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REPORT OF THE FIRST MEETING OF OIE AD HOC GROUP ON SUSCEPTIBILITY OF CRUSTACEAN SPECIES TO INFECTION WITH OIE LISTED DISEASES[1]

Paris, 10–12 February 2015

The OIE *ad hoc* Group on Susceptibility of crustacean species to infection with OIE listed diseases (the *ad hoc* Group) met at OIE Headquarters on 10–12 Februray 2015. Dr Grant Stentiford chaired the meeting.

1. Welcome and introduction

The members of the *ad hoc* Group and other participants at the meeting are listed at Annex I. The adopted agenda is provided as Annex II.

On behalf of Dr Bernard Vallat, Director General of the OIE, the Head of the International Trade Department, Dr Derek Belton, welcomed all members and thanked them for their agreement to work with the OIE on this important topic.

2. Objectives of the meeting

Chapter 1.5. 'Criteria for listing species as susceptible to infection with a specific pathogen' was introduced into the 2014 edition of the OIE *Aquatic Animal Health Code (Aquatic Code)*. The purpose of this chapter is to provide criteria for determining which host species should be listed as susceptible in each disease-specific chapter of the *Aquatic Code.* These criteria are to be applied progressively to each disease-specific chapter in the *Aquatic Code*. Furthermore, for species where there is some evidence of susceptibility but insufficient evidence to demonstrate susceptibility through the approach described in Article 1.5.3., information will be included in the relevant disease-specific chapter of the *Manual of Diagnostic Tests for Aquatic Animals (Aquatic Manual)*.

Assessment of the scientific evidence will be undertaken by the *ad hoc* Group and the assessments will be provided to Member Countries for comment prior to any change in the list of susceptible species in Article X.X.2. of the crustacean disease-specific chapters of the *Aquatic Code* and *Manual.*

The objectives of the meeting were therefore as follows:

1) To consider the general elements of the three-stage approach for determining susceptibility of given host taxa to infection with the listed crustacean pathogens
2) To determine the specific evidence required to fulfil stages 2 (identification of the pathogen) and 3 (determination of infection) for yellow head virus (YHV) genotype 1 (hereafter YHV1)
3) To apply specific criteria defined in 2 to the available peer-reviewed and grey literature pertaining to YHV1 for determining susceptibility according to *Aquatic Code* chapter 1.5.
4) To classify evidence pertaining to susceptibility of specific host taxa to YHV1 to either Group 1 (*Aquatic Code*-listed), Group 2 (*Aquatic Manual*-listed) or Group 3 (other, e.g. mechanical vector)
5) To report on the outcome of the analysis prior to the meeting of the Aquatic Animal Health Standards Commission in March 2015.

3. Terms of Reference

The Terms of Reference were adopted and the final version is shown in Annex III.

[1] Note: This ad hoc Group report reflects the views of its members and may not necessarily reflect the views of the OIE. This report should be read in conjunction with the March 2015 report of the Aquatic Animal Health Standards Commission because this report provides its considerations and comments. It is available at http://www.oie.int/en/international-standard-setting/specialists-commissions-groups/aquatic-animal-commission-reports/meeting-reports/

4. Discussion of working documents and other relevant documents

Prior to the meeting, the *ad hoc* Group was provided with the European Food Safety Authority (EFSA) opinion relating to susceptibility of aquatic animals to pathogens listed in EC Directive 2006/88 (EFSA, 2008). Furthermore, a peer-reviewed paper arising from this work and focussed on application of the criteria outlined by EFSA to susceptibility of hosts to the crustacean diseases white spot disease (WSD), Taura syndrome (TS) and yellowhead disease (YHD), was also provided (Stentiford *et al.*, 2009).

The *ad hoc* Group agreed that the three-stage approach as outlined in Article 1.5.3. would be adequate (given appropriate supporting data) to define a host as 'susceptible' to 'infection' with YHV1.

The Group wished to raise the following specific points related to Articles within Chapter 1.5.:

Article 1.5.4. In reference to crustacean diseases, the *ad hoc* Group agreed that while injection of an infectious agent can be considered as an experimental invasive route, it does not mimic a natural route of infection. This contrasts the previous review of susceptibility of crustacean hosts to pathogens by EFSA (EFSA, 2008) in which injection was considered to potentially mimic a natural route of infection in crustaceans.

Article 1.5.4. In reference to consideration of 'environmental factors' associated with route of transmission/natural pathways, the Group considered this a relevant inclusion when considering the evidence reported in specific studies (e.g. did the temperature at which a given challenge study was conducted mimic expected natural conditions for the host/pathogen?).

Article 1.5.5. In reference to use of section 7 of the appropriate chapter of the *Aquatic Manual* to provide a means to 'identify' the pathogen under consideration, the Group considered it vital that section 7 be modified to include appropriate molecular diagnostic (PCR) and phylogenetic elements. In most cases this should take the form of PCR followed by sequencing of the amplicon, whilst in some cases pathogen taxon-specific PCR assays may be sufficient. If this information is not consistently provided in section 7, it is difficult to confirm the taxonomy of the pathogen under consideration against the reference listed pathogen.

Article 1.5.6. In reference to criteria A-D, the Group discussed and agreed a set of descriptive elements for each criterion, related to YHV1. These descriptions take account of previous work by EFSA (2008) and Stentiford *et al.* (2009) for susceptibility to YHV1. The descriptions to be applied to assess susceptibility to YHV1 in accordance with Chapter 1.5. of the *Aquatic Code* are thus:

A: Replication	B: Viability / Infectivity	C: Pathology / Clinical signs	D: Location
Presence of characteristic inclusion bodies and positive labelling of inclusion bodies by ISH or IFAT Presence of virions in inclusion bodies by TEM Demonstration of increasing copy number over time with RT-qPCR Serial passage from individual to SPF individual of the same species*	Single passage bioassay to a SPF (target pathogen) of any susceptible host species and confirmation of pathogen identification**	Characteristic inclusion bodies, with pyknosis and karyorrhectic nuclei in target tissues and haemocytic infiltration and/or clinical signs***	Haemocytes, heart, peripheral nerves, eye, lymphoid organ and sinuses, connectiv tissue****

Key:*To demonstrate replication by this approach requires evidence for multiple passages in confirmed target pathogen-free hosts of the same species as being assessed. **To demonstrate viability or infectivity of the target pathogen within the host being assessed, single passage in any known susceptible SPF host is required. ***Clinical signs typical of YHV1 may provide evidence for fulfilment of this category when evidence from histopathology is not available. However, clinical signs according to the *Manual* chapter may not present equally in all host taxa and may not be specific for infection with YHV1. ****Lymphoid organ not present in most non-penaeid host taxa.

Article 1.5.5. In reference to specific identification of YHV1, the **Group** noted that as currently written, there are several inconsistencies between the *Aquatic Code* Chapter 9.2. (Infection with Yellow Head Virus) and the *Aquatic Manual* Chapter 2.2.8. (Yellow Head Disease). Since only infection with Yellow Head Virus (genotype 1) of the Yellowhead complex of viruses (i.e. that including GAV, etc.) is listed by the OIE, it was recommended that the *Code* and *Manual* chapters should be modified to clarify this point. To this end, and for the purposes of defining susceptibility of hosts to the listed pathogen (YHV1), publications were scrutinised to provide specific evidence that the pathogen under study was in fact YHV1 and not (potentially) other viruses within the complex. Where this definition could not be made, poor evidence for fulfilling stage 2 of the approach (see Articles 1.5.3. and 1.5.5.) was noted. In such cases, and where other studies could not be identified to fulfil this evidence gap, a host taxon would not be proposed for listing in the *Aquatic Code* (Group 1).

Article 1.5.7. In reference to outcomes of the assessment for each host taxon, those hosts for which identification of the agent is confirmed (section 1.5.5.) and where evidence to fulfil either criteria A, or at least two of B, C, D of Article 1.5.6. (see table above) is provided, hosts may be classified as Group 1 (for inclusion in the *Code*). This outcome is strengthened somewhat where infections are natural rather than experimental (Article 1.5.4.). In cases where evidence to fulfil some of those criteria listed in Article 1.5.6. (see table above) are not achieved, and/or where identification of the pathogen is not sufficient to confirm YHV1 (Article 1.5.5.), or where infection was due to invasive experimental procedures only, hosts may be classified as Group 2 (for inclusion in the *Manual*).

In all other cases, where evidence for 'infection' cannot be demonstrated conclusively (e.g. where only PCR evidence for presence of the pathogen was provided), hosts were classified to a third group, Group 3. Group 3 hosts may potentially include those taxa to be listed in section 2.2.6. of the *Manual* chapter under the heading of 'Vector'.

In reviewing susceptibility of aquatic hosts to YHV1 the *ad hoc* Group considered the taxonomic range over which susceptible hosts exist. Such an approach may be used to better inform on risk related to the importation of potentially susceptible hosts. Evidence for susceptibility to YHV1 is available from only two families (*Penaeidae* and *Palaemonidae*) within the Decapod suborder (Dendrobranchiata). Susceptibility was tested (though not demonstrated) in several other families (including Bracyhura, the crabs) of the suborder Pleocyemata. An understanding of taxonomic spread in host range is a new concept in addressing susceptibility and will undoubtedly highlight the variation in virulence strategies for the pathogens (including those of fish and molluscs) listed the *Aquatic Code* and *Manual*. Where specific evidence does not exist for susceptibility of a given host taxon to YHV1 (or other listed crustacean diseases), a risk analysis based upon taxonomic range should be conducted.

5. Outcome of the analysis

The *ad hoc* Group recommended to retain the listing of *Penaeus monodon* as a species susceptible to YHV1 infection. The assessment undertaken by the *ad hoc* Group against the criteria is provided below:

STAGE 1

Transmission has been obtained naturally (Wijegoonawardane *et al.*, 2008 and Boonyaratpalin *et al.*, 1993) in accordance with Article 1.5.4. The *ad hoc* Group considered that this criterion was met.

AND STAGE 2

The identity of the pathogenic agent has been confirmed (Wijegoonawardane *et al.*, 2008) in accordance with Article 1.5.5. The *ad hoc* Group considered that this criterion was met.

AND STAGE 3

There is evidence of infection with the pathogenic agent in the suspect host species (Wijegoonawardane *et al.*, 2008; Boonyaratpalin *et al.*, 1993; Longyant *et al.*, 2006) in accordance with criteria A to D in Article 1.5.6. The *ad hoc* Group considered that this criterion was met.

In addition:

The *ad hoc* Group recommended to list *Penaeus vannamei* as a species susceptible to YHV1 infection. The assessment undertaken by the *ad hoc* Group against the criteria is provided below.

STAGE 1

Transmission has been obtained naturally (Songsuk *et al.*, 2011), and by experimental procedures (Lightner *et al.*, 1998) that mimic natural pathways for *infection* in accordance with Article 1.5.4. The *ad hoc* Group considered that this criterion was met.

AND STAGE 2

The identity of the *pathogenic agent* has been confirmed (Songsuk *et al.*, 2011) in accordance with Article 1.5.5. The *ad hoc* Group considered that this criterion was met.

AND STAGE 3

There is evidence of *infection* with the *pathogenic agent* in the suspect host species (Lightner *et al.*, 1998; Songsuk *et al*., 2011) in accordance with criteria A to D in Article 1.5.6. The *ad hoc* Group considered that this criterion was met.

The *ad hoc* Group recommended to list *Penaeus stylirostris* as a species susceptible to YHV1 infection. The assessment undertaken by the *ad hoc* Group against the criteria is provided below.

STAGE 1

Transmission has been obtained naturally (Castro-Longoria *et al.*, 2008), in accordance with Article 1.5.4. The *ad hoc* Group considered that this criterion was met.

AND STAGE 2

The identity of the *pathogenic agent* has been confirmed (Castro-Longoria *et al.*, 2008) in accordance with Article 1.5.5. The *ad hoc* Group considered that this criterion was met.

AND STAGE 3

There is evidence of *infection* with the *pathogenic agent* in the suspect host species (Lu *et al.*, 1994; Castro-Longoria *et al.*, 2008) in accordance with criteria A to D in Article 1.5.6. The *ad hoc* Group considered that this criterion was met.

The *ad hoc* Group recommended to list *Metapenaeus affinis* as a species susceptible to YHV1 infection. The assessment undertaken by the *ad hoc* Group against the criteria is provided below.

STAGE 1

Transmission has been obtained by experimental procedures that mimic natural pathways for *infection* (Longyant *et al.*, 2006) in accordance with Article 1.5.4. The *ad hoc* Group considered that this criterion was met.

AND STAGE 2

The identity of the *pathogenic agent* has been confirmed (Longyant *et al.*, 2006) in accordance with Article 1.5.5. The *ad hoc* Group considered that this criterion was met.

AND STAGE 3

There is evidence of *infection* with the *pathogenic agent* in the suspect host species (Longyant *et al.*, 2006) in accordance with criteria A to D in Article 1.5.6. The *ad hoc* Group considered that this criterion was met.

The *ad hoc* Group recommended to list *Palaemonetes pugio* as a species susceptible to YHV1 infection. The assessment undertaken by the *ad hoc* Group against the criteria is provided below.

STAGE 1

Transmission has been obtained by experimental procedures that mimic natural pathways for *infection* (Ma *et al.*, 2009) in accordance with Article 1.5.4. The *ad hoc* Group considered that this criterion was met.

AND STAGE 2

The identity of the *pathogenic agent* has been confirmed (Ma *et al.*, 2009) in accordance with Article 1.5.5. The *ad hoc* Group considered that this criterion was met.

AND STAGE 3

There is evidence of *infection* with the *pathogenic agent* in the suspect host species (Ma *et al.*, 2009) in accordance with criteria A to D in Article 1.5.6. The *ad hoc* Group considered that this criterion was met.

In addition:

The *ad hoc* Group recommended to remove *Penaeus esculentus* as a species susceptible to YHV1 infection as there is insufficient evidence to demonstrate susceptibility through the approach described in Article 1.5.3. The assessment undertaken by the *ad hoc* Group against the criteria is provided below.

STAGE 1

Transmission has only been obtained by experimental invasive procedures that do not mimic natural pathways for *infection* in accordance with Article 1.5.4. Further the literature only refers to studies using genotype 2 (GAV) so susceptibility to infection with the listed YHV1 cannot be confirmed (Spann *et al.*, 2000, 2003). The *ad hoc* Group considered that this criterion was not met.

AND STAGE 2

The identity of the *pathogenic agent* has not been confirmed in accordance with Article 1.5.5. Specifically, studies have not sufficiently demonstrated use of the agent YHV1 (Spann *et al.*, 2000, 2003). The *ad hoc* Group considered that this criterion was not met.

AND STAGE 3

There is not sufficient evidence of *infection* with the *pathogenic agent* in the suspect host species in accordance with criteria A to D in Article 1.5.6. Specifically, non-specific clinical signs were reported but internal pathology was not characteristic (Spann *et al.*, 2003). The *ad hoc* Group considered that this criterion was not met.

The *ad hoc* Group recommended to remove *Penaeus japonicus* as a species susceptible to YHV1 infection as there is insufficient evidence to demonstrate susceptibility through the approach described in Article 1.5.3. The assessment undertaken by the *ad hoc* Group against the criteria is provided below.

STAGE 1

Transmission has been obtained naturally for the *infection* (Wang *et al.*, 1996) in accordance with Article 1.5.4. The *ad hoc* Group considered that this criterion was met.

AND STAGE 2

The identity of the *pathogenic agent* has not been confirmed (Wang *et al.*, 1996) in accordance with Article 1.5.5. Specifically, animals obtained from the outbreak under study were coinfected with WSSV and did not display typical clinical signs of YHV1. In addition, no typing of YHV1 in accordance with Section 7 of the appropriate *Manual* chapter was reported (Wang *et al.*, 1996). The *ad hoc* Group considered that this criterion was not met.

AND STAGE 3

There is evidence of *infection* with the *pathogenic agent* in the suspect host species (Wang *et al.*, 1996) in accordance with criteria A to D in Article 1.5.6. Specifically, although TEM was reported, the authors did not confirm that infection was caused by YHV1 (Wang *et al.*, 1996). The *ad hoc* Group considered that this criterion was met.

6. Review and finalise report of meeting

The *ad hoc* Group utilised an existing database of papers and reports pertaining to Yellowhead disease (YHV1, GAV and other known genotypes) (Dr Stentiford, Cefas). In addition, the *ad hoc* Group searched the CAB Abstracts database (time range 1968 and 2015) (EBSCO host) using the search terms “yellow head virus” (n=386) and “yellow baculovirus” (n=30). We limited our search from 2008 to 2015 to the key words “yellow head disease” (n=115) as the literature had been reviewed previous to 2009 (Stentiford *et al.*, 2009). Over 700 articles in the database were identified using these key words. The initial selection of articles was based on the relevance of the titles to the objectives of the terms of reference (host susceptibility). Selected titles were then evaluated to determine the route of infection, confirmation of the pathogen genotype, and the presence of viable replicating virus in the host. Once we had sufficient papers to assess that a host species was susceptible we did not search for other references pertaining to that crustacean host species. The search was broadened by using the Boolean operators “OR” and “AND”, and other databases, such as Google Scholar and PubMed. Key terms searched included “YHV and Mosquito” (n=2), and “YHV and chinensis” (n=0), and “YHV and indicus” (n=1). A few “backward” searches on relevant articles were also conducted. Approximately 40 papers were downloaded for initial review. In total 18 papers were cited. Three proceedings and two peer-reviewed papers initially selected could not be accessed.

7. Summary

In summary, five crustacean host taxa fulfilled the criteria required for listing a species susceptible to infection with YHV1 according to Article 1.5 of *Aquatic Animal Health Code.* These Group 1 hosts were: *Penaeus monodon*, *Penaeus vannamei*, *Penaeus stylirostris*, *Palaemonetes pugio* and *Metapenaeus affinis*. In addition, a further nine crustacean host taxa fulfilled some of the criteria required for listing as susceptible but evidence was lacking to either confirm the identity of the pathogen under study as YHV1, to demonstrate a natural route of infection, or to definitively confirm an ’infected’ status. These Group 2 hosts were: *Macrobrachium sintangense*, *Metapenaeus brevicornis*, *Palaemon serrifer*, *Palaemon styliferus*, *Penaeus aztecus*, *Penaeus duorarum*, *Penaeus japonicus*, *Penaeus merguiensis* and *Penaeus setiferus.* Finally, numerous taxa were classified in to a third group when either the viability of the virus within the host was not demonstrated, or where its status as a mechanical vector could not be ruled out. Detailed analysis of evidence pertaining to Group 1, 2 and 3 hosts is provided in Annex IV.

Table 2. Susceptiblity of species to yellow head virus Genotype 1.

Species	Overall status
Metapenaeus affinis	1
Palaemonetes pugio	1
Penaeus monodon	1
Penaeus stylirostris	1
Penaeus vannamei	1
Macrobrachium sintangense	2
Metapenaeus brevicornis	2
Palaemon serrifer	2
Palaemon styliferus	2
Penaeus aztecus	2
Penaeus duorarum	2
Penaeus japonius	2
Penaeus merguiensis	2
Penaeus setiferus	2
Acetes sp.	3
Callinectes sapidus	3
Chelonibia patula	3
Ergasilus manicatus	3
Fundulus grandis	3
Metapenaeus bennettae	3
Metapenaeus ensis	3
Octolasmis muelleri	3
Penaeus esculentus	3

8. Next meeting

Next meeting date to be confirmed after Aquatic Animals Health Standards Commission meeting in March 2015.

9. References

Boonyaratpalin S., Supamataya K., Kasornchandra J., Direkbusarakom S., Ekpanithanpong U., Chantanachookin C. (1993). - Non-occluded baculo-like virus the causative agent of yellowhead disease in the black tiger shrimp *Penaeus monodon*. *Fish Pathology,* 28, 103-109

Castro-Longoria R., Quintero-Arredondo N., Grijalva-Chon J.M., Ramos-Paredes J. (2008). - Detection of the yellow-head virus (YHV) in wild blue shrimp, *Penaeus stylirostris*, from the Gulf of California and its experimental transmission to the Pacific white shrimp, *Penaeus vannamei*. *J. Fish Dis.*, 31 (12), 953–956.

Chantanachookin, C., Boonyaratpalin, S., Kasornchandra, J., Direkbusarakom, S., Aekpanithanpong, U., Supamattaya, K., Sriuraitana, S., Flegel, T.W., (1993). - Histology and ultrastructure reveal a new granulosis-like virus in *Penaeus monodon* affected by yellow-head disease. *Dis. Aquat. Org.* 17, 145–157.

Flegel, T.W., (1997). - Special topic review: major viral diseases of the black tiger prawn (*Penaeus monodon*) in Thailand. *World J. Microb. Biol.* 13, 433–442

Flegel, T.W., Fegan, D.F., Sriurairatana, S., (1995). - Environmental control of infectious diseases in Thailand. In: Shariff, M., Subasinghe, R.P., Arthur, J.R. (Eds.), Diseases in Asian Aquaculture II. Asian Fisheries Society, Manila, The Phillippines, pp. 65–79.

Lightner, D.V., Hasson, K.W., White, B.L., Redman, R.M., (1998). - Experimental infection of western hemisphere penaeid shrimp with asian white spot syndrome virus and asian yellow head virus. *J. Aquat. Anim. Health* 10, 271–281.

Longyant, S., Sattaman, S., Chaivisuthangkura, P., Rukpratanporn, S., Sithigorngul, W.,Sithigorngul, P., (2006). - Experimental infection of some penaeid shrimps and crabs by yellow head virus (YHV). *Aquaculture* 257, 83–91.

Longyant, S., Sithigorngul, P., Chaivisuthangkura, P., Rukpratanporn, S., Sithigorngul, W., Menasveta, P., (2005). - Differences in the susceptibility of palaemonid shrimp species to yellow head virus (YHV) infection. *Dis. Aquat. Org.* 64, 5–12.

Lu, Y., Tapay, L.M., Brock, J.A., Loh, P.C., (1994). - Infection of the yellow head baculo-like virus (YBV) in two species of penaeid shrimp *Penaeus stylirostris* (Stimpson) and *Penaeus vannamei* (Boone). *J. Fish Dis.* 17, 649–656.

Ma, H., Overstreet, R. M., & Jovonovich, J. A. (2009). - Daggerblade grass shrimp (Palaemonetes pugio): A reservoir host for yellow-head virus (YHV). *Journal of Invertebrate Pathology*, 101(2), 112–8. http://doi.org/10.1016/j.jip.2009.04.002

Overstreet, R. M., Jovonovich, J., & Ma, H. (2009). - Parasitic crustaceans as vectors of viruses, with an emphasis on three penaeid viruses. *Integrative and Comparative Biology*, 49(2), 127–41. http://doi.org/10.1093/icb/icp033

Songsuk, A., Limsuwan, C., Chuchird, N., Laisuthisan, K., Somsiri, T., Baoprasertkul, P., Senapin, S. (2011). - Yellow head virus outbreaks in intensive freshwater culture of Pacific white shrimp (*Litopenaeus vannamei*) in Thailand and its experimental infection at different salinity levels. *Kasetsart University Fisheries Research Bulletin*, 35(1), 29–40.

Spann K.M., Donaldson R.A., Cowley J.A., Walker P.J. (2000). - Differences in susceptibility of some penaeid prawn species to gill-associated virus (GAV) infection. *Diseases of Aquatic Organisms*,42, 221-225

Spann, K.M., McCulloch, R.J., Cowley, J.A., East, I.J. and Walker, P.J. 2003. - Detection of gillassociated virus (GAV) by *in situ* hybridisation during acute and chronic infections of *Penaeus monodon* and *Penaeus esculentus* shrimp. *Diseases of Aquatic Organisms*, 56, 1-10.

Stentiford, G. D., Bonami, J.-R., & Alday-Sanz, V. (2009). - A critical review of susceptibility of crustaceans to Taura syndrome, Yellowhead disease and White Spot Disease and implications of inclusion of these diseases in European legislation. Aquaculture, 291(1-2), 1–17. http://doi.org/10.1016/j.aquaculture.2009.02.042

Walker P.J., Cowley J.A., Spann K.M., Hodgson R.A.J., Hall, M.R., Withyachumnarnkul, B. (2001). - Yellow head complex viruses: Transmission cycles and topographical distribution in the Asia-Pacific Region. In: The New Wave, Proceedings of the Special Session on Sustainable Shrimp Culture, Aquaculture 2001, Browdy C.L. & Jory D.E., eds. The World Aquaculture Society, Baton Rouge, LA, USA, 292-302.

Wang C.S., Tang K.F.J., Chen S.N. (1996). Yellow head disease-like infection in the Kuruma shrimp *Penaeus japonicus* cultured in taiwan. *Fish Pathology* 31: 177-182.

Wijegoonawardane P.K.M., Cowley J.A., Phan T., Hodgson R.A.J., Nielsen L., Kiatpathomchai W. & Walker P.J. (2008). - Genetic diversity in the yellow head nidovirus complex. *Virology* 380, 213–225.

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Annex I

MEETING OF THE OIE AD HOC GROUP ON SUSCEPTIBILITY OF CRUSTACEAN SPECIES TO INFECTION WITH OIE LISTED DISEASES

Paris, 10–12 February 2015

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Annex II

MEETING OF *AD HOC* GROUP ON SUSCEPTIBILITY OF CRUSTACEAN SPECIES TO INFECTION WITH OIE LISTED DISEASES

Paris, 10–12 February 2015

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Agenda

1) Welcome and introduction
2) Objectives of the meeting
3) Terms of Reference
4) Discussion of working documents and other relevant documents
5) Outcome of the analysis
6) Review and finalise the report of the meeting
7) Summary
8) Next meeting

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Annex III

AD HOC GROUP ON SUSCEPTIBILITY OF CRUSTACEAN SPECIES TO INFECTION WITH OIE LISTED DISEASES

Terms of Reference

Background

A new Chapter 1.5. 'Criteria for listing species as susceptible to infection with a specific pathogen' was introduced into the 2014 edition of the *Aquatic Code*. The purpose of this chapter is to provide criteria for determining which host species are listed as susceptible in Article X.X.2. of each disease-specific chapter in the *Aquatic Code.* The criteria are to be applied progressively to each disease-specific chapter in the *Aquatic Code*.

These assessments will be undertaken by *ad hoc* Groups and the assessments will be provided to Member Countries' for comment prior to any change in the list of susceptible species in Article X.X.2. of the disease-specific chapters in the *Aquatic Code.*

For species where there is some evidence of susceptibility but insufficient evidence to demonstrate susceptibility through the approach described in Article 1.5.3., information will be included in the relevant disease-specific chapter in the *Aquatic Manual.*

Purpose

The *ad hoc* Group on Susceptibility of crustacean species to infection with OIE listed diseases will undertake this task for OIE listed crustacean diseases.

Terms of Reference

1) Consider standards of evidence required to satisfy the criteria in Chapter 1.5.
2) Review relevant literature documenting susceptibility of species
3) Propose susceptible species for OIE listed diseases based on Article 1.5.7.
4) Propose susceptible species for OIE listed diseases based on Article 1.5.8.

Expected outputs of the *ad hoc* Group

1) Develop a list of susceptible species for inclusion in the relevant Articles of crustacean disease-specific chapters in the *Aquatic Code* and *Manual*, starting with Yellow Head Disease, and if time allows other OIE listed crustacean diseases.
2) Draft a report for consideration by the Aquatic Animals Commission at their March 2015 meeting.

Evidence for susceptibility of host species to infection with yellow head virus according to Chapter 1.5. Criteria for listing species as susceptible to infection with a specific pathogen.

Genus	Species	Route of transmission	Pathogen id.	A	B	C	D	Reference	Outcome	Status
Acetes	*sp.*	N	suspected	no	yes	no	no	Flegel *et al.*, 1995	3	3
Callinectes	*sapidus*	EN	confirmed	no	no	no	yes	Ma *et al.*, 2009	3	3
Chelonibia	*patula*	EN	confirmed	no	no	no	no	Overstreet *et al.*, 2009	3	3
Ergasilus	*manicatus*	EN	confirmed	no	no	no	no	Overstreet *et al.*, 2009	3	3
Fundulus	*grandis*	EN	confirmed	no	no	no	no	Overstreet *et al.*, 2009	3	3
Metapenaeus	*bennettae*	EI	confirmed					Walker *et al.*, 2001	3	3
Macrobrachium	*sintangense*	EI	confirmed	yes	no	no	no	Longyant *et al.*, 2005	2	2
Metapenaeus	*affinis*	EN	confirmed	yes	no	yes	yes	Longyant *et al.*, 2006	1	1
Metapenaeus	*brevicornis*	EI	confirmed	yes	no	yes	yes	Longyant *et al.*, 2006	2	2
Metapenaeus	*ensis*	EI	suspected	no	no	no	no	Chantanchookin *et al.*, 1993	3	3
Octolasmis	*muelleri*	EN	confirmed	no	no	no	no	Overstreet *et al.*, 2009	3	3
Palaemon	*serrifer*	EI	confirmed	yes	no	no	no	Longyant *et al.*, 2005	2	2
Palaemon	*styliferus*	N	suspected	yes	yes	yes	yes	Flegel, 1997	2	2
		EI	confirmed	yes	no	no	no	Longyant *et al.*, 2005	2	
Palaemonetes	*pugio*	EN	confirmed	yes	no	yes	yes	Ma *et al.*, 2009	1	1
Penaeus	*aztecus*	EN	suspected	yes	no	yes	yes	Lightner *et al.*, 1998	2	2
Penaeus	*duorarum*	EN	suspected	yes	no	yes	yes	Lightner *et al.*, 1998	2	2
Penaeus	*esculentus*	N	confirmed	no	no	no	no	Walker *et al.*, 2001	3	3
		EI	suspected	no	no	yes	no	Spann *et al.*, 2000	3	
		EI	confirmed	no	no	yes	yes	Spann *et al.*, 2003	3	

Annex IV (contd)

Genus	Species	Route of transmission	Pathogen id.	A	B	C	D	Reference	Outcome	Status
Penaeus	*japonius*	N	suspected	yes	no	yes	yes	Wang *et al.*, 1996	2	2
Penaeus	*merguiensis*	N	suspected	no	yes	yes	yes	Flegel 1997	2	2
		EI	suspected	no	no	no	no	Chantanchookin *et al.*, 1993	3	
Penaeus	*monodon*	N	confirmed	no	no	yes	yes	Wijegoonawardane *et al.*, 2008	1	1
		N	suspected	yes	no	yes	yes	Boonyaratpalin *et al.*, 1993	2	
		EI	suspected	no	yes	yes	no	Longyant *et al.*, 2006	2	
Penaeus	*setiferus*	EN	suspected	yes	no	yes	yes	Lightner *et al.*, 1998	2	2
Penaeus	*stylirostris*	N	confirmed	no	yes	yes	yes	R Castro-Longoria *et al.*, 2008	1	1
		EI	suspected	yes	no	yes	yes	Lu *et al.*, 1994	2	
Penaeus	*vannamei*	N	confirmed	no	yes	yes	yes	Songsuk *et al.*, 2011	1	1
		EN	suspected	yes	no	yes	yes	Lightner *et al.*, 1998	2	

Route of transmission: Natural (N), Experimental Non-invasive (EN), Experimental Invasive (EI);