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Research Article

The Identification of Ticks That Have the Potential to Transmit Diseases To Human (Ticks Borne Diseases) that Infested Sumatran Tiger (*Panthera tigris sumatrae*) in West Sumatera Province

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A B S T R A C T

The Sumatran tiger (Panthera tigris sumatrae) is endemic to the island of Sumatera. Ticks-borne diseases are diseases caused by bacteria, viruses and other parasites carried by intermediary animals, namely insects (Arthropods) especially ticks. We aimed to focus on identifying the ticks parasitizing Sumatran tigers (*Panthera tigris sumatrae*) from Pasaman based on morphological analysis. The taxonomic identification of ticks collected from *Panthera tigris sumatrae* was performed based on the morphology of adults with loupe and microscope at a magnification of 10 x 40. We revealed three species of ticks including, *Amblyomma javanense*, *Haemaphysalis bispinosa*, *Haemaphysalis wellingtoni*. All three species are known to feed on humans and appear to have established populations within Indonesia. Three spesies of ticks in Sumatran tigers (*Panthera tigris sumatrae*) from Pasaman were found. The recent detection of ticks in Indonesia highlights the need for more extensive research into these parasites and potential disease vectors, both within the island nation and across Asia more broadly.

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INTRODUCTION

The Sumatran tiger (*Panthera tigris sumatrae*) is endemic to the island of Sumatera, having the smallest average body size among the extant tiger subspecies [1]. Male Sumatran tigers have a body weight of ±120 kg and an average length from head to tail of 240 cm. Meanwhile, females weigh ±90 kg and have an average length from head to tail of 220 cm [1]. The Sumatran tiger is categorized into the Critically Endangered category, which means it is very critical and is threatened with extinction by the conservation agency International Union for Conservation of Nature (IUCN) [2]. IUCN is an institution that regulates wildlife trade.

There are 3 factors that cause the decline in wild animal populations, namely habitat damage due to deforestation and encroachment, ongoing illegal hunting and disease factors. One of the causes of disease in Sumatran tigers is caused by parasites. Parasitic diseases in tigers (zoonosis) can also be transmitted to humans through arthropod bites (vector borne disease). One of the arthropods that can transmit parasitic diseases from tigers to humans is ticks.

Ticks-borne diseases are diseases caused by bacteria, viruses and other parasites carried by intermediary animals, namely insects (Arthropods) especially ticks. One potential vector in wild animals is ticks and the infection they transmit is called rickettsia [3]. Spotted fever group rickettsioses comprises a large group of zoonotic infections caused by Rickettsia and transmitted by ticks, fleas, and mites. Rickettsia infection is a spotted fever group and infects humans consisting of Rocky Mountain spotted fever, Boutonneuse fever, African tick bite fever, North Asian tick typhus, Lymphangitis rickettsioses, Queensland tick typhus, Flinders Island spotted fever, Japanese spotted fever, Tick-borne lymphadenopathy, Far Eastern spotted fever, Flea-borne spotted fever, and Rickettsialpox[4][5]. Rickettsia is a neglected and dangerous vector-borne zoonoses and has been reported to be the second most common cause of non-malarial fever in Southeast Asia after dengue infection[6][3]. Rickettsia infection also has the same symptoms as leptospirosis, dengue or Salmonella typhi infection [7]. This causes miss-diagnosis which causes treatment errors and leads to death[8]. It is estimated that more than one million cases of rickettsia occur each year and one billion people are at risk of infection worldwide[9]. Spotted fever group rickettsia is the most virulent human infection, especially Rocky Mountain Spotted Fever (RMSF) with a case fatality rate (CFR) of 25–80%[10]. The seroprevalence of scrub typhus rickettsia in Asia ranges from 9.3 –27.9%[11]. Ticks include blood-sucking arthropods in reptiles, birds and mammals including humans. This animal has hard chitin skin, the larvae have three pairs of legs, while the nymphs and adults have four pairs of legs, all stages require blood for growth and reproduction, the non-parasitic period lives in the wild and can survive without food[12].

The existence of human-wildlife conflict is a big opportunity for vectors, especially ticks, to move or obtain new hosts from animals to humans[13]. This is because wild animals also carry tick vectors attached to their entire bodies and most ticks have a multihost life cycle involving more than three hosts at each stage. In addition, there is a tendency for ticks to fall to the ground if the condition of the host's body for a long time makes it impossible to live with. (death/exposed to acaricides) and stick to grass to wait for a new host, which has great potential for humans as a new host[14]. Disease vectors such as ticks are often found freely in nature, but can also be found in residential areas. Therefore, ticks are a potential vector for rickettsia infection in residential areas that come into contact with wild animals, either from hunting activities because they disrupt agricultural activities or when wild animals enter residential areas.

Several studies of the types of ticks found on tigers in various countries, including research conducted by Kumar et. al (2018) in India found one type of tick on a tiger (*Panthera tigris*), namely *Haemaphysalis* (Kaiseriana) *bispinosa Neumann* [15]. Currently research on rickettsia in Indonesia has begun to be carried out, rickettsia of the Murine typhus type which infests mice with infectious vectors in the form of fleas, mites and ticks spread across Java, Sumatera, Sulawesi and Kalimantan.

Based on the explanation above, it is necessary to identify ticks on Sumatran tigers in conflict with humans found in Pasaman by microscopic examination. This examination was carried out because the Sumatran tiger can be used as a model to study the types of ticks on its body and the potential for the ticks themselves to transmit disease agents to humans. Apart from that, the results of this research can also be used as a reference for the potential spread of zoonotic vectors in Sumatran tigers.

METHOD

Research Design

This study was observational qualitative research where researchers describe the diversity of ticks based on morphological identification using a microscope and adjusted to the identification key book

Time and Setting

This research was conducted in Pasaman, West Sumatera. Data collection in April-May 2024.

Population and Sample

The research material is in the form of ectoparasite vectors collected directly from wild animals that enter settlements from several areas in West Sumatera. The selection of conflict animals was carried out by chance (Accidental sampling) when collectors found wild animals that had entered residential areas either dead due to the actions of hunters or living entangled in snares made by local people and reported by residents or to the BKSDA.

Instrument

The tools used in taking samples for this research include gloves, tweezers, masks, sample bottles, microscopes, digital cameras, writing instruments, 70% alcohol. Vector collection is done manually using tweezers, making it easier to remove the hypostome so that it is not left behind when the tick sucks on the animal's body. Vector samples are taken from several parts of the animal's body in sequence starting from the head, neck, back, stomach or abdomen, groin, legs and tail of the animal found. Samples are taken and collected and put into a bottle containing 70% alcohol and the sample bottle is labeled with the animal number, gender and body part of the animal.

Collecting the sample

Vector samples collected in labeled bottles are stored in a freezer or cool box if they are not immediately identified. Then the nymph stage sample to be identified is placed on an object glass covered with a cover glass and observed using a stereo microscope or compound microscope at a magnification of 10 x 40. The observation results are adjusted to the identification key (16)(17), while for large samples observations are made using loop/magnifying glass (loupe) at the Kinantan Wildlife and Cultural Park laboratory, Bukittinggi, West Sumatera.

Data analysis

After all the data has been collected, it continues with examination correct and repair existing equipment. Data from microscope result for the ticks ectopparasite then saved as a database in Microsoft Excel 2010 program.

RESULT AND DISCUSSION

The existence of human-wildlife conflict is a big opportunity for vectors, especially ticks. The record of *Panthera tigris sumatrae* infestation by ticks presented in this study represents the first from Indonesia. Tick hosts that have been previously reported in Indonesia include *Amblyomma javanense* infested lizards (Varanus salvator) [16], *Dermacentor auratus* and *Haemaphysalis bispinosa* infested Moa buffalo (Bubalus bubalis)[17], *Haemaphysalis bispinosa* infested cattle, [18]), *Ixodes cordifer* infested cuscus [19], and *Rhipicephalus sanguineus* infested dogs [20].

The ticks collected from Sumatran tigers in Pasaman were correctly identified as Haemaphysalis sp. according to their morphological characters using specific taxonomic keys. Briefly, the unique character of Haemaphysalis ticks is their second segment of palps that were laterally produced beyond the basis capituli (Fig. 1). Their eyes are lacking, festoons are present, no ornamentation on scutum and possessed a distinct anal groove embracing the anus posteriorly (Fig. 1).

Figure 1. External morphological characteristics of adult male Haemaphysalis ticks on dorsal (left) and ventral (right) view.

The male of H. bispinosa had an average length of 1.96±0.21 mm and a width of 1.14±0.08 mm. The ticks had a short cervical groove and lateral grooves starting from the center of the idiosome to the posterior, evenly distributed and numerous punctations, the genital aperture parallel to coxa II, and the anal opening opposite to the oval-shaped spiracles. In addition, the ticks had long and thick legs as well as dentition (4/4) with 8 teeth per file. The female ticks had an oval-shaped body, a capitulum of which the length and width were almost the same, a short hypostome, dentition 4/4 with 8 teeth per file, a deep cervical groove, evenly distributed and very numerous punctations, and a genital aperture located between the anterior border of coxa III, festoons of which the length and width were almost the same. However, the festoons in the engorged females were not visible because the bodies were enlarged [18].

Among the three Haemaphysalis species newly detected in Indonesia, H.bispinosa is of particular interest as it has long been considered an exotic species on the Southeast Asia,but native to India. Although this is the first time H.bispinosa has been officially reported from *Panthera tigrIs sumatrae*, ,historical specimens held in Java especially cattle, indicate that this species was present in Indonesia [21].

The females of the *Haemaphysalis wellingtoni* had the following combination of characters 4/4 dentition, scutum longer than wide, retroverted spur extending from posterodorsal edge of palpal article III (internal), short, and blunt cornuae. The males of *Haemaphyalis wellingtoni* had medium sized blunt cornuae, small, blunt, posteronternally directed spur on dorsal surface of palpal article III, lateral grooves on conscutum, 4/4 dentition throughout most of hypostome [22].

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Figure 3. External morphological characteristics of adult male ticks on dorsal *Haemaphysalis wellingtoni* (left) and ventral (right) view.

To inform public health policy and biosurveillence, it is crucial to understand the potential zoonotic risk posed by ticks, including the three newly detected Haemaphysalis specieses and *Amblyomma*. Although the authors have seen no cases of this species infesting humans in Indonesia, local cases of human infestation may emerge in the future. This is particularly likely given the propensity of this species to infest wild life and can contact with human too or ticks infest human directly. Pathogenic bacterial genera have been detected in H. bispinosa in the region, including Rickettsia [23] and Bartonella [24]. H. wellingtoni has been recorded feeding on humans, this appears to occur more rarely than H. bispinosa [25]. Surveillance of ticks and tick-borne diseases is crucial for safeguarding public health in Indonesia. The recent ticks morphological identifcation of H. bispinosa, H. wellingtoni in Indonesia highlights the need for more extensive research into these parasites and potential disease vectors, both within the island nation and across Asia more broadly. Expanded research into Singapore’s tick fauna should not only focus on their microbiomes, but also their ecologies, as understanding their life histories and habitat needs is key to predicting and mitigating future disease spillover.

The third species was *Amblyomma javanense*. Morphological characterization identified all specimens to be *Amblyomma javanense* which belongs to the family of hard ticks (Ixodidae). Morphological characterization was undertaken based on the combination of some specific characters such as festoons, wide- rounded and blunt spurs on coxae, inornate scutum, and dentition formulae (fig. 3).

Figure 3. External morphological characteristics of adult male Amblyomma ticks on dorsal (left) and ventral (right) view.

The inornate scutum in males was expanded to the whole body. inornate scutum in females covered 1/3rd of its body. The scutum was present and covered 2/3 of its body. Two sub equal separated blunt spurs presented at 1st coxae, short blunt spur present at II and III coxae, short pointed spur presented at IV coxae. The anal ridge and groove were present on the ventral side of the body, and the genital aperture was present at the level of 2nd coxae. Total 13 festoons were present of which the first festoon was broadest. Adult ticks had hypostome with 3/3 dentition formulae, while the denti tion in nymphs was 2/2 with eight teeth file [26].

Amblyomma javanense was also potential vector for zoonotic disease especially infested human. A Jingmen tick virus (JMTV) strain was isolated from the tick Amblyomma *javanense* into an embryo-derived tick cell line in China. it was able to accumulate in salivary glands of experimentally infected *Amblyomma javanense* [27].

CONCLUSION

Three species of ticks from Sumatran Tiger (*Panthera tigris sumatrae*) were recorded from Pasaman, West Sumatera, Indonesia suggesting the contribution of wild life for tick abundance and prevalence in the tick fauna of this region. Haemaphysalis wellingtoni was common among the human and the large carnivores. The data presented will be helpful for designing ticks and tick-borne disease control programs in this region of the country.

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