



22

CITROBACTER, EDWARDSIELLA, ENTEROBACTER AND SERRATIA

22.1 INTRODUCTION

These are members of Enterobacteriaceae. They are gram negative bacilli, motile with peritrichous flagella, non-sporing, non-acid fast. They are oxidase negative, catalase positive and reduce nitrates to nitrites. They are considered as environmental contaminants and normally isolated from soil, water and faeces of man and animals.



OBJECTIVE

After reading this lesson, you will be able to:

- describe characteristics of Citrobacter, Edwardsiella, Enterobacter, and Serratia
- describe pathogenicity of Citrobacter, Edwardsiella, Enterobacter, and Serratia.
- differentiate between Citrobacter, Edwardsiella, Enterobacter, and Serratia.

22.2 CITROBACTER

It belongs to tribe Citrobacteriaceae of Enterobacteriaceae family. Members of this genus are motile, grow well on ordinary media producing smooth, convex, non pigmented 2-3 mm colonies. On MacConkey agar they form pale to pink coloured colonies due to fermentation of lactose which can be late. Capsule may be present. Genus has three species: *C.freundii*, *C.koseri*, and *C.amalonicus*. They are indole positive except *C.freundii*, MR positive, VP negative, Citrate

MODULE

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Notes

Citrobacter, Edwardsiella, Enterobacter, and Serratia

positive, urease weakly positive, H₂S is produced by *C. freundii*. Mannitol fermentation is always positive. Lactose fermentation may or may not be positive but they always produce β-galactosidase (ONPG positive).

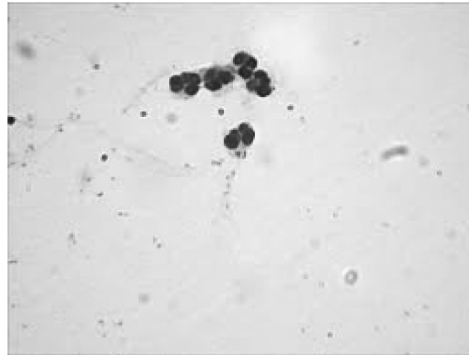


Fig. 22.1

22.2.1 Pathogenicity

They are normal commensals of human gastrointestinal tract. Pathogenicity can be due to endotoxins, O (somatic) and H (flagellar) antigen, capsular antigen, adhesion proteins produced by bacteria. They share O Ag with *Salmonella* and if isolated in faecal samples, they can be mistaken as *Salmonella*. They can cause UTI, infection of gall bladder, middle ear. *C. koseri* may occasionally cause neonatal meningitis.

22.3 EDWARDSIELLA

It belongs to tribe Edwardsiellae. *Edwardsiella tarda* is the only recognised human pathogen. It is non-capsulated, motile, produce hydrogen sulphide in KI medium. On MacConkey agar they form pale coloured colonies which can become pink on further incubation due to fermentation of lactose which can be late. Term *tarda* refers to slow or weak fermentation of sugars by this organism. Only glucose and maltose are fermented. It is indole positive, utilise citrate, urease negative.

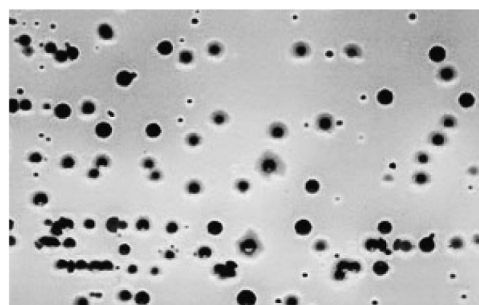


Fig. 22.2

22.3.1 Pathogenicity

Normal habitat is intestine of cold blooded animals and fresh water. It is mainly pathogenic to water animals. It causes occasional infection in humans. Its pathogenic role is uncertain but it has been isolated from wound, urine, blood and CSF.

22.4 ENTEROBACTER

It belongs to tribe Klebsielleae. Members of this genus are motile, capsulated, form pink coloured mucoid colonies on MacConkey agar. It is MR negative, VP positive, indole negative, citrate positive. It does not produce H₂S. It has 12 species of which *E.aerogenes* and *E.cloacae* are most commonly encountered in clinical specimen. *E.aerogenes* is urease negative while *E.cloacae* is urease positive.

22.4.1 Pathogenicity

Both the species are widely distributed in water, sewage, soil and on vegetables. They are associated with opportunistic infection including UTI, respiratory tract infection and cutaneous wounds. They may occasionally cause meningitis and septicaemia. They are an important cause of hospital acquire infections.

22.5 SERRATIA

It belongs to tribe Klebsielleae. They are motile, gram negative coccobacilli. They may form capsule. Several species have been described of which *S.liquifaciens*, *S.rubidaea* and *S.marcescens* are of clinical significance. *S.marcescens* is the most frequently encountered species. It forms smooth, convex colonies with crenated edges. It form red coloured pigment (prodigiosin) which is insoluble in water and does not diffuse into the media. Therefore colonies are red to pink in colour. Pigment is soluble in alcohol, ether, acetone and chloroform. Pigment is best formed at 15-20°C however, growth is poor at this temperature.

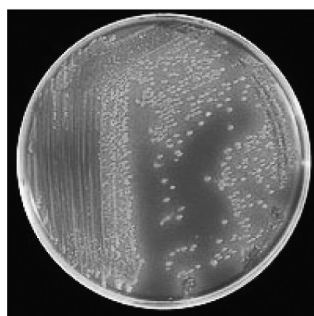


Fig. 22.3 *Serratia marcescens*



Notes

MODULE

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Notes

Citrobacter, Edwardsiella, Enterobacter, and Serratia

Serratia species are ONPG positive but fail to ferment lactose. Form pale coloured colonies on MacConkey agar. It is indole, MR and urease negative, citrate and VP positive. It does not form H₂S.

22.5.1 Pathogenicity

It is basically a saprophyte, found in water, soil and food. It can cause nosocomial infection mainly in newborns and patients receiving immunosuppressive therapy which are increasing in frequency now days. It is associated with meningitis, endocarditis, septicaemia, peritonitis and respiratory tract infections. Multidrug resistance is common making it serious pathogens in hospital setting.

Table 22.1: Characteristics of Citrobacter, Edwardsiella, Enterobacter and Serratia.

Characteristics Habitat	Citrobacter Human gut	Edwardsiella Intestine of cold blooded animals	Enterobacter Water, soil, sewage	Serratia Saprophyte, water and soil
Colonies on MCA	Pale to pink	Pale	pink	pale
Motility	+	+	+	+
Capsule	±	-	+	+
ONPG	+	+	+	+
Lactose	±	+(slow)	+	-
Indole	±	+	-	-
MR	+	+	-	-
VP	-	-	+	+
Citrate	+	+	+	+
Urease	-	-	+	-
H ₂ S production	+	+	-	-



INTEXT QUESTIONS 22.1

1. Citrobacter are gram bacilli
2. Enterobacteria are environmental contaminants commonly present on, &
3. Citrobacter are mannitol bacilli
4. Serratia causes nosocomial infection in and patients receiving therapy.



WHAT YOU HAVE LEARNT

- They are important members of enterobacteriaceae. They occur mainly as either normal commensal of GIT or as saprophyte in the environment. Infections caused by this genus are nowadays increasing in frequency. They are often multidrug resistant and difficult to treat. They can be easily differentiated from each other on the basis of colony morphology and biochemicals. Citrobacter is often mistaken as Salmonella. Enterobacter colonies do look like that of Klebsiella but it can be differentiated from it by its motility.



Notes



TERMINAL QUESTIONS

1. Describe the characteristics of genus Edwardsiella?
2. Write pathogenesis of Citrobacter?
3. Describe the colonies and morphology of Enterobacter?
4. Name the pigment produced by *S.marsecens*?



ANSWERS TO INTEXT QUESTIONS

22.1

1. Negative
2. Water, soil, faeces
3. Fermenting
4. Newborns & immunosuppressive