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Getah Virus in the Canadian Context

Getah virus (GETV) is an emerging vector-borne disease that primarily affects horses and pigs, but may cause disease in a variety of species. This Info-Sheet supplements the Getah Virus Fact Sheet by the Swine Health Information Center (SHIC, 2021) by summarizing the known competent GETV vectors within Canada and the viral host range. It provides additional information on Canada's vulnerability to the future GETV establishment.

Virus Characteristics and Distribution

GETV is an arbovirus, in the genus Alphavirus and family Togaviridae (**Figure 1**) (Lu et al., 2019; SHIC, 2021). It is part of the Old World alphaviruses, namely the Semliki Forest complex, which includes Chikungunya virus (CHIKV), Mayaro virus (MAYV), Ross River virus (RRV), and Sagiyama virus (SAGV), to name a few.

GETV was first detected in 1955 in Malaysia (Zhang et al., 2021), and since then it has been isolated from various mosquito vectors and host species across Eurasia and the Pan-pacific (Figure 2), including Australia (Rawle et al., 2020; Yuen at al., 2022), Cambodia (Chastel & Rageeu, 1966), China (Li et al., 1992; Li et al., 2019; Liu et al., 2019; Lu et al., 2019; Shi et al., 2022a; Yang et al., 2018), India (Brown & Timoney, 1998), Japan (Bannai et al., 2016; Kuwata et al., 2018; Nemoto et al., 2015), Malaysia (Sam et al., 2022), Mongolia (Lvov et al., 2000; Guryev et al., 2008), Philippines (Ksiazek et al., 1981), Russia (Guryev et al., 2008; Mitchell et al., 1993; Lvov et al., 2000), South Korea (Turell et al., 2003), Sri Lanka (Peiris et al., 1994), Thailand (Rattanatumhi et al., 2022, and Vietnam (Bryant et al., 2005).

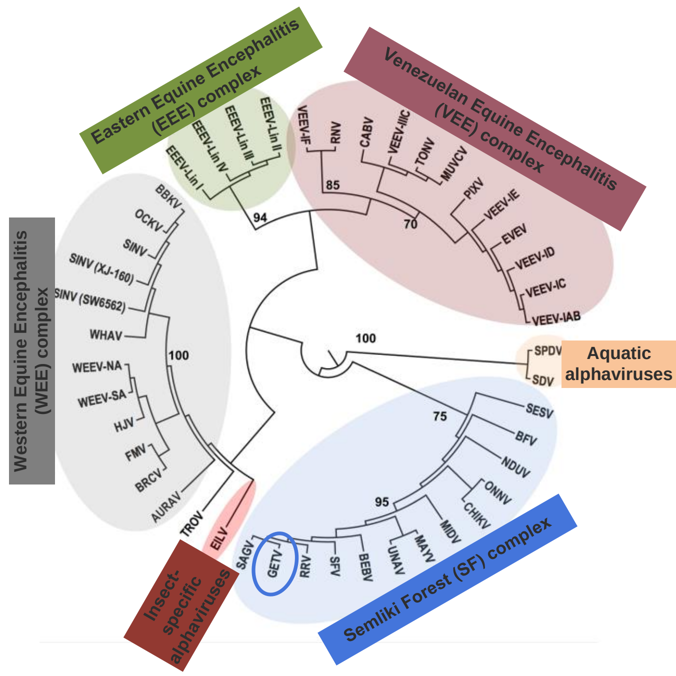


Figure 1 – Phylogenetic Tree of Togaviruses – GETV is part of the Old World alphaviruses in the Semliki Forest complex. New world viruses include VEE, EEE and WEE (Modified from Roundy et al., 2017).

Across this geographic area, four groups (I, II, III, and IV) of GETV have been identified (**Figure 2**). Group III has been found to be dominant, has been expanding its range since 1964, and is likely to continue to do so (Li et al., 2017), as it has spread from tropical to temperate regions (Li et al., 2017; Li et al., 2022). The virus has been isolated from various mosquito vectors as well as animal hosts, which may act as amplifiers[1] or reservoirs[2] of the virus. The other three viral groups have remained localized: Group I appears to be the oldest original GETV strain (isolated in Malaysia in 1955); Group II was isolated twice

[1] Amplifier – "The level of virus can become high enough that an insect vector such as a mosquito that feeds on it will probably become infectious." (Go, Balasuriya and Lee 2014)

[2] Reservoir – "Can harbor a virus indefinitely with no ill effects", "is the primary host of a virus and may be re-infected several times during their life." (Go, Balasuriya and Lee 2014)

in 1956 in Japan; and Group IV included four isolated strains in Thailand, China, Malaysia and Russia (Li et al., 2017).

Comparisons can be made between GETV and Japanese Encephalitis virus (JEV). Both are arboviruses and they have similar geographic ranges. The likely origin of JEV was the Malaysia/Indonesia region, which is where GETV was first detected (Zhang, Yu et al., 2021), and JEV has spread to similar countries throughout Asia (Centers for Disease Control and Prevention, 2023; Gao et al., 2013) where GETV has also been isolated (Li et al., 2022). JEV is a federally immediately notifiable disease in Canada whereas there are no notification requirements for GETV (Canadian Animal Health Surveillance System, 2020; Canadian Food Inspection Agency, 2021).

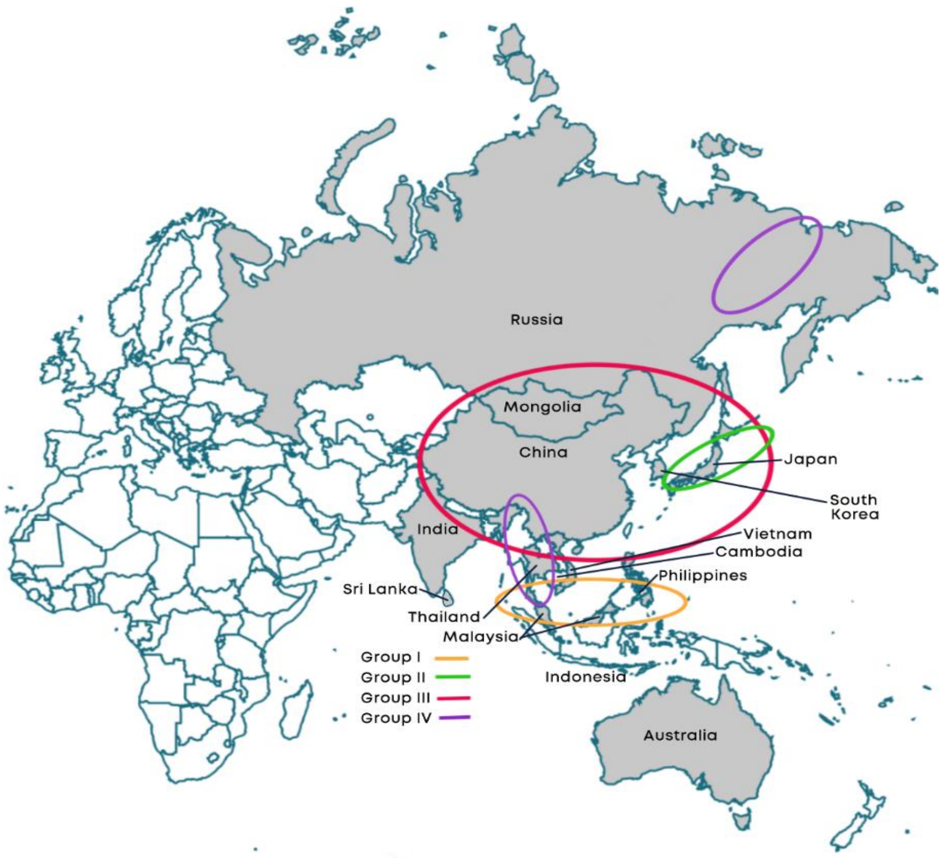


Figure 2 – Distribution of GETV – Highlighted countries where GETV has been isolated and circled areas showing distribution of GETV Groups I, II, III, and IV (Modified from Li et al., 2017; Li et al., 2022).

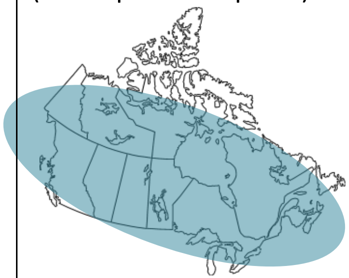
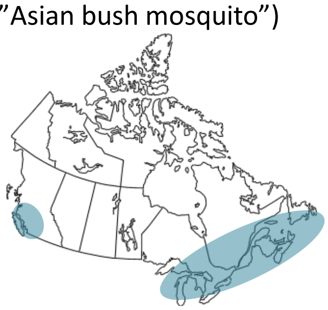
Competent GETV Vectors within Canada

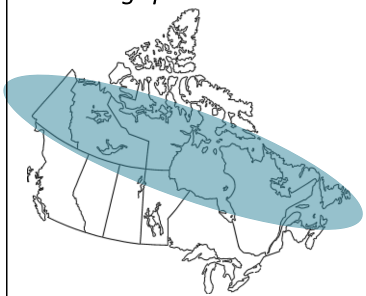
The introduction and establishment of exotic vector-borne pathogens into Canada's temperate climate is possible through various means such as travel, trade or (bird) migration (Ng et al., 2019; Shi et al., 2022b). GETV has demonstrated adaptability to various environments, spreading from tropical to temperate climates on the Eurasian continent (Li et al., 2022), even into cold artic regions of Russia and Mongolia (Lvov et al., 2000). Similarly, with a changing climate, the risk of mosquito-borne disease can also increase (Ludwig et al., 2019) as more competent mosquito species become established within Canada.

GETV is transmitted to animals through mosquito bites (Shi et al., 2022b), and has not been identified in Canada at this time. There are many mosquito species associated with the transmission of GETV, including those of genera *Culex*, *Anopheles* and *Aedes*, however, **Table 1** summarizes the competent GETV mosquito vector species (SHIC, 2021) that are present in parts of Canada with some believed to be in localized areas. Maps show the approximate range of distribution of these vectors within Canada.

Table 1 – Known competent GETV mosquito vectors (alphabetical order) in Canada[*]

Competent GETV Vectors	Known Presence in Canada and Additional Information
Aedes aegypti ("Yellow fever mosquito") 	• First detected and recorded in low numbers in Southern Ontario (Windsor) in 2016 (Giordano et al., 2020) and 2017 (Giordano et al., 2020; Lapierre 2018), including southern Quebec (St-Armand) in 2017 (Lapierre 2018; Ludwig et al., 2019) • Likely introduced through human activity (Giordano et al., 2020; Peach & Mathews, 2022) and adapts well in urban areas through breeding in water in natural settings and artificial containers (Lima et al., 2016) • Thought to be able to persist through winter in its larval form in warm microenvironments (Lima et al., 2016) • Projected range expansion into parts of southern Canada (Ontario, Quebec, including Canada's west coast) by mid to late 21st century based on climate models (Kamal et al., 2018; Khan et al., 2020)
Aedes albopictus ("Asian tiger mosquito") 	• Documented in Ontario, including Niagara region in 2001 (Thielman & Hunter, 2007), Toronto, Peel and Ottawa areas in 2005, Windsor in 2012 (Public Health Ontario, 2023), and found to be established in 2019 in Windsor following detection between 2016 and 2018 (Giordano et al., 2020), with specimens additionally found from 2019 to 2021 (Public Health Ontario, 2023) • Intercepted and destroyed in Washington state, close to the Canadian border (Moore, 1999) • Tendency to spread through human activity (Giordano et al., 2020; Peach & Matthews, 2022), such as through tires and other containers (Moore & Mitchell 1997), and can outcompete other mosquito species in the same breeding environment (Braks et al., 2004) • Overwintering may occur in the egg stage, but they do not survive below 0°C temperatures in larval, pupal or adult form, unless they seek shelter (Giordano et al., 2020) • Range expansion projected into parts of southern Canada by mid to late 21st century, but further north than *Ae. aegypti* (Kamal et al., 2018; Khan et al., 2020). For example, climate models predict *Ae. albopictus* could establish in southern parts of Canadian provinces by 2040 (Lowe et al., 2021), 2050 or 2080 (Khan et al., 2020), including Ontario, Quebec, Prairies, Canada's west coast and Maritimes (Kamal et al., 2018; Kraemer et al., 2019; Khan et al., 2020; Lowe et al., 2021)

Aedes communis (“snowpool mosquito”) 	• One of the most widely distributed species in the northern hemisphere (Ringrose et al., 2013) • Can be found throughout Canada (Ellis & Brust, 1973; Global Biodiversity Information Facility (GBIF) Secretariat, n.d.a; Statman, n.d.) as a dominant species of the Canadian shield and throughout the Boreal forest (Wood et al., 1979). • Additional sources indicating presence in the following provinces/territories: British Columbia (Peach, 2018), Northwest Territories (Government of Northwest Territories, n.d.a), Ontario (Ringrose et al., 2013), and Yukon (Peach et al., 2021)
Aedes excrucians (“Woodland snowmelt mosquito”) 	• Found throughout North America, south of the arctic tundra in Canada, in high numbers in forested areas (Wood et al., 1979; Crans, 2023) • Have been confirmed in all Canadian provinces and territories (Darsie & Ward 2005; GBIF Secretariat, n.d.b) • Additional sources indicating presence in the following provinces/territories: British Columbia (Peach, 2018), Northwest Territories (Government of Northwest Territories, n.d.b), Ontario (Ringrose et al., 2013), Yukon (Peach et al., 2021)
Aedes japonicus (Ochlerotatus japonicus or ”Asian bush mosquito”) 	• *Ae. japonicus japonicus*, one of four subspecies of *Ae. japonicus*, is found in North America (Kaufman & Fonseca, 2014). • Introduced in the United States (New Jersey and New York) in 1998 via used tire trade (Peyton et al., 1999) • *Ae. j. japonicus* was first discovered in Ontario (Niagara Region) in 2001 (Government of Canada, 2017; Thielman & Hunter, 2006), has spread over much of the continent, and is projected to continue spreading (Peach et al., 2019). • Known to be in British Columbia (Lower Mainland and southern Vancouver Island) (Jackson et al., 2016; Peach, 2018), Ontario (Cwinska, Hunter & Hebert, 2006; Dussault et al., 2018; Thielman & Hunter, 2006; Thielman & Hunter 2007), Quebec (Shahhosseini et al., 2020), Newfoundland (Fielden et al., 2015), New Brunswick (Edsall et al., 2010), and Nova Scotia (J. Ogden, pers. comm. as cited in Fielden et al., 2015 and Edsall et al., 2010). • Invasive characteristics include surviving in containers, dispersal over wide geographic area, cold winter temperatures, and eggs resistant to drying out (Shahhosseini et al., 2020) • Climate models predict northward range expansion of *Ae. j. japonicus* due to suitable habitats in Atlantic Canada, southern Ontario, and the Pacific Northwest by mid-21st century (Peach et al., 2019)

Aedes nigripes 	• *Aedes nigripes* is an arctic species due to its lower temperature thresholds of development (Haufe & Burgess, 1956). • Found in Nunavut, Yukon and Northwest Territories (Wood et al., 1979; Peach et al., 2021), northwestern British Columbia (Peach, 2018; Wood et al., 1979), northern parts of Manitoba (Haufe & Burgess, 1956; Wood et al., 1979), alpine regions of Quebec (Wood et al., 1979), and in Newfoundland and Labrador (Darsie & Ward, 2005; Wood et al., 1979). • In Ontario it has been recorded in Polar Bear Provincial Park (Cochrane, ON), the most southern edge of it distribution (Beresford, 2011)
Aedes vexans nipponii 	• *Ae. vexans* is found throughout Canada (GBIF Secretariat, n.d.c; Outammassine, Zouhair & Loqman, 2022) • Includes three geographically structured subspecies, one of which is *Aedes vexans nipponii* (Walter Reed Biosystematics Unit, 2021) • *Aedes vexans nipponii* was likely brought from Korea to the USA in 1999 (Cwinska, Hunter & Hebert, 2006), and has been found in British Columbia (Peach, 2018) and southern Ontario (Region of Peel, 2003). • No other sources were found describing distribution of the *Aedes vexans nipponii* subspecies in Canada, although it is predicted that *Ae. vexans* appears highly suitable to the climate of southeastern Canada with projected expansion to the Prairies by 2050 based on habitat suitability modelling under future climate conditions (Outammassine, Zouhair & Loqman, 2022)

*Additional resource for viewing maps of occurrences of various species: [Global Biodiversity Information Facility]

GETV Hosts

Studies have shown that GETV exhibits host adaptation and amplification in a broad range of hosts (Li et al., 2017; Shi et al., 2022b). Virus-infected animals serve as reservoirs or amplifying hosts from which uninfected mosquitoes can acquire the virus. Thus, GETV undergoes a mosquito–vertebrate host–mosquito cycle, similar to JEV (SHIC, 2021).

Due to their high susceptibility, some hosts are classified as amplifiers, including horses and pigs. (Bannai et al., 2017; Kumanomido et al., 1982; Kumanomido et al., 1988b; Kuwata et al., 2018). The very high levels of virus in these hosts results in infection of the mosquito vector when taking a blood meal (Kumanomido et al., 1988b). Like pigs, wild boars have also shown to spread GETV (Kuwata et al., 2018). Pigs have symptoms of fever, anorexia, ataxia, tremor, and reproductive disorders, including abortions (Izumida et al., 1988; Yago et al., 1987; Yang et al., 2018). Horses have similar symptoms of fever, rash, edema of the limbs, and lymphadenopathy (Fukunaga et al., 2000).

Beef cattle show a higher positive rate of neutralizing antibody compared to dairy cattle (Li et al., 2019). Cattle can become infected, though not all appear to show clinical symptoms (Liu et al 2019; Sanderson 1969). They appear to play a less important role in GETV ecology compared to horses and pigs, since GETV was only found in mosquitoes collected from pig pens and horse-baited stables, but not from those collected from cow sheds (Kumanomido et al., 1986). Positive rates of anti-GETV antibodies were also detected in sheep and goat specimens although at lower rates than those in horses, pigs, and cattle (Shi et al., 2022a).

Seroconversion of GETV has been shown in ducks and chickens, but at very low neutralizing antibody levels (Li et al., 2019). GETV antibodies were also detected in chicken and duck sera by hemagglutination-inhibition test in another study (Marchette et al., 1978). Other studies have shown no evidence of GETV infection in poultry sera (Chung 1973), and GETV was not detected in chicken embryos inoculated with the virus nor could the virus be isolated from newly hatched chicks (Chung, 1969). However, chicks inoculated with a close GETV subtype, Sagiyama virus (Centers for Disease Control and Prevention, n.d.; National Library of Medicine. n.d.), did demonstrate viremia (Scherer et al., 1962b).

Regarding wild birds, older studies investigating Sagiyama virus have shown that herons and egrets have antibodies (Scherer et al., 1962a). GETV antibodies were also detected in sera collected from birds (yellow-vented bulbul (*Pycnonotus goiavier*), little spiderhunter (*Arachnothera longirostra*), and chestnut-rumped babbler (*Stachyris maculata*)) in the Peninsular Malaysia (Marchette et al., 1978). One study speculates that bird migrations along a flyway and large quantities of mosquitoes at the roosting sites may have enabled a strain of GETV to spread over long distances (Sam et al., 2022). This is similar to JEV, which appears to be potentially transmitted through migratory birds that further distribute the virus (Bae et al., 2018; Mackenzie, Gubler & Petersen, 2004).

Healthy asymptomatic humans have been found to be seropositive. However, some people with unexplained febrile illness were found to have a significantly higher GETV antibody levels compared to apparently healthy humans (Li etal.,1992). Nevertheless, "as of 2022, no cases have been reported of human disease from GETV" (Li et al., 2022).

With detection of GETV antibodies in a variety of domestic animals, it is believed that domestic animals (primarily pigs, horses, but also cattle, sheep, and goats) are the main amplifying hosts of GETV (Li et al., 1992; Fukanaga et al., 2000; Shi et al., 2022a) compared to wild animals, which exhibit subclinical disease (SHIC, 2021). Vaccines against GETV are available and can prevent disease (United States Animal Health Association, 2008). **Table 2** provides a summary of various GETV studies of both domestic and wild animal species, and identifies if the species underwent experimental infection, had clinical signs or showed evidence of seroconversion (GETV antibodies detected).

Table 2 – Study findings showing infection spectrum in laboratory studies and in domestic animals and wildlife species (listed in alphabetical order in each section)

Species	Infection Spectrum	Study Finding* (study location in parentheses)	Reference
Humans	Seroconversion†	No human clinical disease cases reported as of 2022; evidence of seroconversion found using complement fixation (CF) test.	(Li et al., 2022)
		Antibodies against GETV detected in serum from healthy people and from individuals with unknown cause of fever using CF and neutralization tests (China)	(Li et al., 1992)
		Human serum reacted to GETV by neutralization and hemagglutination-inhibition (HI) test (Australia)	(Doherty et al., 1966)
		GETV antibodies detected in serum by HI test in healthy humans as well as in patients with unknown cause of febrile illness (Peninsular Malaysia)	(Marchette et al., 1980)
Laboratory Studies			
Chickens	Clinical signs and viremia	Chicks inoculated with a close GETV subtype, Sagiyama virus‡, demonstrated viremia, a few deaths occurred in chicks with or without illness, and some strains killed embryos; virus was isolated from tissues of the embryo and yolk sac	(Scherer et al., 1962b)
	No viral propagation	GETV was not detected in chicken embryos inoculated with the virus nor could the virus be isolated from chicks newly hatched from infected eggs	(Chung, 1969)
Guinea Pigs	Viremia and vertical transmission	Transplacental infection with GETV; virus was detected in fetuses and placentas from a few pregnant inoculated specimens, but not recovered from mummified fetuses from another specimen; GETV recovered from some maternal organs	(Asai et al., 1991)
Hamsters	Viremia and vertical transmission	Transplacental infection with GETV in pregnant hamsters depending on inoculation date with GETV detected in fetuses and placentas, including dead fetuses upon delivery; high levels of GETV also recovered from maternal organs	(Asai et al., 1991)
Mice	Clinical signs and seroconversion	Experimental infection with signs of illness (prostration and paralysis of hind limbs) followed by death; antigen was identified by HI test in brains of ill mice and inoculated in mice that developed GETV antibody	(Li et al., 1992)
	Clinical signs, viremia, and	Transplacental transmission of pregnant mice inoculated with GETV (and demonstrated viremia) resulted in delivery of dead young, decrease in litter size, number born alive and survival rate depending on day of inoculation	(Kumanomido et al., 1988a)

	vertical transmission		
Rabbits	Viremia and vertical transmission	Transplacental infection with GETV where virus was isolated in some fetuses and placentas from some inoculated pregnant specimens	(Asai et al., 1991)
Domestic Animal Findings			
Cattle	Clinical signs and seroconversion	GETV RNA and neutralizing antibodies detected in blood samples of infected beef cattle in forest grazing areas; not all cattle appeared to show clinical symptoms (e.g., fever, loss of appetite, depression) (China)	(Liu et al., 2019)
	Seroconversion	Serological survey of GETV showed positive rates of neutralizing antibodies in whole blood samples of dairy and beef cattle; positivity rates were much higher in beef than in dairy cattle, and antibody levels for dairy were low compared to beef cattle, which suggests a different response to GETV infection among subspecies (China)	(Li et al., 2019)
		Serological survey of arthropod-borne viruses finds antibodies (via neutralization test) against GETV in cattle greater than two years of age (Japan)	(Miura et al., 1980)
		A single seropositive case of GETV was reported in a cow using the HI test (Indonesia)	(Miura et al., 1982)
		ELISA and neutralizing tests on serum samples from cattle resulted in detection of anti-GETV antibodies and low levels of neutralizing antibodies; no GETV RNA was detected (China)	(Shi et al., 2022a)
Chickens and ducks	Mixed evidence of seroconversion	Serological survey of GETV showed low positive rates of GETV neutralizing antibody in chicken and duck whole blood samples compared to pigs and cattle (the positive rate for ducks was slightly higher than for chickens); findings were similar with low GETV neutralizing antibody levels detected (China)	(Li et al., 2019)
		Antibody survey conducted found no evidence of infection with GETV upon examination of poultry serum; low level HI reactions to GETV (Australia)	(Chung, 1973)
		Antibodies to GETV detected in serum of domestic fowl by HI test, but not by neutralization, "and were considered to contain a non-antibody inhibitor unrelated to previous infection" (Australia)	(Doherty et al., 1966)
		GETV antibody detected in chicken and duck serum by HI test; two-thirds of chicken samples also exhibited neutralizing antibodies (Peninsular Malaysia)	Marchette et al., 1978)

Goats and sheep	Seroconversion	Neutralizing antibody against GETV found in serum from black goats using CF test (China)	(Li et al., 1992)
		ELISA and neutralizing tests on serum samples from adult sheep and goat resulted in detection of anti-GETV antibodies and low levels of neutralizing antibodies; no GETV RNA was detected (China)	(Shi et al., 2022a)
		Sheep found to have antibodies to GETV in serum by HI and neutralization tests (Australia)	(Doherty et al., 1966)
		GETV antibody detected in serum by HI test (Peninsular Malaysia)	(Marchette et al., 1978)
Dogs	Seroconversion	HI test results for GETV confirmed by neutralization test in serum (Australia)	(Doherty et al., 1966)
Horses	Clinical signs and seroconversion	Disease outbreak on thoroughbred farm; seropositive with signs of disease, including depression, anorexia, fever, limb oedema and lymphocytopenia); Seroprevalence in thoroughbred population determined by microneutralization test (India)	(Brown & Timoney, 1998)
		Disease outbreak among racehorses, some of which were vaccinated, some showing signs of febrile illness, edema in their legs, rashes on their bodies; GETV RNA extracted and antibodies detected by neutralization test (Japan)	(Nemoto et al., 2015)
	Clinical signs	GETV RNA positive results in a racehorse with sudden onset of fever not vaccinated against GETV (China)	(Lu et al., 2019)
	Seroconversion	GETV antibodies detected in both horses and mules tested by neutralization test (China)	(Li et al., 1992)
	<u>Additional information sources</u>	• Getah virus as an Equine Pathogen • A 2015 outbreak of Getah virus infection occurring among Japanese racehorses sequentially to an outbreak in 2014 at the same site • Seroconversion of anti-Getah virus antibody among Japanese native Noma horses around 2012 • Effect of viral inoculum size on appearance of clinical signs in equine Getah virus infection • Molecular and serological surveillance of Getah virus in the Xinjiang Uygur Autonomous Region, China, 2017–2020	(Fukunaga et al., 2000) (Bannai et al., 2016) (Takeishi et al., 2022) (Kamada et al., 1991) (Shi et al., 2022a)
Pigs	Clinical signs, vertical transmission,	GETV outbreak resulted in stillbirths and death of piglets 5-10 days following birth as well as fever, anorexia, ataxia and tremor; evidence of	(Yang et al., 2018)

	and seroconversion	transplacental transmission of GETV, and serological investigation in pigs found antibodies (via neutralization test) against GETV (China)	
	Clinical signs and seroconversion	Newborn piglets showing clinical symptoms (depression, tremor, diarrhea) with some fatalities and the sow showing no clinical signs; the sow and surviving piglets were positive for neutralizing antibodies	(Yago et al., 1987)
	Seroconversion	Seropositive and relatively high seroprevalence (based on ELISA) in young and old pigs compared to pigs in finishing stage (Thailand)	(Rattanatumhi et al., 2022)
		Antibodies against GETV serum samples collected from one-year-old healthy pigs detected by neutralization and CF tests (China)	(Li et al., 1992)
		Serological survey of GETV showed positive rates of neutralizing antibodies in whole blood samples (China)	(Li et al., 2019)
	Additional information sources	• Clinical and virological observations on swine experimentally infected with Getah virus • Geospatial and temporal associations of Getah virus circulation among pigs and horses around the perimeter of outbreaks in Japanese racehorses in 2014 and 2015 • Experimental Infection of Getah Virus in Swine • Molecular and serological surveillance of Getah virus in the Xinjiang Uygur Autonomous Region, China, 2017–2020	(Kumnaomido et al., 1988) (Bannai et al., 2017) (Izumida et al., 1988) (Shi et al., 2022a)
 Water Buffalo	Seroconversion	GETV antibody was detected in serum by HI test (Peninsular Malaysia)	(Marchette et al., 1978)
Wildlife Species Findings			
 Blue foxes	Clinical signs and seroconversion	Variable levels of antibodies were detected by neutralization test in ill foxes, and GETV RNA found in dead foxes were closely related phylogenetically to a highly pathogenic strain in swine; symptoms in foxes included fever, anorexia, depression, (China)	(Shi et al., 2019)
 Marsupials (kangaroos, wallabies, bandicoots)	Seroconversion	Antibodies to GETV detected in serum by neutralization or HI test, but bandicoot serum only reacted to GETV by HI test (Australia); no disease recorded	(Doherty et al., 1966; United States Animal Health Association, 2008)
 Monkey	Seroconversion	GETV neutralizing antibody was present in most of the serum samples where HI antibodies were detected (Peninsular Malaysia)	(Marchette et al., 1978)

Red panda	Clinical signs with coinfection	Two novel strains of GETV detected in a dead red panda (some also positive for red panda amdoparvoviruses) closely related to three strains from pigs in same province (China)	(Zhao et al., 2022)
Reptiles (lizards, snakes	Seroconversion	Antibodies detected (test not indicated) in reptiles, but no sign of illness (country not indicated)	(United States Animal Health Association, 2008)
		HI test detected GETV antibody in serum of monitor lizards and snakes (Peninsular Malaysia)	(Marchette et al., 1978)
Wild birds	Seroconversion	Antibodies detected (test not indicated), but no sign of illness (bird type and country not indicated)	(United States Animal Health Association, 2008)
		Wild duck serum was tested by HI as having antibodies to GETV (Australia)	(Doherty et al., 1966)
		Sagiyama virus[†] neutralizing antibodies found in some blood of black-crowned night herons, but not clearly in egrets except the cattle egret (Japan)	(Scherer et al., 1962a)
		GETV antibody was detected by HI test in serum of various birds (Peninsular Malaysia)	(Marchette et al., 1978)
Wild boars	Seroconversion	Wild boars were positive for GETV antibodies (by neutralization test and ELISA) and likely resulted in a GETV outbreak in vaccinated horses (Japan)	(Kuwata et al., 2018)
Additional species	Seroconversion	GETV antibody was detected by HI test in serum of a bat (very low percentage where antibody was detected), musangs, canopy squirrels, and rats; neutralizing antibody detected in one of two HI-positive musangs, but not in HI-positive rats, and insufficient amount of sera to conduct neutralization test for bats and canopy squirrels (Peninsular Malaysia)	(Marchette et al., 1978)

[*]Various serological tests exist that can identify antibodies or antigens in the blood serum, including complement fixation, enzyme-linked immunosorbent assay (ELISA), hemagglutination-inhibition test, or neutralization test. Similar viruses (e.g., GETV, Ross River, Chikungunya, Bebaru) may result in cross-reaction in antibody tests (Doherty et al., 1966; Marchette et al., 1978).

[†]Seroconversion suggests there is evidence of an immune response; the study did not always state or it was not always clear if there were clinical signs of disease in the animal studied

[‡]Sagiyama virus, a close GETV subtype (Centers for Disease Control and Prevention, n.d.; National Library of Medicine. n.d.)

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