Pakistan J. Zool., vol. 45(5), pp. 1329-1333, 2013

Prevalence of Coccidia (*Eimeria* spp.) Infection in Domestic Rabbits, *Oryctolagus cuniculus,* in Riyadh, Saudi Arabia

Abdel-Azeem S. Abdel-Baki[1, 2]* and Saleh Al-Quraishy[1]
[1]*Zoology Department, College of Science, King Saud University, Saudi Arabia, P.O. Box 2455, Riyadh 11451, Saudi Arabia.*
[2]*Zoology Department, Faculty of Science, Beni-Suef University, Beni-Suef, Egypt.*

Abstract.- The prevalence of coccidia infection among domestic rabbits in Riyadh, Saudi Arabia was investigated for one year in the present study. Based on the morphological features of oocysts, ten species of *Eimeria* were identified in 100 fecal samples of domestic rabbits. The overall prevalence was 75%. Mixed infection with three different species occurred most frequently. The species detected and their prevalence values included the following: *Eimeria coecicola* (70%), *E. magana* (60%), *E. perforans* (60%) and *E. media* (55%) are mostly predominating and *E. irresidua* (30%) and *E. flavescence* (25%) were less common while *E. intestinalis* (7%), *E. piriformis* (6%), *E. stiedai* (5%) and *E. exigua* (5%) were relatively rare.

Keywords: Coccidia, rabbit, *Eimeria*, prevalence, Saudi Arabia

INTRODUCTION

In recent years, there has been increasing commercial production of rabbits as a source of protein. The consumers prefer rabbits for their low cholesterol and fat contents (Al-Mathal, 2008). In addition to this commercial value, these animals are used as very important models for medical research and as pets (Yousif and Abdul-Aziz, 1995). Therefore, rabbit production became one of the important animal resources in Saudi Arabia (Al-Mathal, 2008). Coccidiosis remains one of the most important infectious causes of digestive disorders in fattening rabbits (Vancraeynest *et al*., 2008). Coccidiosis is caused by intercellular protozoon parasites of the genus *Eimeria* and can causes significant mortality in domestic rabbits (Oncel *et al*., 2011). Although mortality can result from heavy infection by these parasites, the majority of infections result in morbidity due to lower weight gain and diarrhea (Renaux *et al*., 2003). Thus far, 15 species of *Eimeria* in rabbit have been identified (El-Shahawi *et al*., 2012). Of them, 14 are known to infect the intestine while one is located in the biliary ducts of the liver. The identification of these coccidia is based on the morphological characteristics of the oocysts, sporulation time, site of infection and clinical signs (Li and Ooi, 2009, El-Shahaw *et al*., 2012). Previously, three parasitological surveys have been conducted to identify different *Eimeria* species in domestic rabbits (*Oryctolagus cuniculus*) in Saudi Arabia. These studies are those of Kasim and Al-Shawa (1987) (identified seven species), Toula and Ramadan (1998) (identified five species) and Bashtar *et al*. (2003) (identified seven species). They reported in total of 10 species of *Eimeria*. To further understand the diversity of *Eimeria* spp. and epidemiological information of coccidiosis in Saudi Arabia, the present study was undertaken to determine the natural prevalence of *Eimeria* infections among domestic rabbits and to also describe the sporulated oocysts of the all species identified here in Riyadh.

MATERIALS AND METHODS

During the year 2011-2012, a total one hundred adult domestic rabbits (*Oryctolagus cuniculus*) were collected from Riyadh city in Saudi Arabia. These animals were caged separately. Fresh faecal samples were collected and examined microscopically for the incidence of the *Eimeria* infection. Fresh oocysts were collected from faeces of the infected rabbits and concentrated by floatation technique (Long *et al*., 1976). To determine the sporulation time, fresh collected non-

* Corresponding author: azema1@yahoo.com
0030-9923/2013/0005-1329 $ 8.00/0

sporulated oocysts were suspended in 2.5% (W/V) aqueous potassium dichromate, placed in Petri-dishes in air and allowed to sporulate at room temperature (25±2°C). Periodic samples were examined under the microscope using an oil immersion objective lens and the progress of sporulation was recorded. The sporulation time was determined when sporozoites within the sporocysts were fully formed. The morphometric and the specific characteristics of unsporulated and sporulated oocysts were studied by Olympus microscope using the oil immersion lens. The length and width of at least fifty sporulated oocysts were measured. All measurements were made with an eyepiece micrometer and the oil immersion lens. The measurements were given in micrometre as means±SD followed by the range in parentheses. Only, oocysts with sharply defined outline and intact sporocysts were measured and recorded.

RESULTS

The present study revealed presence of oocysts of ten species of *Eimeria* in the faeces of rabbits in Riyadh, Saudi Arabia. The structural features of oocysts, their dimensions, and their presence or absence are used for the identification and differentiation of these species (Table I, Fig. 1). The eight species previously reported from Riyadh rabbits were present and two additional species (*E. exigua*, *E. piriformis*) were recorded for the first time in Riyadh city. Of 100 adult rabbits examined 75 (75%) were excreting oocysts of *Eimeria* species. Mixed infection with three species is most frequently occurring while infection with more than five species is rarely occurring. The overall prevalence for each species is shown in Table I. *Eimeria coecicola*, *E. magana*, *E. perforans* and *E. media* are mostly predominating and *E. irresidua* and *E. flavescence* were less common while *E. intestinalis*, *E. piriformis*, *E. stiedai* and *E. exigua* were relatively rare.

DISCUSSION

Coccidiosis is considered the major parasitic disease which causes severe economic losses in rabbit farming. Two forms of cocccidosis were recognized in rabbits; hepatic coccidiosis and intestinal coccidiosis. The hepatic coccidiosis is due to *E. stiedai* that cause severe damage to the liver and it is more pathogenic in young rabbits and led to death among these animals (Oncel *et al*., 2011). The intestinal coccidiosis can be classified into three types when clinical signs like weight gain, diarrhoea and mortality are taken into consideration (Lebas *et al*., 1986). These are non- pathogenic or slightly pathogenic species including *E. media, E. exigua, E. perforans* and *E. coecicola*, moderately pathogenic species including *E. irresidua*, *E. magna* and *E. piriformis* and very pathogenic species including *E. intestinalis* and *E. flavescens* (Jithendran, 1995). The identification of *Eimeria* species in rabbits has been performed using some biological features such as oocyst size and morphology (curvature, presence or absence of oocyst residuum, conspicuous/ inconspicuous micropyle, sporulation time) (Coudert *et al*., 1995, Pakandl, 2009, Oliveira *et al*., 2011). Based on the previously mentioned criteria, ten *Eimeria* species were identified in the faeces of the rabbits collected from Riyadh city during the present study. Our descriptions of the sporulated oocysts of *Eimeria* from rabbits in the present study vary slightly in size and other characteristics with those from previous descriptions (Kasim and Al-Shawa, 1987, Toula and Ramadan, 1998, Razavi *et al*., 2010, El-Shahawi *et al*., 2012). Kasim and Al-Shawa (1987) and Bashtar *et al*. (2003) reported seven species from rabbits collected from central, eastern and western regions in Saudi Arabia while Toula and Ramadan (1998) recorded five species in Jeddah city in Saudi Arabia. In total ten species were reported so far in Saudi Arabia. The prevalence of coccidial infection in the domestic Saudi Arabian rabbits in previous studies has ranged from (73%) to (90%). In the present study, the prevalence of coccidial infection (75 %) was consistent with the previous study. The factors that might affect prevalence in domestic rabbits include management factors such as housing and the use of chemoprophylaxis (Chowdhury and Fraser, 2008). Mixed infection with three *Eimeria* species was most frequent in the present study and in all previous studies as natural infection with a single *Eimeria* species are rare (Mehlhorn, 2006, Khan *et al*., 2000). In conclusion commercial rabbits in

Table I.- Characteristics of sporulated oocysts of *Eimeria* species from domestic rabbits. Measurements (in µm) are based on 30 oocysts of each species. Values are in Mean (Range).

Eimeria species	Oocyst						Sporocyst			Sporulation time at 25±2°C (h)	Prevalence (%)
	Length	Width	Micropyle	Shape	Residuum	Wall color	Length	Width	Residuum		
E. coecicola Cheissin, 1947	24 (23-29)	14 (11-17)	+	Cylindrical	+	Greenish yellow	9 (8-10)	5 (4-6)	+	56	70
E. exigua Yakimoff, 1934	15 (14-17)	15 (14-17)	-	Spherical	-	Purple	7 (6-8)	5 (4-7)	-	20	5
E. flavescens Marotel and Guilhon, 1941	23 (22-30)	16 (14-18)	+	Ovoid	-	Brown	7 (6-8)	6 (5 -7)	+	40	25
E. intestinalis Cheissin, 1948	20 (19-24)	13 (12-15)	+	Pyriform	+	Greenish brown	8 (7-9)	4 (4-5)	-	50	7
E. irresidua Kessel and Jankiewicz, 1931	35 (33-41)	23 (21-26)	+	ellipsoid	-	Brownish yellow	18 (15-21)	9 (8-10)	+	48	30
E. magna Pérard, 1925	24 (23-26)	14 (13-16)	+	Ovoid	+	Brownish red	8 (6-10)	5 (4-6)	+	45	60
E. media Kessel, 1929	22 (19-24)	12 (10-15)	+	Ellisoid	+	Yellow	8 (7-9)	4.5 (4-6)	-	30	55
E. perforans (Leuckart, 1879) Sluiter and Swellengrebel, 1912	16 (13-18)	10 (9-11)	+	ellipsoid	+	Greenish	5.3 (5-6)	4 (3-5)	-	25	60
E. piriformis Kotlan and Pospesch 1934	26 (24-32)	20 (19-21)	+	pyriform	-	Tan	13 (11-14)	8 (7-9)	+	28	6
E. stiedai (Lindemann, 1865) Kisskalt and Hartmann, 1907	26 (25-29)	13 (12-15)	+	Ellipsoid	+	Pink	10 (9-11)	6 (5-7)	+	60	5

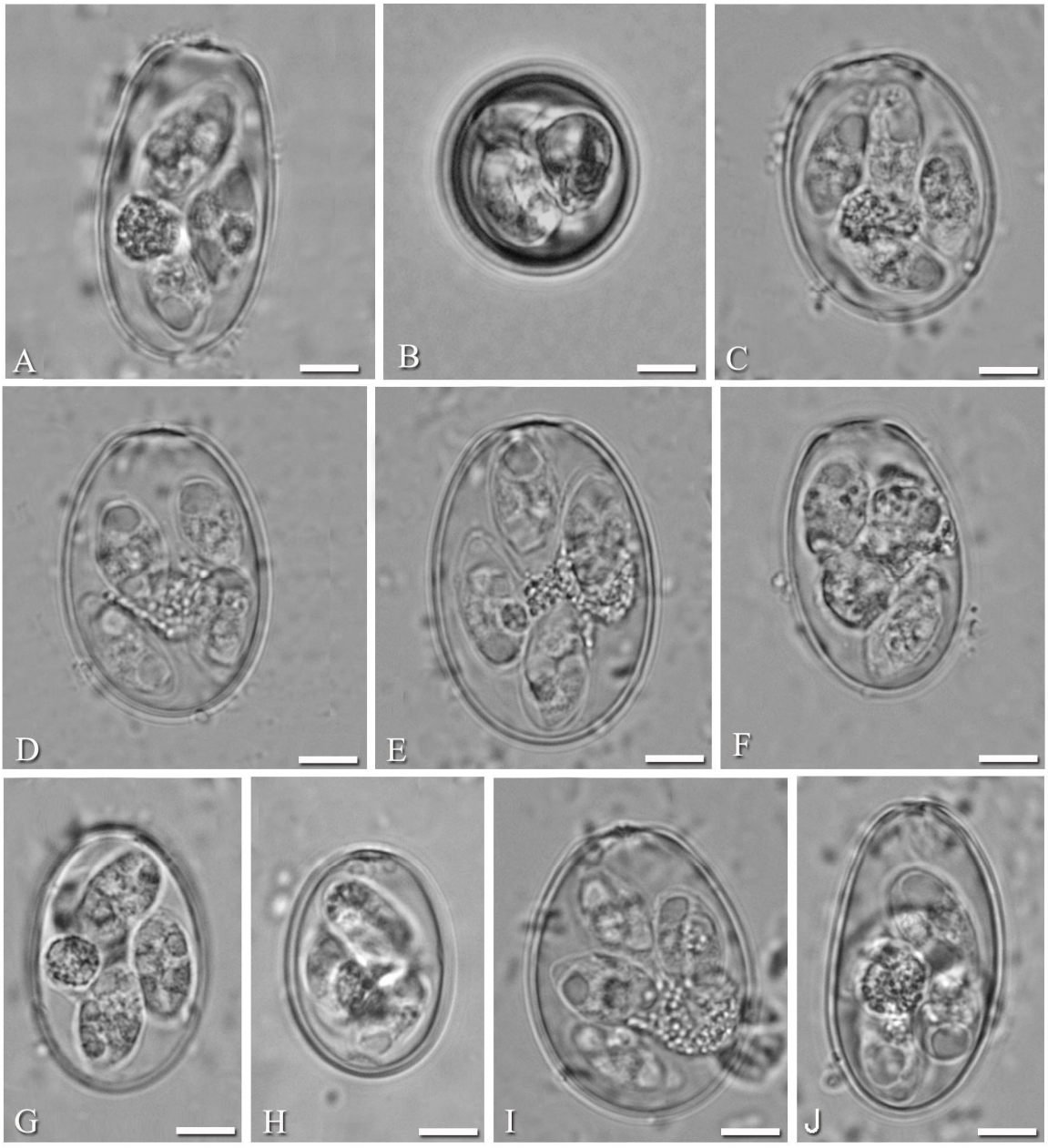

Fig. 1. Sporulated oocysts of the ten species of *Eimeria* collected from naturally infecting domestic rabbits *Oryctolagus cuniculus* in Riyadh, Saudi Arabia. **A,** *E. coecicola;* **B,** *E. exigua;* **C,** *E. flavescens;* **D,** *E. intestinalis;* **E,** *E. irresidua;* **F,** *E. magna;* **G,** *E. media;* **H,** *E. perforans;* **I,** *E. piriformis;* **J,** *E. stiedai*.
Scale bars=10 µm.

Saudi Arabia are under potential risk of coccidiosis and it is necessary to carry out further studies on epidemiology of coccidiosis in commercial rabbitries and to develop the appropriate control strategy against this disease.

ACKNOWLEDGEMENT

The authors extend their appreciation to the Deanship of Scientific Research at King Saud University for funding the work through the research group project number RGP-VPP-004.

REFERENCES

AL-MATHAL, E.M., 2008. Hepatic coccidiosis of the domestic rabbit *Oryctolagus cuniculus domesticus* L. in Saudi Arabia. *World. J. Zool.,* **3:**30-35.

BASHTAR, A.R., AL-RASHEID, K.A., MOBARAK, M. AND AL-GHAMDY, A.A., 2003. Coccidiosis in rabbits from Saudi Arabia. 1. Exogenous stages of different *Eimeria* spp. *J. Egypt. Ger. Soc. Zool.,* **42:** 1-10.

CHOWDHURY, A.A. AND FRASER, G.C., 2008. Coccidia (*Eimeria* spp.) of domestic rabbits in New South Wales. *Aust. Vet. J.,* **86**: 365–366.

COUDERT, P., LICOIS, D. AND DROUET-VIARD, F., 1995. *Eimeria* species and strainsof rabbit. In: *COST. 89/820. Biotechnology: guidelines on techniques in coccidiosis research* (eds. J. Eckert, R. Braun, M.W., Shirley and P. Coudert). Office for Official Publications of the European Communities, Luxembourg, pp. 52-73.

EL-SHAHAWI, G.A., EL-FAYOMI, H.M. AND ABDEL-HALEEM, H.M., 2012. Coccidiosis of domestic rabbit (*Oryctolagus cuniculus*) in Egypt: light microscopic study. *Parasitol. Res.*, **110:** 251–258.

JITHENDRAN, K.P., 1995. Clinical coccidiosis in Angora rabbits. *Vet. Rev. Kathmandu,* **10:** 21-22.

KASIM, A.A. AND AL-SHAWA, Y.R., 1987. Coccidia in rabbits (*Oryctolagus cuniculus*) in Saudi Arabia. *Int. J. Parasitol.,* **17:** 941–944.

KHAN, R.M., SHAIKH, A.A. AND KHAN, M.M., 2000. Natural infection with *Eimeria* species (Ampicomplexa: Eimeriidae) in indigenous fowls of Hyderabad district of Sindh province (Pakistan). *Pakistan J. Zool.,* **32:** 11-14.

LEBAS, F., COUDERT, P., ROUVIER, R. AND DE ROCHAMBEAU, H., 1986. *The rabbit husbandry, health and production.* Animal Production and Health, no 21, FAO, Rome, Italy.

LI, M. AND OOI, H., 2009. Fecal occult blood manifestation of intestinal *Eimeria* spp. infection in rabbit. *Vet. Parasitol.,* **161:** 327–329.

LONG, P.L., JOYNER, L.P., MILLARD, B.J. AND NORTON, C., 1976. A guide to laboratory techniques used in the study and diagnosis of avian coccidiosis. *Folia Vet.,* **6:** 201–207.

MEHLHORN, H., 2006. Morphology. In: *Parasitology in focus, facts and trends* (ed. H. Mehlhorn), 3rd edn. Springer, Berlin.

OLIVEIRA, U.C., FRAGA, J.S., LICOIS, D., PAKANDL, M. AND GRUBER, A., 2011. Development of molecular assays for the identification of the 11 *Eimeria* species of the domestic rabbit (*Oryctolagus cuniculus*). *Vet. Parasitol.,* **176:** 275-280.

ONCEL, T., GULEGEN, E., SENLIK, B. AND BAKIRCI, S., 2011. Intestinal coccidiosis in angora rabbits (*Oryctolagus cuniculus*) caused by *Eimeria intestinalis*, *Eimeria perforans* and *Eimeria coecicola*. *YYU Vet. Fak. Derg.,* **22:** 27-29.

PAKANDL, M., 2009. Coccidia of rabbit: a review. *Folia Parasitol.,* **56:** 153–166.

RAZAVI, S.M., ORYAN, A., RAKHSHANDEHROO, E., MOSHIRI, A. AND MOOTABI, A.I., 2010. *Eimeria* species in wild rabbits (*Oryctolagus cuniculus*) in Fars province, Iran. *Trop. Biomed.,* **27:** 470-475.

RENAUX, S., QUÉRÉ, P., BUZONI-GATEL, D., SEWALD, B., LE VERN, Y., COUDERT, P. AND DROUET-VIARD, F., 2003. Dynamics and responsiveness of T-lymphocytes in secondary lymphoid organs of rabbits developing immunity to *Eimeria intestinalis*. *Vet. Parasitol.,* **110:** 181-195.

TOULA, F.H. AND RAMADAN, H.H., 1998. Studies on coccidian species of genus *Eimeria* from domestic rabbit (*Oryctolagus cuniculus domesticus* L.) in Jeddah, Saudi Arabia. *J. Egypt. Soc. Parasitol.,* **28:** 691–698.

VANCRAEYNEST, D., DE GUSSEM, M., MARIEN, M. AND MAERTENS, L., 2008. *The anticoccidial efficacy of robenidine hydrochloride in Eimeria challenged rabbits. Pathology and hygiene*, 9th World Rabbit Congress, Verona, Italy, pp. 1103–1106.

YOUSIF, O.M.A. AND ABDUL-AZIZ, J.A.M., 1995. Commercial rabbit production. Published by Al-Dar Al-Arabia, Cairo, Egypt.

(Received 11 June 2013, revised 4 September 2013)