A PROPOSAL FOR THE EVALUATION OF VERTEBRATES AS TO THEIR ROLE IN THE CIRCULATION OF ARBOVIRUSES*)

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Abstract. The authors present a proposal for the classification of vertebrates as hosts or hosts-amplifiers of arboviruses from an ecological point of view.

In 1967 WHO published the following definition of arboviruses (arthropod-borne viruses). “Arboviruses are viruses which are maintained in nature principally, or to an important extent, through biological transmission between susceptible vertebrate hosts by haematophagous arthropods; they multiply and produce viraemia in the vertebrates, multiply in the tissues of arthropods, and are passed on to new vertebrates by the bites of arthropods after a period of extrinsic incubation. This basic definition is based on ecological considerations involving not only the virus but a vertebrate host and arthropod vector as well.”

This definition mentions only susceptible vertebrate hosts and multiplication and production of viremia by these vertebrates.

In the following years the first and the main step was to classify all arboviruses of vertebrates. This step was initiated in 1971 by an Expert Committee. The aim of that undertaking was to evaluate the state of knowledge on all the registered viruses, classifying each agent as:
1) arbovirus, 2) probable arbovirus, 3) possible arbovirus, 4) probably not arbovirus or, 5) not arbovirus.

The results have been published in the Berge’s International Catalogue of Arboviruses (1975). In this Catalogue each virus has its Registration Card with all fundamental details known at the time of registration. This initiative was very useful and it helped significantly not only to give a clear picture of our knowledge on arboviruses but it also stimulated interest in basic research on arboviruses.

Experimental infections in vertebrates have disclosed that susceptibility to infection of vertebrates alone does not guarantee an arbovirus multiplication in them to such an extent that the viremia is sufficient for a successful infection of a susceptible arthropod. It is therefore necessary to differentiate between susceptible vertebrates, in whom the virus multiplies but the level of viremia is not sufficient for a successful infection of a susceptible arthropod and vertebrates where viremia is sufficiently high and above the threshold of susceptibility of arthropods. The former should be called “hosts”, the latter “host-amplifiers”.

The situation is similar as in 1971 with arboviruses, since vertebrates are only briefly described in the Catalogue mentioned above and the natural host range of arboviruses is given only generally. Though this is considered to be sufficient as a piece of information on the participation of a particular vertebrate in the circulation of an arbovirus, it is not enough as far as the extent of its participation is concerned, in other words, it does

not say if a given species of vertebrate is amplifying the amount of an arbovirus in the natural focus. This was of course not the aim of the above mentioned Catalogue, but it is felt, that it is time to pay more attention to the elucidation of the role played by vertebrates in the circulation of arboviruses and define the extent of their participation.

For theoretical and practical reasons it is regarded important to know what species of vertebrates are significant for the ensuring of the permanent circulation of arboviruses in nature. The enumeration of vertebrates as hosts only is considered inadequate and therefore it is felt that certain criteria should be developed for the classification of the vertebrates participating in the circulation of an arbovirus. The following rating procedure is proposed for discussion.

According to the results of experimental studies done in the laboratory and/or the field, hosts should be rated as: potential, probable, very probable, and true (proven) hosts. A detailed justification for this rating is given in Table 1.

| Table 1. Guide to the rating of vertebrates as hosts and hosts-amplifiers |
|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| Hosts                                             | **Potential***                                   | **Probable**                                       | **Very probable**                                 |
| seen with feeding ticks in nature                | caught in nature and being serologically positive | developing viremia and seroconversion or seroconversion only after experimental infection in the laboratory | |
| Hosts Amplifiers                                  | **Possible***                                   | **Probable**                                       | **True (Proven)**                                 |
| low level of viremia after an experimental infection not considered to be sufficient to infect the biological vector | the level of viremia after an experimental infection is considered to be sufficiently high to infect the biological vector | the level of viremia after an experimental infection was proven to be sufficiently high to infect the feeding biological vector | the biological vector was infected after feeding on a vertebrate infected by an infected arthropod |

* According to the Webster’s New Collegiate Dictionary (1974) “potential” means something that can develop and “possible” something within the limits of realization*

Having defined the true (proven) hosts of an arbovirus the following steps should be undertaken to identify the true (proven) hosts-amplifiers, since not all true (proven) hosts are ensuring permanent circulation of an arbovirus in the natural focus. This step is the most important step since only hosts-amplifiers are ensuring together with the biological vector the permanent circulation of an arbovirus in nature. Again as mentioned above all published results of experimental works should be scrutinized according to the criteria given in the lower part of Table 1.

The following rating is recommended: possible, probable, very probable and true (proven) hosts-amplifiers.

This proposal of rating the vertebrates involved in the circulation of arboviruses is put forward to make instantly clear the stage of our knowledge as regards the role of vertebrates in the circulation of a given arbovirus and indicate immediately what kind of experimental work should be undertaken in the future, if necessary, to define the true hosts-amplifiers of arboviruses.

This difficult task of rating the vertebrates involved in the circulation of all
known arboviruses is not an easy one and therefore it is recommended to appoint
a Committee on Evaluation of Vertebrates as Hosts and Hosts-Amplifiers Status of
Arboviruses (CEVHAS). The charges to this Committee are recommended to be as
follows:
1. To formulate guidelines how to proceed in the study of vertebrates in regard of
their role in the circulation of arboviruses. (Selection of strains, dose, way of infection
and evaluation)
2. To develop criteria for placing any vertebrate known to participate in the circulation
of an arbovirus in the recommended classification.
3. To formulate guidelines for the decision as to whether a particular vertebrate is
a host.
4. To formulate guidelines for the decision whether a particular vertebrate is a host-
amplifier.
5. To publish results of their decision.
6. To receive or obtain pertinent new information and to periodically review and update
the published decisions.
7. To invite those working with arboviruses to perform critical studies needed.
8. To invite persons possessing critical data relative to this effort to transmit such to
the chairman of CEVHAS.

The CEVHAS should be charged with examination of all available data with the
aim to publish the decisions on the collected information periodically in an internationall
renown journal.

Continuing scrutiny of the new data by CEVHAS will hopefully result in the eventual
classification of all vertebrates of registered arboviruses as regards their role as hosts
and hosts-amplifiers.

ПРОЕКТ КЛАССИФИКАЦИИ ПОЗВОНОЧНЫХ ОТНОСИТЕЛЬНО
ИХ РОЛИ В ЦИРКУЛЯЦИИ АРБОВИРУСОВ

В. Бардош, Б. Росицкий

Резюме. Авторами представлен проект классификации позвоночных в качестве хозяев
и хозяев-на-копителей арбовирусов с экологической точки зрения.

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