

= Horse @-@ fly =

Horse @-@ flies or horseflies (for other names , see common names) are true flies in the family Tabanidae in the insect order Diptera . They are often large and agile in flight , and the females bite animals , including humans , to obtain blood . They prefer to fly in sunlight , avoiding dark and shady areas , and are inactive at night . They are found all over the world except for some islands and the polar regions .

Adult horse @-@ flies feed on nectar and plant exudates ; the males have weak mouthparts and only the females bite animals to obtain enough protein from blood to produce eggs . The mouthparts of females are formed into a stout stabbing organ with two pairs of sharp cutting blades , and a spongelike part used to lap up the blood that flows from the wound . The larvae are predaceous and grow in semiaquatic habitats .

Female horse @-@ flies can transfer blood @-@ borne diseases from one animal to another through their feeding habit . In areas where diseases occur , they have been known to carry equine infectious anaemia virus , some trypanosomes , the filarial worm *Loa loa* , anthrax among cattle and sheep , and tularemia . As well as making life outdoors uncomfortable for humans , they can reduce growth rates in cattle and lower the milk output of cows if suitable shelters are not provided .

Horse @-@ flies have appeared in literature since Aeschylus in Ancient Greece mentioned them driving people to madness through their persistent pursuit .

= = Common names = =

Apart from the common name " horse @-@ flies " , broad categories of biting , bloodsucking Tabanidae are known by a large number of common names . The word " Tabanus " was first recorded by Pliny the Younger and has survived as the generic name . In general , country @-@ folk did not distinguish between the various biting insects that irritated their cattle and called them all " gad @-@ flies " , from the word " gad " meaning a spike . The most common name is " cleg [g] " , " gleg " or " clag " , which comes from Old Norse and may have originated from the Vikings . Other names such as " stouts " refer to the wide bodies of the insects and " dun @-@ flies " to their sombre colouring . Chrysops species are known as " deer @-@ flies " , perhaps because of their abundance on moorland where deer roam , and " buffalo @-@ flies " , " moose @-@ flies " and " elephant @-@ flies " emanate from other parts of the world where these animals are found . In North America they are known as " breeze @-@ flies " , and in Australia , some are known as " March flies " , a name used in other Anglophonic countries to refer to the non @-@ bloodsucking Bibionidae .

= = Description = =

Adult tabanids are large flies with prominent compound eyes , short antennae composed of three segments , and wide bodies . In females , the eyes are widely separated but in males , they are almost touching ; they are often patterned and brightly coloured in life but appear dull in preserved specimens . The terminal segment of the antennae is pointed and is annulated , appearing to be made up of several tapering rings . There are no hairs or arista arising from the antennae . Both head and thorax are clad in short hairs but there are no bristles on the body . The membranous forewings are clear , uniformly shaded grey or brown , or patterned in some species ; they have a basal lobe (or calypter) that covers the modified knob @-@ like hindwings or halteres . The tips of the legs have two lobes on the sides (pulvilli) and a central lobe or empodium in addition to two claws that enable them to grip surfaces . Species recognition is based on details of head structures (antennae , frons , and maxillae) , the wing venation and the body patterning ; minute variations of surface structure cause subtle alterations of the overlying hairs which alters the appearance of the body .

Tabanid species range from medium @-@ sized to very large , robust insects . Most have a body length between 5 and 25 mm (0 @-@ 2 and 1 @-@ 0 in) , with the largest having a wingspan of 60

mm (2 @. @ 4 in) . Deer flies in the genus Chrysops are up to 10 mm (0 @. @ 4 in) long , have yellow to black bodies and striped abdomens and have membranous wings with dark patches . Horse @-@ flies (genus Tabanus) are larger , up to 25 mm (1 in) in length and are mostly dark brown or black , with dark eyes , often with a metallic sheen . Yellow flies (genus Diachlorus) are similar in shape to deer flies but have yellowish bodies and the eyes are purplish @-@ black with a green sheen . Some species in the subfamily Pangoniinae have an exceptionally long proboscis (tubular mouthpart) .

The larvae are long and cylindrical with small heads and twelve body segments . They have rings of tubercles (warty outgrowths) known as pseudopods around the segments , and also bands of short setae (bristles) . The posterior tip of each larva has a breathing siphon and a bulbous area known as Graber 's organ . The outlines of the adult insect 's head and wings are visible through the pupa , which has seven movable abdominal segments , all except the front one of which bears a band of setae . The posterior end of the pupa bears a group of spine @-@ like tubercles .

Some species , such as deer flies and the Australian March flies , are known for being extremely noisy during flight , though clegs , for example , fly quietly and bite with little warning . Tabanids are agile fliers ; Hybomitra have been observed to perform aerial manoeuvres similar to those performed by fighter jets , such as the Immelmann turn .

= = Distribution and habitat = =

Horse @-@ flies are found worldwide , except for the polar regions , but they are absent from some islands such as Greenland , Iceland , and Hawaii . The genera Tabanus , Chrysops , and Haematopota all occur in temperate , subtropical and tropical locations , but Haematopota are absent from Australia and South America . Horse @-@ flies mostly occur in warm areas with suitable moist locations for breeding , but also occupy a wide range of habitats from deserts to Alpine meadows . They are found from sea level to at least 3 @, @ 300 metres (10 @, @ 800 ft) .

= = Evolution and taxonomy = =

The first record of a tabanid comes from the Late Jurassic of China , and specimens from the Cretaceous have been found in England , Spain , and possibly South Africa . In the New World , the first discoveries date from the Miocene of Florissant , Colorado . These insects are recognisable as tabanids both from their mouthparts and their wing venation . Although the bloodsucking habit is associated with a long proboscis , a fossil insect that has elongated mouthparts is not necessarily a bloodsucker , as it may instead have fed on nectar . The ancestral tabanids may have co @-@ evolved with the angiosperm plants on which they fed . With a necessity for high @-@ protein food for egg production , the diet of early Tabanomorphs was probably predatory , and from this the bloodsucking habit may have evolved . In the Santana Formation in Brazil , no mammals have been found , so the fossil tabanids found there likely fed on reptiles . Cold bloodsucking probably preceded warm bloodsucking , but some dinosaurs are postulated to have been warm @-@ blooded and may have been early hosts for the horse @-@ flies .

The Tabanidae are true flies and members of the insect order Diptera . With the families Athericidae , Pelecorhynchidae and Oreoleptidae , Tabanidae are classified in the superfamily Tabanoidea . Along with Rhagionoidea , this superfamily makes up the infraorder Tabanomorpha . Tabanoid families seem to be united by the presence of a venom canal in the mandible of the larvae . Worldwide , about 4 @, @ 455 species of Tabanidae have been described , over 1 @, @ 300 of them in the genus Tabanus .

Tabanid identification is based mostly on adult morphological characters of the head , wing venation , and sometimes the last abdominal segment . The genitalia are very simple and do not provide clear species differentiation as in many other insect groups . In the past , most taxonomic treatments considered the family to be composed of three subfamilies : Pangoniinae (tribes Pangoniini , Philolichini , Scionini) , Chrysopsinae (tribes Bouvieromyiini , Chrysopsini , Rhinomyzini) , and Tabaninae (tribes Diachlorini , Haematopotini , Tabanini) . Some treatments

increased this to five subfamilies , adding the subfamily Adersiinae , with the single genus Adersia , and the subfamily Sceptidinae , with the two genera Braunsimyia and Sceptis .

A 2015 study by Morita et al. using nucleotide data , aimed to clarify the phylogeny of Tabanidae and supports there being three subfamilies . The subfamilies Pangoniinae and Tabaninae were shown to be monophyletic . The tribes Philolichini , Chrysopsini , Rhinomyzini and Haematopotini were found to be monophyletic , with Scionini also being monophyletic apart from the difficult @-@ to @-@ place genus Goniops . Adersia was recovered within Pangoniini as were the genera previously placed in Sceptidinae , and Mycteromyia and Goniops were recovered within Chrysopsini .

Subfamily Chrysopsinae (deer flies or banded horse @-@ flies)

Subfamily Pangoniinae (long @-@ tongued horse @-@ flies)

Subfamily Tabaninae (horse @-@ flies)

The Tabaninae lack ocelli (simple eyes) and have no spurs on the tips of their hind tibiae . In the Pangoniinae , ocelli are present and the antennal flagellum (whip @-@ like structure) usually has eight annuli (or rings) . In the Chrysopsinae , the antennal flagellum has a basal plate and the flagellum has four annuli . Females have a shining callus on the frons (front of the head between the eyes) . The Adersiinae have a divided tergite on the ninth abdominal segment , and the Sceptidinae have highly reduced mouthparts . Members of the family Pelecorhynchidae were initially included in the Tabanidae and moved into the Rhagionidae before being elevated into a separate family . The infraorder Tabanomorpha share the blood @-@ feeding habit as a common primitive character , although this is restricted to the female .

Two well @-@ known genera are the common horse @-@ flies , Tabanus , named by Swedish taxonomist Carl Linnaeus in 1758 , and the deer flies , Chrysops , named by the German entomologist Johann Wilhelm Meigen in 1802 . Meigen did pioneering research on flies and was the author of Die Fliegen (Flies) ; he gave the name Haematopota , blood @-@ drinker , to another common genus of horse @-@ flies .

= = Biology = =

= = Diet and biting behavior = =

Adult horse @-@ flies feed on nectar and plant exudates , and some are important pollinators of certain specialised flowers ; several South African and Asian species in the Pangoniinae have spectacularly long proboscises adapted for the extraction of nectar from flowers with long , narrow corolla tubes , such as Lapeirousia , and certain Pelargonium .

Both males and females engage in nectar feeding , but in addition to this , females of most species are anautogenous , meaning they require a blood meal before they are able to reproduce effectively . To obtain the blood , the females bite animals , including humans , while the males are harmless . It takes the female about six days to fully digest its blood meal and after that it needs to find another host . It seems that the flies are attracted to a potential victim by its movement , warmth , and surface texture , and by the carbon dioxide it breathes out . The flies mainly choose large mammals such as cattle , horses , camels , and deer , but few are species specific . They have also been observed feeding on smaller mammals , birds , lizards and turtles , and even on animals that have recently died . Because their bite is irritating to the victim , they are often brushed off , and may have to visit multiple hosts to obtain sufficient blood . This behaviour means that they may carry disease @-@ causing organisms from one host to another .

The mouthparts of females are of the usual Dipteran form and consist of a bundle of six chitinous stylets that , together with a fold of the flesh labium , form the proboscis . On either side of these are two maxillary palps . When the insect lands on an animal it grips the surface with its clawed feet , the labium is retracted , the head is thrust downwards and the stylets slice into the flesh . Some of these have sawing edges and muscles can move them from side @-@ to @-@ side to enlarge the wound . Saliva containing anticoagulant is injected into the wound to prevent clotting . The blood

that flows from the wound is lapped up by another mouthpart which functions as a sponge . Horsefly bites can be painful for a day or more ; fly saliva may provoke allergic reactions such as hives and difficulty with breathing . Tabanid bites can make life outdoors unpleasant for humans , and can reduce milk output in cattle . They are attracted by reflections from water which are polarized , making them a particular nuisance near swimming pools . Since tabanids prefer to be in sunshine , they normally avoid shaded places such as barns , and are inactive at night .

Attack patterns vary with species : clegs fly silently and prefers to bite humans on the wrist or bare leg ; large species of *Tabanus* buzz loudly , fly low , and bite ankles , legs or backs of knees ; *Chrysops* fly somewhat higher , bite the back of the neck , and have a high buzzing note . It has been suggested that the striped hides of zebras have evolved to reduce their attractiveness to horse @-@ flies and tsetse flies than either plain dark or plain white hides . The closer together the stripes , the fewer flies are visually attracted ; the zebra 's legs have particularly fine striping , and this is the shaded part of the body that is most likely to be bitten in other , unstriped equids . This does not preclude the possible use of stripes for other purposes such as signaling or camouflage .

= = = Predators and parasites = = =

The eggs of horse @-@ flies are often attacked by tiny parasitic wasps , and the larvae are consumed by birds as well as being parasitised by tachinid flies , fungi and nematodes . Adult horse @-@ flies are eaten by generalized predators such as birds , and some specialist predators , such as the horse guard wasp (a bembicinid wasp) , also preferentially attack horse @-@ flies , catching them to provision their nests .

= = = Reproduction = = =

Mating often occurs in swarms , generally at landmarks such as hilltops . The season and time of day , and type of landmark , used for mating swarms is specific to particular species .

Eggs are laid on stones or vegetation near water , in clusters of up to one thousand , especially on emergent water plants . The eggs are white at first but darken with age . They hatch after about six days , the emerging larvae using a special hatching spike to open the egg case . The larvae fall into the water or onto the moist ground below . *Chrysops* species develop in particularly wet locations while *Tabanus* species prefer drier places . The larvae are legless grubs , tapering at both ends . They have small heads and eleven or twelve segments and moult six to thirteen times over the course of up to a year or more . In temperate species , the larvae have a quiescent period during winter (diapause) while tropical species breed several times a year . In the majority of species they are white , but in some , they are greenish or brownish , and they often have dark bands on each segment . A respiratory siphon at the hind end allows the larvae to obtain air when submerged in water . Larvae of nearly all species are carnivorous , often cannibalistic in captivity , and consume worms , insect larvae , and arthropods . The larvae may be parasitized by nematodes , flies of the families *Bombyliidae* and *Tachinidae* ; and Hymenoptera in the family *Pteromalidae* . When fully developed , the larvae move into drier soil near the surface of the ground to pupate .

The pupae are brown and glossy , rounded at the head end and tapering at the other end . Wing and limb buds can be seen and each abdominal segment is fringed with short spines . After about two weeks , metamorphosis is complete , the pupal case splits along the thorax and the adult fly emerges . Males usually appear first , but when both sexes have emerged , mating takes place , courtship starting in the air and finishing on the ground . The female needs to feed on blood before depositing her egg mass .

= = = As disease vectors = = =

Tabanids are known vectors for some blood @-@ borne bacterial , viral , protozoan and worm diseases of mammals , such as the equine infectious anaemia virus and various species of *Trypanosoma* which cause diseases in animals and humans . Species of the genus *Chrysops*

transmit the parasitic filarial worm *Loa loa* between humans , and tabanids are known to transmit anthrax among cattle and sheep , and tularemia between rabbits and humans .

Blood loss is a common problem in some animals when large flies are abundant . There are anecdotal reports of horse @-@ fly bites leading to fatal anaphylaxis in humans , an extremely rare occurrence .

= = = Management = = =

Controlling horse @-@ flies is difficult . Malaise traps are most often used to capture them and these can be modified with the use of baits and attractants that include carbon dioxide or octenol . A dark shiny ball suspended below them that moves in the breeze can also attract them and forms a key part of a modified " Manitoba trap " that is used most often for trapping and sampling Tabanidae . Cattle can be treated with pour @-@ on pyrethroids which may repel the flies , and fitting them with insecticide impregnated ear tags or collars has had some success in killing the insects .

= = Horse @-@ fly bites = =

Humans find horse @-@ fly bites painful . There is usually a weal (raised area of skin) around the site and other symptoms may include urticaria (a rash) , dizziness , weakness , wheezing , and angioedema (a temporary itchy , pink or red swelling occurring around the eyes or lips) ; a few people experience an allergic reaction . The site of the bite should be washed and a cold compress applied . Scratching the wound should be avoided and an antihistamine preparation can be applied . In most cases , the symptoms subside within a few hours but if the wound becomes infected , medical advice should be sought .

= = In literature = =

The Ancient Greek playwright Aeschylus has a gadfly pursue and torment Io , a maiden associated with the moon , watched constantly by the eyes of the herdsman Argus , associated with all the stars : " Io : Ah ! Hah ! Again the prick , the stab of gadfly @-@ sting ! O earth , earth , hide , the hollow shape ? Argus ? that evil thing ? the hundred @-@ eyed . " William Shakespeare , inspired by Aeschylus , has Tom o 'Bedlam in *King Lear* , " Whom the foul fiend hath led through fire and through flame , through ford and whirlpool , o 'er bog and quagmire " , driven mad by the constant pursuit . In *Antony and Cleopatra* , Shakespeare likens Cleopatra 's hasty departure from the Actium battlefield to that of a cow chased by a gadfly : " The breeze [gadfly] upon her , like a cow in June / hoists sail and flies " , where " June " may allude not only to the month but also to the goddess Juno who torments Io ; and the cow in turn may allude to Io , who is changed into a cow in Ovid 's *Metamorphoses* .

The physician and naturalist Thomas Muffet wrote that the horse @-@ fly " carries before him a very hard , stiff , and well @-@ compacted sting , with which he strikes through the Oxe his hide ; he is in fashion like a great Fly , and forces the beasts for fear of him only to stand up to the belly in water , or else to betake themselves to wood sides , cool shades , and places where the wind blows through . " The " Blue Tail Fly " in the eponymous song was probably the mourning horse @-@ fly (*Tabanus atratus*) , a tabanid with a blue @-@ black abdomen common to the southeastern United States .