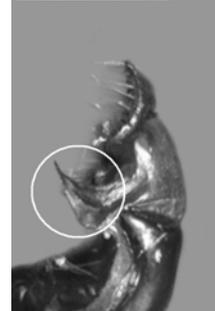
- Gonostylus without a narrow inner proximal process (right, circled), at most marked with a broad shallow curve or swelling, or if there is a very small sharp inner tooth then the distal lobe has a submarginal longitudinal groove (*Alpinobombus*); gonocoxa with the inner distal corner rounded and just before its distal margin convex without a mid-dorsal oval concavity; spatha longer than broad.

⇒ 8



- 7 (6) Volsella in ventral aspect in its distal half broad, the inner hooks (absent in *B. persicus*, from Turkey and Iran) placed either close to the midpoint of its length between its broadest point and the distal end (above right, circled), or if close to the distal end then reduced to a broad blunt process (middle right, circled); gonostylus with the inner proximal process often weakly sclerotised in the ventral part of the shelf, and if it has a long spine then this is usually nearly straight sharp and inwardly pointed (below right, circled); hind tibia with the outer surface inside the posterior margin convex, or if concave then the penis valve head has an outer proximal hook that is longer than the breadth of the adjacent penis valve head (*B. dahlbomii* and *B. morio*, from South America). (Holarctic, Oriental, Neotropics).

⇒ *Thoracobombus*



- Volsella in ventral aspect in its distal half narrow, the inner hooks pointed and always placed close to the distal end (above, circled); gonostylus with the inner proximal process uniformly strongly sclerotised and strongly re-curved away from the body midline and back towards the distal part of the gonostylus, with either at least one long strongly curved tubular spine with a blunt tip or flatter and with many teeth (below, circled); hind tibia with the outer surface inside the posterior margin concave, or if convex then the volsella has the more proximal of the inner hooks with many radiating teeth (*diversus*-group, from eastern Asia). (Palaeartic, Oriental).

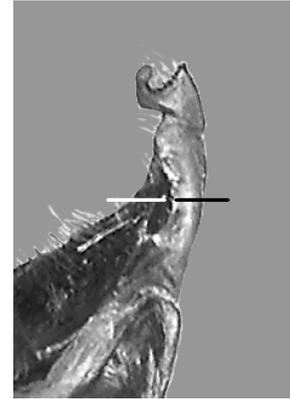
⇒ *Megabombus*



key to subgenera for male bumblebees

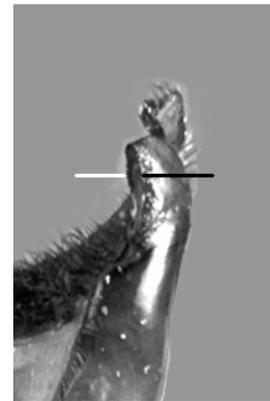
- 8 (6) Gonostylus with the inner distal margin simple, flattened, and blade-like in cross section (right, between the lines); antenna very long, reaching distinctly beyond the wing base; hind basitarsus with the posterior fringe shorter than the greatest breadth of the basitarsus.

⇒ 9



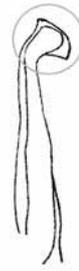
- Gonostylus with the inner distal margin thickened in cross section, with a submarginal longitudinal groove (right, between the lines); antenna long, reaching only as far as the posterior margin of the tegula at the wing base; hind basitarsus with the posterior fringe longer than the greatest breadth of the basitarsus. (Holarctic).

⇒ *Alpinobombus*



- 9 (8) Penis valve head turned outwards and flattened like an axe head (above right, circled); gonostylus longer than broad (middle right, circled); volsella narrow, the inner hook near the distal end (below right, circled); hind basitarsus with an anterior face flattened proximally, the proximal outer process at the articulation with the tibia strongly produced, as long as proximal breadth. (Palearctic).

⇒ **Kallobombus**



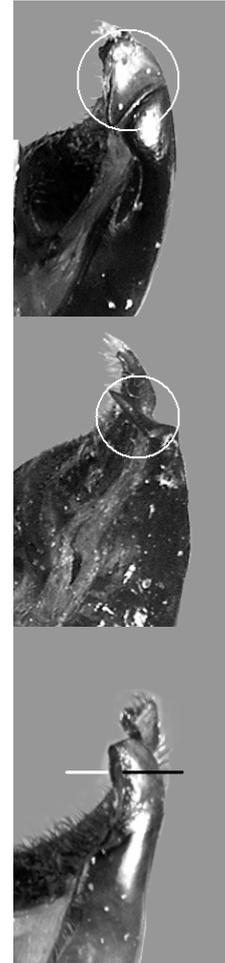
- Penis valve head straight, narrowed, and pointed like a spear head (above right, circled); gonostylus shorter than broad (middle right, circled); volsella broad, the inner hook near the mid point of its length (below right, circled); hind basitarsus with the anterior margin rounded in section proximally, the proximal outer process at the articulation with the tibia weakly produced, shorter than proximal breadth. (Oriental).

⇒ **Orientalibombus**



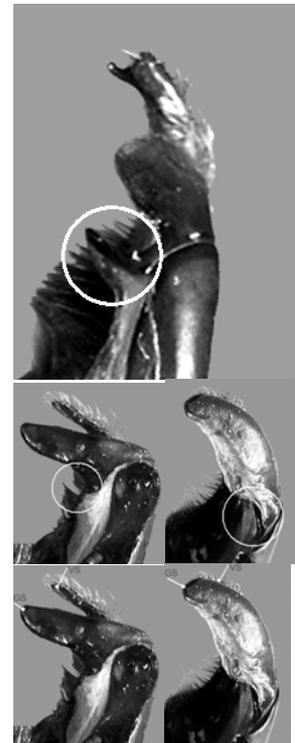
- 10 (5) Gonostylus usually a simple triangle, always without an inner proximal process (above right, circled), or if reduced to a single long stout pointed spine (middle right, circled) then the penis valve head has an outer flange broader than the adjacent penis valve head and projecting ventrally and laterally (the rare *B. pressus*, from the central Himalaya); gonostylus with the inner distal margin at least slightly thickened in cross section with a submarginal longitudinal groove (similar to below right, between the lines). (Holarctic, Oriental, northern edge of the Neotropics).

⇒ *Pyrobombus*



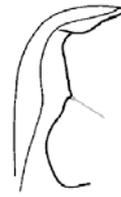
- Gonostylus very variable in shape, but usually with a distinct inner proximal process (e.g. above right, circled), or if this is strongly reduced or absent (middle right, circled) then the distal lobe of the gonostylus is greatly expanded distally and projecting inwardly beyond the volsella (below right, arrows) (*B. (Cu.) macgregori*, from Central America, and *B. (Cu.) handlirschi*, from the Andes); gonostylus with the inner distal margin simple flattened and blade-like in cross section without a submarginal longitudinal groove.

⇒ 11



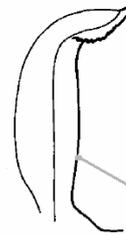
- 11 (10) Penis valve shaft with a ventral angle about half way along its length and distinct either as a pronounced sharp angle (above right, arrow) or produced as a larger transverse process (below right, circled).

⇒ 12



- Penis valve shaft with a ventral angle about half way along its length either reduced and very broadly rounded (not sharply marked) or absent (right, arrow), although there may be an additional ventral rounded angle at the proximal end of the penis valve head (most easily confused in e.g. *B. (Cu.) rubicundus* and *B. (Cu.) funebris*, from the Andes).

⇒ 13



- 12 (11) Penis valve head turned inwards distally as an incurved bowl-shaped spoon (above right, circled); penis valve shaft with the ventral angle about half way along its length produced ventrally and laterally as a broad transverse paddle-like process (below right, circled); mandible distally pointed and with one anterior tooth. (Holarctic, Oriental).



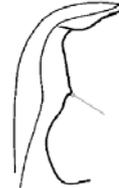
⇒ **Subterraneobombus**



- Penis valve head turned inwards distally as a dorso-ventrally flattened sickle (above right, circled); penis valve shaft with the ventral angle about half way along its length produced ventrally as a pronounced angle (middle right, arrow); mandible distally pointed and with two anterior teeth (below right, spots). (Palearctic, Oriental).



⇒ **Alpigienobombus**



13 (11) Mid basitarsus on its outer surface with many medium and long hairs; gonostylus with the distal lobe longer or shorter than broad; oculo-malar distance longer or shorter than the breadth of the mandible proximally between the outer ends of its articulations (condyles); antenna either medium or long, reaching to or beyond the tegula at the wing base.

⇒ 14

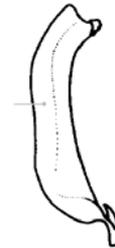
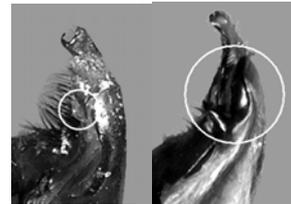
— Mid basitarsus on its outer surface with sparse short hairs and very few or no moderate and long hairs; gonostylus with the distal lobe always longer than broad (right, circled); oculo-malar distance always longer than the breadth of the mandible proximally between the outer ends of its articulations (condyles); antenna usually very long, reaching distinctly beyond the wing base, or if shorter and reaching only to the posterior margin of the tegula then the recurved hook of the penis valve head is strongly club-shaped (the rare *B. oberti*, from Central Asia). (Palearctic, Oriental).



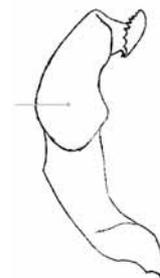
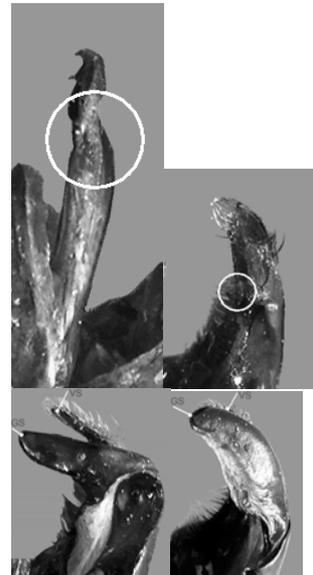
⇒ *Sibiricobombus*

- 14 (13) Oculo-malar distance at least as long as the breadth of the mandible proximally between the outer ends of its articulations (condyles); gonocoxa with the inner proximal process about as long as broad; either the penis valve head narrowed as a short slender barbed arrow head without a dog-leg (above right, circled) (*lapidarius*-group, from the Palaearctic and Oriental regions), or the gonostylus with the shelf of the inner proximal process membranous (middle near right, circled) (*B. festivus*, from the Oriental region), or the gonostylus reduced to a narrow S-shaped band (middle far right, circled) (*rufipes*-group, from the southern Oriental region); volsella, if it is thickened ventrally, then this forms only a narrow more coarsely-sculptured band extending for most of the length of the volsella (below right, arrow); antenna of medium length, not reaching beyond the posterior margin of the tegula at the wing base. (Palaearctic, Oriental).

⇒ **Melanobombus**



- Oculo-malar distance shorter than the breadth of the mandible proximally between the outer ends of its articulations (condyles), or if equal in length then the gonocoxa with the inner proximal processes finger-like and more than twice as long as broad (*B. coccineus*, from the Andes); penis valve head either not narrowed, or if narrowed then forming an elongated spear head with a small dog-leg proximally (above near right, circled) (*B. rubicundus*, from the Andes); gonostylus either with a strongly sclerotised inner proximal process, or together with the inner distal lobe reduced to two small teeth (above far right, circled) (*B. rufocinctus*, *B. cullumanus*, from the Holarctic region), or if absent then the distal lobe is strongly produced distally and inwardly beyond the volsella (middle right, arrows) (*B. handlirschi* and *B. macgregori*, from the Andes and Central America); volsella expanded ventrally into a short pear-shaped coarsely-sculptured thickened pad in its distal half (below right, arrow), or if it is thickened ventrally only as a narrow more coarsely-sculptured band extending for most of the length of the volsella then either the gonostylus has the inner processes reduced to two small teeth (above far right, circled) (*B. rufocinctus*, *B. cullumanus*), or the gonostylus is strongly produced distally and inwardly beyond the volsella (middle right, arrows) (*B. handlirschi*, from the Andes); antenna either of medium length or longer, reaching to or beyond the tegula at the wing base. (Holarctic, Neotropics).



⇒ **Cullumanobombus**