BLACK SPOT IN CANARIES: Lessons from Pigeons & Parrots

by Dr. Jan Vanderborght MD

Black Spot & Circo Virus (PBF-Disease)

Who does not know it during the breeding season, that recurring problem of high mortality of chicks during the first days. Most deceased chicks have the same symptoms: feeble chicks which are not begging for food, empty crop, anaemic appearance, yellowish skin discoloration, poor yolk absorption and above all the "black dot". Chicks with the black spot usually die in the first 3-5 days. The appearance of the Black Point was first reported in the early 90s. First investigations were made at that time. The results were different. A published study from the year 2006 of the Justus-Liebig-University in Giessen / Germany found lethal atoxoplasma infection, whereby at that time the infection paths as well as the biology of the parasite and the biological classification were not known. Other European researchers believe that there is a relationship between the black spot (also called "black dot") and the mycoplasma infection. In January 2018, a detailed report was published by Dr. Jan Vanderborght MD. Here is the unaltered and complete publication:

Friends in the Fancy - Dr. Jan Vanderborght, MD - Black Spot In Canaries
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Most of us have been confronted in the past with 'black spot' chicks. Chicks dying in their first days of life. Many have tried to solve the problem, mostly without success. Every time we hear vets speaking on a meeting, we all hope to hear what can solve this problem. But it is not that easy. Let me take you on a journey, trying to understand better what is going on.IntroductionA virus is a biological agent that reproduces inside the cells of living hosts. When infected by a virus, a host cell is forced to produce thousands of identical copies of the original virus at an extraordinary rate. Unlike most living things, viruses do not have cells that divide; new viruses are assembled in the infected host cell. Also our canaries face virus infections, best example being the pox virus, but there are many others. Of one of these, the circoviruses, most scientists agree they are the causative agent of what we call 'black spot'. Circovirus infections are commonly associated with immune deficiency-related diseases that are potentially fatal. A condition known as 'black spot' of neonatal canaries, characterized by abdominal enlargement, gallbladder congestion and failure to thrive, has been described for many years in Europe and was reported to have been caused by a circovirus (Goldsmith, 1995). More recently, a circovirus-like infection of canaries was identified in adult birds that had died following a short illness characterized by dullness, anorexia, lethargy and feather disorder (Todd et al., 2001).Not much research has been done on the canary circovirus (CaCV), probably because of being of no economic value. Nevertheless, DNA analysis has been done, which showed the CaCV is distinct from other circoviruses (parrots, pigeons, Gouldian finches,). This means the virus is host specific, in a way CaCV cannot infect parrots or pigeons or vice versa. But DNA analysis has shown the CaCV is closely related to the pigeon circovirus (CoCV, 63,4% same DNA as CaCV) and the parrot psittacine beak and feather disease(BFDV,62,9% same DNA as CaCV). (Phenix et al., 2001) In this contribution I am making a hypothesis about what happens with black spot in canaries, using some data coming from research which has been done in parrots and pigeons. Future research will have to be done to prove or discard these assumptions.

New-born chicks are protected against infection by antibodies received from the mother through the egg.

If we think this way it seems logic pigeons and parrots must have received protective antibodies from their mother in the egg, protecting them from circovirus infections in the egg and in their first weeks of life. As Dr. Leslie Woods notes (2009): 'Birds exposed to BFDV (parrot circovirus) have been shown to seroconvert (produce protective antibodies). Clinically normal birds that have been exposed to BFDV have higher titers (number of antibodies) than birds with active infections, suggesting that antibody is protective against development of clinical disease. Experimental vaccination studies have demonstrated that chicks from vaccinated hens remain clinically normal following challenge with BFDV'. In the same way we may think most of our canaries also have received protecting antibodies from their mother through the egg. I say this because most of our canaries do not have any problem with black spot. If we would agree this way of thinking is correct we immediately think: Why do some canary hens do not provide their eggs with protective antibodies? If we agree most birds are immune competent, the only reason can be: they have not been infected before. For this we have to consider in which way circovirus infections are transmitted.

In passerine birds immune suppression is caused by stress hormones and sex hormones.

Interplay of different factors Now we know important factors are: protecting antibodies from the hen transferred to the egg, and the timing of the primo infection are important, but this is not all! As Prof. Dennis Rubbenstroth, Institut für Virologie, Universitätsklinikum Freiburg (2016) says about the young pigeon disease (YPD): If YPD is an infectious disease the causative agent(s) remain(s) still undiscovered. It seems there is a delicate interplay of 3 factors: circovirus – immune system (stress) – secondary infections. Only one of these cannot cause the young pigeon disease. Experimental infection of pigeons with circovirus did not cause disease. It is even thought circovirus infections probably have been existing for a long time. They can be predisposing, but not the real trigger. Do we have some other factors weakening the immune system, like inbreeding or mycotoxins? Or, do we have a problem with the secondary infections? For example, have E. Coli infections become more virulent in time? We know these bacteria have become more resistant to antibiotics, but this is not the same as virulence. I only mention E. Coli, best known, but secondary infections can be caused by whatever bacteria, viruses, fungi or protozoa.An impaired ability to absorb and utilize yolk sac material has been noted in black spot chicks (Dr. Coutteel, personal communication). In this way the chick cannot utilize the protecting antibodies from the yolk sac. As to the cause of this inbreeding and breeding for new colour mutations have been proposed (Speer 2016).

What we can do If one looks at the three factors involved, each of them is important as to prevention and understanding the disease.

Immunity- A variety of nutrients modulate the immune system. For example, several essential nutrients fed at dietary levels that are clearly above the nutritional requirement regulate the type of response to a pathogen that occurs, including long-chain polyunsaturated fatty acids (PUFA) and vitamins A, D, and E. Additionally, some nutrients that are not normally considered as dietary essentials may modulate immunity, including carotenoids, phytonutrients (e.g., essential oils, genistein, cinnamaldehyde, curcumin, capsicum), and vitamin C. As to secondary infections we could use probiotics (live bacteria), or prebiotics like mannan oligosaccharides from yeast cell walls which have been shown to reduce enteric E. Coli load. - A special note should be made about the use of beta-glucan. There has been one study in which the use of beta-glucan has shown to clear the blood of parrots from circovirus load. I quote Dr Tomasek (2008):- Therefore, one of the possible mechanisms of effect of b-glucan could be augmentation of interferon production. This immune-stimulating substance is one of the promising solutions in the fight against infectious diseases in poultry and other animals; however, further investigation is needed to validate its efficiency in psittacine birds.- As interferon therapy has been successfully used in parrots (Miesle 2017), this could be true.- Levamisole, used as de-wormer also has immune stimulating effects, but only at low dose. Levamisole seems to have little effect on the normal immune system, but it seems to stimulate a subnormal response and suppress hyperactive responses. The effects are dose related. Low doses are reported to enhance responses, and higher doses are reported to suppress responses (Lunn, 2004)- I want to mention an anecdotal story (Miller, 2010) about the use of carrot juice. He pretended pigeons suffering from young

pigeon disease were cured with diluted carrot juice. If this can be reproduced or if it is true high level of carotenoids can cure the bird's remains to be proven. But the use of carrot soup is also mentioned by Prof. Rubbenstroth (2016).- But, with all immune stimulants I want to quote Dr. Chalmers (2004): ***A general word of caution in the use of immune stimulants: It seems to me that there have to be limits to the amount of stimulation the immune system can handle before it collapses under the strain of attempting to respond to multiple stimulating products. For this reason, I'd suggest limiting the number of immune stimulants to only a few to avoid exhausting the system.*** - Immune stimulation, OK, but at low dose and intermittent.- Best option would be vaccination, still unavailable till today. Maybe in the future a vaccine will be produced using recombinant DNA. If we are lucky the targeted fragments of the virus are the same for parrots, pigeons and canaries this would be the ultimate answer.
Secondary infections, prototype: E. Coli- E.Coli is a normal inhabitant of the birds intestinal flora, but is has been shown domesticated birds do have higher levels in their intestines to their wild relatives.- Reducing E. Coli: prebiotics, probiotics, hygiene protocol. Addition of 5-10% of egg yolk powder also has shown to reduce E. Coli numbers, probably because of the protective antibodies they contain (Kunert et all. 2015)- The use of oregano oil has proven to reduce enteric E. Coli (Sienkiewicz, 2012).- Antibiotics. Secondary infections can be eliminated by the use of antibiotics in a successful way. Condition is these will have to be provided a few weeks before the breeding season. In this way they can be loaded in the egg yolk (weeks before egg deposition) and the egg white (24 hours before egg deposition) and combat the secondary infections already present in the egg.
The question is: do we have to medicate all of our birds for these low numbers of black spot chicks? And, even more important, using these will build antibiotic resistance and a possible massive outbreak of black spot can occur the next year. Without antibiotics we can see which chicks are ill, so we can cull them. - Some people will say they don't want to lose all their chicks to black spot. But in the case massive losses are met due to black spot it is my conviction the whole shed is contaminated with multiple resistant bacteria(prototype: E. Coli) in the intestines. One has to consult a vet for identification of which kind of infection has come along and an antibi gram has to be made in search for the correct antibiotic which clears the birds from these bacteria. In this case a veterinary correctly prescribed antibiotic cure pre-breeding is 100% indicated and will stop these massive outbreaks.-
One final remark about antibiotics. It seems the fancy is leaving the (abuse of antibiotics, which is the way to go. So, most of us only give some preventative as to coccidiosis. I read a comment by Dr. René Becker (2012):***Caution should be exercised in using Coccidiosis medicine, we made bad experience by using Baycox to many times. Although highly active against coccidia, it is not uncommon after treatment to get outbreaks of youngster's disease.*** - I have been searching for this on medical databases but did not find any proof Baycox compromises our bird's immune system. Remember Baycox only combats coccidiosis but not whatever bacterial infection. It is my idea in the past we all used products like ESB3 30% pre-breeding for controlling coccidiosis. But ESB3 30% is a sulfamid antibiotic which also kills E. Coli in the intestines, so secondary infections become less frequent. Due to increased antibiotic resistance this way of doing things would not work any longer. **Circovirus**- As the circovirus is very stable and can persist for months or even years it is hard to get rid of it. Some disinfectants like F-10 or Virkon S can kill the virus, but enough contact time or repeated use has to be done to achieve low levels (Stanford, 2006; Australian Government 2006). Heat disinfection by using steam cleaners is also a possibility. Temperature needed is 90°C for 5 minutes (Emmoth, 2014). Using heat steaming also has the advantage red mite eggs are killed, as they are already killed at temperatures above 40°C. This is very important because red mite eggs can survive for months in the surroundings and are not killed by commonly used sprays.- It is even a question if total disinfection would be wise, as for natural build-up of antibodies in immune competent birds the virus has to be present.- As the circovirus is the smallest known DNA virus it can also attach itself to dust, so good ventilation is very important.- **Culling black spot chicks must be done.** One can try to save black spot chicks, and this has been done often by the use of fluids and/or antibiotics it seems to me these chicks will never have a fully developed immune system, and these birds probably will become carrier birds without producing antibodies. They will keep on spreading the

virus, and if they survive the virus will be silently present in the genital tract as long as they live.- The same holds true for hens having black spot chicks in the second or third clutch. These hens have not produced protecting antibodies and are the silent carriers of the virus.- Buying birds can always pose a problem. But don't blame the seller too soon if black spots pop up. It could be possible you bought a bird carrying the virus, but if it fit looks healthy nobody knows. It is also possible this bird is a carrier of different serotypes of E. Coli.- As we know timing of infection is important. The younger the birds are at the time of infection the more pronounced the effects as to mortality. At a very young age immune suppression dominates the picture with birds dying of even banal secondary infections. At later ages, plumage deformities dominate the picture.- But if you already experienced black spot in your shed, and you have a bird with some chronic feather problems (mainly the long tail and wing feathers) it is almost certain this is a circovirus shedding bird, which has to be culled.

Conclusion- Black spot is no disaster, except for massive outbreaks, which seem to be the exception rather than the rule. Till today no vaccine is available. Understanding the disease is very important as to prevention and/or interpretation of what we see.- As the disease seems multifactorial, just like in pigeons, we propose to call it 'black spot disease syndrome'. '**Dr. Jan Vanderborght MDJanuary 2018***Thanks to Dr. Coutteel DVM and Ing. Vanden Borre Msc, for their specific contribution.*References- Becker René (2012): Ask the Vet, Young Pigeon disease. http://www.amazing-wings.com/index.php/en/12-fragen-an-rene/89-ask-the-vet-young-pigeons-disease-what-to-do- Chalmers (2004): 75th annual meeting of the Canadian Racing Pigeon Union and the 100th anniversary of the Calgary RPC, held in Calgary, Alberta, Canada- Duchatel Jean Pierre(2009). Quantification of pigeon circovirus in serum, blood, semen and different tissues of naturally infected pigeons using a real-time polymerase chain reaction. Avian Pathology, Taylor & Francis, pp.143-148- Emmoth et all. (2014): Heat inactivation of porcine circovirus type 2.- Goldsmith, T. L. (1995). Documentation of passerine circoviral infection. In Proceedings of the Annual Conference of the Association of Avian Veterinarians, pp. 349–350, August 1995, Philadelphia, PA, USA- Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds (2006) Australian Government Department of the Environment and Heritage- Koutsos and Klasing† (2014): Factors Modulating the Avian Immune System- Kunert Filho et all. (2015) Avian Pathogenic Escherichia coli (APEC) - an update on the control.- Lunn et all. (2004): Immunomodulation: Principles and Mechanisms. 50th Annual Convention of theAmerican Association of Equine Practitioners,- Marshall Rob (2005): Canary Health- Miesle J. (2017) Psittacine Beak and Feather Disease. An Overview In: IVIS Reviews in Veterinary Medicine, I.V.I.S.- Miller Garry (2010) Arizona Pigeon Club http://www.aviculture-europe.nl/nummers/10E01A09.pdf- Phenix et all. (2001)Nucleotide sequence analysis of a novel circovirus of canaries and its relationship to other members of the genus Circovirus of the family Circoviridae. Journal of General Virology-Schmidt V., Schlomer J., Luken C., Johne R., Biere B., Muller H., Krautwald-Junghanns M.-(2008).: Experimental infection of domestic pigeons with pigeon circovirus. Avian Dis. 52, 380-386.- Rubbenstroth Dennis, DVM, PhD (2016) FCI Meeting, Halle: Update on „Young pigeon disease (YPD) syndrome"- Sienkiewicz (2012): The antibacterial activity of oregano essential oil (Origanum heracleoticum L.) against clinical strains of Escherichia coli and Pseudomonas aeruginosa- Speer Brian (2016) Current Therapy in Avian Medicine and Surgery - Stanford (2006) Control of circovirus infection in psittacine birds using F-10 disinfectant and avian gammainterferon - Stenzel et all. (2017) Application of pigeon circovirus recombinant capsid protein for detecting anti-PiCV antibodies in the sera of asymptomatic domestic pigeons and the potential use of a combination of serological and molecular tests for controlling circovirus infections in pigeon breeding flocks.- Todd, D.,et all. (2001). Nucleotide sequence identification of a novel circovirus from canaries. Avian Pathology 30, 321–325- Tomasek (2008) Psittacine Circovirus Infection in Parakeets of the Genus Eunymphicus and Treatment withβ-(1,3/1,6)-D-Glucan- Woods et all. (2000): Circovirus Infection of Nonpsittacine Birds Journal of Avian Medicine and Surgery- Woods (2009) Diseases of poultry: Circovirus infections of pigeon and other avian species.

Black spot disease syndrome' would reflect better the phenomenon of black spot we observe.

Observations made In canaries we know chicks born with what we call ‘black spot’ show high mortality, up to 90-100%, due to secondary infections. This means the circovirus, which attacks the immune system of the birds, makes the birds vulnerable to infections which, under normal circumstances, pose no problem for the immune system of the birds. Chicks die in their firsts days of life and as they are born with the ‘black spot’, it seems infection already took place in the egg, before the chicks were born. In pigeons the clinical picture of the ‘young pigeon disease complex’ is somewhat different. Pigeons are affected between 1 month and 1 year of age, but it seems when they are born, no problems are seen (Woods et all, 2000). In parrots, the psittacine beak and feather disease (BFDV), birds are infected between 2 months and 3 years of age. The younger the birds are infected the more fatal the clinical course (Miesle J., 2017). For a review of circovirus infections in non-psittacine birds I refer to Dr. Leslie Woods (2000). Birds develop their immune system (antibody diversity) between the age of 3-6 weeks in the Bursa of Fabricius. Birds infected before that age will never develop a mature immune system and will die of secondary infections. Birds which are infected at a later stage mainly show feather abnormalities. In looking at these different clinical pictures of related circovirus infections in different breeds an important question arises. Why are parrots or pigeons not born with a black spot, just like infected canaries do? For answering this question, we must know some things. In birds antibodies from the hen are transferred to the egg. These antibodies (Ig Y in the yolk, IgA and IgM in the egg white) do protect the just born chicks from a range of diseases in their first days of life. Nature has created this because the immune system in no tyet fully developed. So, this very vulnerable ‘gap’ of let’s say 3 weeks after hatch, has to be covered by these antibodies the chick has received from the mother through the egg.

Different ways of transmission Most scientists agree the most important infection route is the horizontal way (from one bird to another; feco-oral, feather dust). As the circovirus survives very well in the surroundings and is very resistant to disinfection (in the way we do it) I think most of our birds are infected in summer or winter. At this age they do have a competent immune system and they develop protective antibodies, which clear the body from the virus. In pigeons it has been shown 70% of the pigeons do have protective antibodies in their serum(Stenzel, 2017). Vertical transmission (from mother to the egg) has been proven in pigeons and parrots, but probably because of having protective antibodies infections in the egg, black spots, just like in canaries, neonatal infections are not often seen. In pigeons it also has been noted transmission through sperm can occur (Duchatel 2009), so probably this is also possible in our canaries. But as observations by canary breeders show, this is not often the case.

Timing of first infection so, what happens in canaries? If the first infection (primo infection) of canaries coincides with the start of the breeding season black spot will pop up. If a bird gets infected by a virus infection it takes some weeks to build the protective antibodies. If a hen lays eggs in the meantime, the virus will be transferred to the egg without these protective antibodies. As the hen is not yet cleared from the virus, the virus will replicate in the egg, destroying the immune system, and whatever secondary infection will kill the newly hatched chick. This is probably the reason why black spot is seen more often in the first clutch of a breeding season. As the breeding season progresses these hens will build more protective antibodies which they can pass to their eggs. Dr. Rob Marshall (2005) notes: ‘Black spot occurs more commonly in nests with a first-time mother’. This seems to support the hypothesis protecting antibodies are built as birds age. It is also important to note transfer of these protective antibodies differs even within the same clutch (Speer Brian 2016). **Late eggs in the laying order have less antibodies**, so protection is lower. In nature this is compensated by higher levels of testosterone in these eggs, so these chicks have higher competitive skills once hatched. This could explain why some chicks in one nest do have black spot, and other don’t. Immediately we pose ourselves the question: why are these hens infected at the start of the breeding season? The answer could be easy: infection can occur all year round. But this is not true. In pigeons we know circovirus infections alone are not enough to produce disease (Schmidt 2008), so other factors are needed. One of these is stress. It is well known stress paralysis the immune system. In pigeons the first flights, basketting them and transport do cause stress. This stress increases the stress hormone cortisolin the blood and gives rise to immune suppression. This is why the ‘young pigeon disease’ pops up at this time. The start of the breeding season always brings stress in the breeding room. Birds are

located on other places, hens becoming nervous, cocks challenging the hens and even the longer daylight hours do produce stress and give rise to immune suppression.
Suppression of immunity during breeding seasonIn passerine birds also something else comes along, and I quote Dr. Koutsos and Dr. Klasing (2014): For example, a large body of evidence indicates that high reproductive effort in female passerines suppresses indices of cellular immunity and is often accompanied by decreased resistance. However, it hasbeen difficult to determine the extent to which immunosuppression is a result of sex hormones versus changes induced by an elevated workload and associated higher glucocorticoids, tissue damage and energy expenditure. So, it seems apart from the stress hormone cortisol, also the increased sex hormones do cause immune suppression. **Note this is only seen in passerine birds!**

Black Spot in Society Finch

Black Spot in Canaries