

Identification and antibiotic resistance patterns of *Klebsiella* sp. isolated from the feces of Bornean Orangutans (*Pongo pygmaeus*) at Taman Safari Indonesia, Bogor

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ABSTRACT: Orangutans are the only great apes that still survive in the Southeast Asian Region. However, their population in the wild habitat continues to decline, with estimates indicating a 50% decreased over the last 60 years. There is limited microbiological data on the antibiotic resistance of *Klebsiella* sp. in the feces of Bornean Orangutan (*Pongo pygmaeus*). This study aimed to identify the presence of *Klebsiella* sp. and assess its resistance pattern to various antibiotics in the feces of Bornean Orangutans. The research involved isolation, identification, and antibiotic resistance testing. Results showed that three isolates (37.5%) were positive for *Klebsiella* sp. Sensitivity test revealed two distinct resistance patterns among *Klebsiella* sp. isolates from the feces of healthy *P. pygmaeus* in Taman Safari Indonesia, Bogor. These isolates exhibited resistance to β -lactam antibiotics but remained sensitive to aminoglycoside, tetracycline, and fluoroquinolone antibiotics.

Keywords:

antibiotics, *Klebsiella* sp., *Pongo pygmaeus*, resistance

■ INTRODUCTION

Orangutans (*Pongo* sp.) are the only surviving great apes in Southeast Asia (Prayogo *et al.* 2014). In Indonesia, they are found exclusively in Sumatra and Kalimantan. Threats such as deforestation, poaching, and low viability have caused the Orangutan population to continue declining. This significant decline has led to their classification as an Appendix I species by CITES (Convention on International Trade of Endangered Species of Fauna and Flora), indicating they are protected and designated as endangered by the IUCN (International Union for Conservation of Nature) (Syahputra 2019). In addition to these factors, health issues, particularly gastrointestinal disorders, also contribute to the decline of Orangutan populations. *Klebsiella* sp., an opportunistic pathogen in the gastrointestinal tract of animals and humans, is a common source of infection, along with *Escherichia coli*, *Pseudomonas* sp., and *Campylobacter* sp. (Wibowo *et al.* 2016). Currently, bacterial infections are typically treated with antibiotics. This study aimed to identify the presence of *Klebsiella* sp. in the feces of Bornean Orangutans (*P. pygmaeus*) and determine their resistance patterns to various antibiotics.

■ MATERIAL AND METHOD

Fecal samples were collected from eight Bornean Orangutans (*P. pygmaeus*) at Taman Safari Indonesia, Bogor. These samples were used for bacterial isolation and identification, and for testing antibiotic sensitivity using tetracycline, gentamicin, ampicillin, ciprofloxacin, ceftazidime, and cefotaxime discs. The antibiotic sensitivity test was conducted using the Kirby-Bauer agar disc diffusion method. The results were interpreted according to the Clinical Laboratory Standards Institute (CLSI) M100 2021 guidelines.

■ RESULT AND DISCUSSION

The results of the antibiotic resistance test for the three isolates are presented in Table 1. Eight fecal samples from Bornean orangutans were analyzed, and three colonies exhibiting the morphology of *Klebsiella* species were identified. Gram staining revealed the presence of Gram-

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negative bacilli, and biochemical tests confirmed these samples as *Klebsiella* species. According to the literature (Boone *et al.* 2001; Singh *et al.* 2016), the characteristics of bacteria in isolates 1 and 2 correspond to *K. oxytoca*, while isolate 3 corresponds to *K. pneumoniae*.

Table 1. Percentage of antibiotic resistance in *Klebsiella* sp.

Antibiotic	Average zone of inhibition (mm)			No. of Isolate		
	1	2	3	S	I	R
Ampicillin	6.0 (R)	6.7 (R)	6.0 (R)	0	0	3
Gentamycin	15.6 (S)	12.3 (R)	15.6 (S)	2	0	1
Tetracycline	25.0 (S)	7.7 (R)	25.7 (S)	2	0	1
Ciprofloxacin	27.0 (S)	17.7 (R)	27.3 (S)	2	0	1
Ceftazidime	23.0 (S)	17.3 (R)	25.0 (S)	2	0	1
Cefotaxime	24.3 (I)	6.0 (R)	25.0 (I)	0	2	1

Note: S: Sensitive; I: Intermediate; R: Resistant

In this study, two distinct resistance patterns were observed. Isolates 1 and 3 remained sensitive to gentamicin, tetracycline, ciprofloxacin, and ceftazidime; showed intermediate sensitivity to cefotaxime; and were resistant to ampicillin. Isolate 3 demonstrated resistance to all evaluated antibiotics, categorizing it as multidrug-resistant (MDR), which refers to bacteria resistant to three or more classes of antibiotics (Magiorakos *et al.* 2012). The high resistance to several antibiotics, especially ampicillin, is noteworthy, as the *P. pygmaeus* samples in this study had never been treated with antibiotics.

Resistance can be acquired through gene transfer from bacteria present in the environment (Wyres & Holt 2018), suggesting that the *Klebsiella* sp. in this study may have acquired resistance traits from environmental sources. This aligns with literature (Baron *et al.* 2021; Larsson & Flach 2022) stating that environmental factors play a crucial role in the incidence of antibiotic resistance. Both biotic and abiotic factors in the environment not only help bacteria survive but also contribute to the development of antibiotic resistance.

CONCLUSION

This study revealed the presence of multidrug-resistant *Klebsiella* sp. isolates in Bornean orangutans. Two

distinct resistance patterns were identified, demonstrating variations in sensitivity and resistance to several antibiotics. *Klebsiella* sp. exhibited resistance to β -lactam antibiotics while remaining sensitive to aminoglycoside, tetracycline, and fluoroquinolone antibiotics.

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