

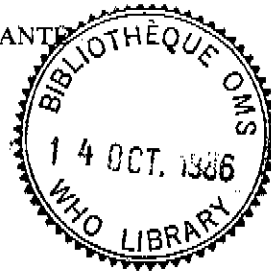


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INTERSECTORAL COLLABORATION FOR THE PROMOTION OF
PRIMARY HEALTH CARE-BASED VECTOR CONTROL: GLOBAL CONSIDERATIONS

by

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1. INTRODUCTION

"Intersectoral collaboration" is a loosely defined term covering all relations and interactions between public health, in the present case, and other sectors of activity. Consequently, the partners are, on the one hand, the health services and members of communities involved in health activities and, on the other hand, a range of public and private bodies: ministries, local authorities, NGOs, cooperatives and state farms, development agencies, industries etc. which contribute to agricultural and industrial development and to the promotion of rural and urban life style.

2. THE CONDITIONS OF INTERSECTORAL COLLABORATION

Intersectoral collaboration must be made effective for the initiation and operation of projects.

What has to be done initially is to build up infrastructures and adopt working methods that minimize the production of vectors and pests lest primary health care (PHC) systems be swamped by newly created problems. Although project planning is the business of specialists, consideration must nevertheless be given to the opinion of representatives of the communities that will use what is planned. The health aspect alone is scarcely likely to lead to costly alterations in projects unless the result will be an increase in agricultural or industrial output capable of convincing the financial backers that their investment will be profitable.

Afterwards vector control will have to be provided by the health services or the communities. However, both may find effective and often indispensable collaboration within the projects to reduce the sources of vectors by environmental measures and the adoption of appropriate methods of cultivation, or to institute chemical, biological or ecological vector control methods. At this stage consideration has to be given to the economic aspect of the measures proposed. Peasants, for example, alter their farming methods only if they can see the economic point of the changes (16,17,20).

The areas in which intersectoral collaboration is possible are many and the partners are various. Therefore, might it not be possible to evolve a plan? The recommendations in many international reports are so general as to look like bold statements of fact. One point that does, however, emerge is that every project calls for local planning in the light of the socioeconomic as well as the epidemiological and ecological aims and context.

Reference is most often made to model experimental projects that are entomologically satisfactory, but that have a cursory epidemiological assessment or none at all. What is needed is to go one step further and to assess the impact of operations on transition from the experimental stage to the operational stage, and to do so at the public health level as well as at the level of reduction in the number of vectors and of rests.

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3. AREAS OF INTERSECTORAL COLLABORATION

Intersectoral collaboration covers three major areas - rural development, industrial development and urban development - which are, moreover, not completely independent. Industrial development occurs in both town and country; dams have to be erected for its power needs, as they do in agriculture for irrigation. Lastly, any development project is capable of contributing to the improvement of health infrastructures and to their operation.

3.1 Rural development

In order to satisfy the food requirements of an exponentially increasing population, there is a need to improve the output of cultivated land, by irrigation for example, and to seek new land, often at the expense of wooded areas. Moreover, the demand for animal protein leads to more and better animal husbandry and fish farming. On top of this demand for food there is a demand for fuel and power, especially for firewood, the main source of household fuel and power in the Third World, which is causing considerable deforestation. All these activities are together reshaping the terrestrial environment, in which the original, natural environments, or environments produced by balanced and lengthy exploitation are being replaced by landscapes recently created by man. The ecologists sounded the alarm long ago and reforestation programmes have been set up, with varying success, in most countries. In the public health field much attention has been paid to the effect of development projects in promoting vector-borne diseases, sometimes forgetting that they help to end food shortages and to make care and drugs more readily accessible through the additional income that they provide.

The exodus from the countryside and the congregation of masses of people in and around large towns is another characteristic of this century. The way to curb it is to make rural life attractive, more especially by doing away with harmful influences and by improving water supply, which is still a very burdensome factor for women. Satisfaction of the requirement for water of good quality affects urbanized areas to an equal, and sometimes to a greater extent.

3.1.1 Access to drinking water

The 80s are the "water decade" which has created a movement of international solidarity of which many countries have taken advantage to install piped water systems, sink bore holes and construct wells and storage tanks. Considerable engineering works are often required to provide large towns with water. However, simple installations carried out with the collaboration of communities can supply the elementary needs of many villages.(30)

Apart from its direct effect on diarrhoeal diseases, access to drinking water is one of the surest ways of preventing dracunculiasis in Africa (9) and in Asia (8). It, in fact, eliminates the risk of drinking water infested with Cyclops contaminated with Dracuncula medinensis larvae. In addition, it saves users from having to go to pools for their daily water supplies; that is the time at which the female worms, which are on the lower limbs, lay their eggs that will infect the Cyclops.

This reduction of contact with pond water also reduces the risk of becoming infected with schistosome cercariae shed by the snails that inhabit these water bodies.

It remains a fact that the inhabitants of many villages prefer pond water to water from fitted out wells, which they find tasteless (Prod'Hon, personal communication). It is the duty of the health educator to make them realize the advantages of using good quality water.

The certainty of always having sufficient drinking water available should discourage the inhabitants from keeping stocks of drinking water in the home. These stocks are breeding grounds for Aedes aegypti, which is the source of severe epidemics of dengue. It has been found that this expectation is not usually borne out because the users lack confidence in the water installations, or because water storage is a traditional practice that still persists even when populations migrate and when water becomes available at the well or from the tap.(24).

3.1.2 Hydraulic engineering works

3.1.2.1 Introductory remarks

Mastery of water resources is one basis for agricultural and sometimes for industrial development. It involves a sequence of hydraulic engineering works, beginning with dams to impound and retain water, continuing with pipelines to carry the water to where it will be used and ending with drainage systems for its evacuation. Situations that are favourable to or, less frequently, unfavourable to the vectors that live a stage of their life in an aquatic environment are created by the supply of water in the new landscapes that result from these hydraulic engineering works.

3.1.2.2 Dams and reservoirs

Dams vary considerably in size and shape, depending on the use for which they are intended. The vast engineering works on large rivers create immense reservoirs, veritable inland seas that submerge river valleys for hundreds of kilometres. On the other hand, small earth dams, on a village scale, often only retain the water temporarily before its distribution to the farmers.

The waters impounded by large dams eliminate the blackfly breeding sites of rapids (23). Thus, the projected dam on the Nioumbel site on the Black Volta in Burkina Faso should suppress all production of Simulium damnosum s.l. for more than 200 km upstream.

However, reservoirs are most often sources of vectors and pests. They are preferred sites for the development of snails and, consequently, of schistosomiasis. In Africa "within a few years transmission of schistosomiasis has become established in all the man-made lakes" (12). Thanks to the existence of small dams, Biomphalaria pfeifferi, the host of S. mansoni, has even been able to occupy areas such as the Bandiagara area in the Sahel zone of Mali, which are outside its climatic distribution range (26).

The shores and the upstream end of reservoir lakes house large anopheline populations, especially when the fall in water level isolates small water bodies surrounded by the footprints of cattle that come to them to drink. These breeding places are especially productive of sun-loving species such as the A. gambiae complex. This additional supply of vectors has a bearing on malaria, which varies with the level of endemicity; in areas in which transmission was high the already holoendemic situation is little changed; but in areas where endemicity was low an increase in transmission may cause severe epidemics such as the one at Adana, in Turkey, where A. sacharovi was the vector (6).

Anophelines are also vectors of Bancroft's filariasis, which is a focal disease; the foci of high incidence of the disease in West Africa correspond to areas inhabited by extremely dense mosquito populations, most often associated with hydraulic engineering works (2).

The spread of water plants, especially Fistia species in inundated areas results in the proliferation of Mansonia, which has intolerable harmful effects everywhere and is, in South-East Asia, the vector of the Brugia malayi filariasis.

One of the few remedies suggested to restrict the production of vectors is the construction of steep-banked reservoirs and the establishment of reed beds. This would appear to be difficult to apply to the hundreds of kilometres of bank of the artificial lakes created by large dams, especially in developing countries. On the other hand, should the epidemiological situation so justify, it would be possible to envisage such works with the participation of village communities on the small reservoirs of earth dams; appropriate fish stocking with species such as Tilapia or carp could reduce the production of mosquitos and provide protein for the villages. This possibility needs the backing of research on the various ecological aspects.

The spillways of dams of all sizes are excellent breeding sites for Simulium damnosum s.l., the African vector of onchocerciasis. Hyperendemic foci of this disease have been created by the irrigated areas established in Mali and Burkina Faso, which were, moreover, rapidly abandoned by their colonizers (23). The production of these spillway breeding sites may be neutralized by installing a double system of gates and spillways that operate alternately and allow the breeding sites to dry out, thus causing death of the blackfly larvae by desiccation. Provision for this equipment should be made in the design of dams; it can be operated by the farmers themselves. In large hydroelectric generating stations the turbines can be operated alternately; the results obtained in this way at Selingué in Mali have been considered excellent (1). If no preventive measures have been taken, it is in general still possible to release insecticides or Bacillus thuringiensis H.14, possibly automatically.

3.1.2.3 The distribution network

These are installations that differ very greatly in size, in discharge and in structure, ranging from large inlet channels, which may be several tens of kilometres long, to the small ditches supplying plots of irrigated land. The presence of vectors in the canal systems is dependent above all on flow rate, on the presence of vegetation and, to a lesser extent, on insolation.

Too fast a current, above 0.7 m/sec, may enable S. damnosum s.l. to establish itself; this is a serious threat in areas in which onchocerciasis is endemic, as has already been noted in the Côte d'Ivoire (Séchan, personal communication).

When the current falls to below 0.3 m/sec snails are able to establish themselves if they find substrates and sources of food, i.e. vegetation. Intermediate schistosome hosts proliferate far more in irrigation canals than in rice paddies, where the water may reach temperatures incompatible with their survival, especially in the arid zones of the Sahel in Africa (26,29,30,31).

When the canals become stagnant considerable mosquito populations, more especially anopheline populations may establish themselves.

Various ways of preventing the production of vectors in canals have been suggested:

- maintaining the current at the optimum velocity, which is not always possible in flat terrain;
- cementing the canals to make upkeep easier;
- lining the canals to avoid the development of vegetation (17);
- constructing underground or enclosed canal systems and using spraying whenever possible (sugar cane).

These very specific measures involve expenditure that may be offset by the water economized.

Maintenance and cleaning of canals, which is easier the better they are constructed, can in itself greatly decrease the risk of schistosomiasis. These operations may easily be entrusted to village communities in the context of intersectoral activities.

Herbivorous fishes, more especially the grass carp (Ctenopharyngodon idellus) have been used in China to eliminate canal vegetation (14).

3.1.2.4 Evacuation of water - drainage

The water that passes through irrigated areas has to be evacuated into rivers or ponds to prevent it forming swamps on bottom land that could become sources of vectors.

Drains raise the same problems as canals; the same solutions apply to their design and maintenance. If it is impossible to evacuate water to a watercourse, it can be stocked in fitted out storage ponds that raise problems very similar to those of the reservoirs of small dams. It should, however, be noted that water that has passed through irrigated areas may have a fertilizer and pesticide content that renders it toxic for fishes.

Drainage also applies to natural marshes that may be desirable to drain as a hygienic measure or for agricultural use. Communities can be called upon to carry out these tasks with the assistance and using the equipment of bodies concerned with development, rural development or public health, as in Gujarat in India (28).

3.1.3 Irrigated areas

When we refer to irrigated areas we think first and foremost of rice paddies, but also of the many crops for which intermittent and sometimes prolonged irrigation is employed. This is true for flooded grasslands in the USA, which are breeding sites for Culex tarsalis (the vector of western equine encephalitis) and other harmful vectors.

There is a very extensive literature on the health problems created by rice fields (17,20,32). Rice-growing systems are extremely varied, but permanent irrigation is the system most favourable to the development of vectors and there is a close correlation between the growth of rice and fluctuations in the abundance of the various mosquito species.

The 10 to 30 days following the rice transplantation are an extremely favourable period for sun-loving vectors such as species of the A. gambiae complex (4). Thereafter, as the rice grows, the populations of some species such as A. sinensis and Culex tritaeniorhynchus (the vector of Japanese encephalitis) continue to increase, reaching a maximum just before the harvest (15). Some species, such as A. funestus, which develop in water bodies with vertical vegetation may take over from the sun-loving species when the rice stems reach a height of 40 cm or more (5).

Numerous anopheline species are connected with rice-growing, but their epidemiological importance varies from region to region. On Java, A. aconitus is the main malaria vector; in China species of the A. sinensis group (A. sinensis and A. anthropophagus) are involved in most cases of Plasmodium vivax. The situation is more complicated in West Africa. The "mopti" cytotype of A. gambiae, which abounds in the rice-fields, is far poorer as a vector than the "savanna" cytotype of the same species, which is to be found in villages growing the traditional crops. It follows that the transmission of malaria in these latter villages is four times higher than in the villages of the rice-growing area although the number of bites per man and per year may be four times less (4). A. hyrcanus does not seem to play an important role in Turkey. These examples are not a review of the anopheline species of rice-fields, but are intended to show the differences that they involve between one region and another and, consequently, the need to make a serious evaluation of their public health impact before undertaking often extremely onerous control operations. Here, perhaps, more than elsewhere is the place to be mistrustful of general ideas without any real basis repeated over the years and in the reviews.

Rice-fields are also favourable sites for the intermediate hosts of schistosomes. In addition to the bulinids and planorbids referred to above, Oncomelania sp. that are hosts of Schistosoma japonicum find conditions in them conducive to their development.

The area of rice-fields is such that their treatment with insecticides (or with bacterial preparations) on public health grounds alone would not be cost-effective in most cases (14). However, insecticides are used by farmers against rice pests. In Korea they controlled C. tritaeniorhynchus very well down to the seventies, when this mosquito became resistant to the organophosphorus insecticides in use; thereafter the agricultural insecticiding had no further impact and there was even an epidemic of encephalitis in 1982. On Taiwan, treatment of the rice, which was too infrequent, never yielded good control of the Culex that are local vectors of encephalitis (Mitchell, personal communication). In Kenya it

would even seem that treatment for the control of insect pests has favoured the proliferation of A. arabiensis by killing the predators that attack the mosquitos (28).

The role of agricultural insecticiding in the development of resistance was reviewed (18) in 1985.

Solution to the problems created by rice-fields has been sought in the modification of farming techniques, environmental development and biological control.

Repeated ploughing and harrowing are eliminating Oncomelania sp. in the Philippines (22). In the United States the eggs of Aedes vexans are submitted to the same techniques when they are in anhydrobiotic conditions and are subsequently unable to hatch. Potamogetes, the plant host of Biomphalaria, is destroyed by herbicides used primarily in cultivation systems that do not employ planting out.

Intermittent irrigation was already in use in Portugal before the Second World War for the control of A. atroparvus, a local malaria vector. Given that the preimaginal cycle of this mosquito was 18 days, the rice-fields were drained every 17 days. An 80% reduction in the number of A. atroparvus larvae was achieved in four years (11). Wet irrigation is practised in China. The rice fields are inundated for 10-15 days at the time of transplantation of the rice, after which they are drained. Thereafter irrigation is carried out for 24 or 48 hours every 3-5 days with a thin layer of water to keep the soil moist. This technique effects water savings of 60% and increases the grain yield. Only one generation of A. sinensis and C. tritaeniorhynchus at most is able to develop at the time of transplantation. Manbiting density of these two species have decreased by between 55 and 70% (16). It appears that the principle motivation for this farming method is water economy and that the resulting vector control is only a side effect of its use. Intermittent irrigation is one of the recommendations of all meetings on integrated control. However, we should be aware that it is not possible everywhere, and it is so far lacking as to be confined in China itself to the Yellow River basin.

Because mechanization of crop-growing results in a reduction in the number of draught animals it may increase anthropophilism and, consequently, the vector capacity of some mosquito species following the disappearance of their usual hosts. This is a development that can be noted without being able to do anything about it.

The creation of rice-fields may lead to the formation of borrow-pits that have to be filled in or drained.

Culiciphagous fishes have been used as biological control agents in rice-fields, more especially in Afghanistan. In China fish have been reared in rice-fields for 2000 years in Sechuan. Small carp, 1.5-3 cm long, are released in the rice-fields at the time of transplantation. Consequently, they are culiciphages before becoming herbivores. The fish are recovered at harvest time, when they weigh 60-100 g; the yield is 75 kg/ha. The density of mosquito larvae may be reduced by 80%. However, this fish-breeding requires special management of the rice-fields and additional work. It is practised only in limited areas (14). It would be an urgent matter to assess the effect of fish and of fish-breeding in terms of the density of bites among the inhabitants and in terms of the incidence of diseases, and not merely in terms of the reduction in the number of larvae.

The use of Bacillus thuringiensis H.14 is also recommended in many reports from specialized agencies. The formulations currently available have no residual effect, and this would necessitate repeated treatment that would make them not very cost-effective even if the product were to be manufactured locally.

3.1.4 Fish farming

The creation of fishponds dug in swampy depressions is one element of integrated control in Gujarat and Pondicherry in India (25,28). The fish reared there eliminate mosquito larvae. In the Congo, however, fishponds in which the same species, Tilapia mossambica, is

reared are the source of very dense populations of A. gambiae and of enormous transmission of malaria (more than 1000 infective bites per man per year) (3). Given that these apparently contradictory observations are believable in both instances, it is appropriate to make a rational study of the culicid productivity of the various types of fishponds stocked with different species in a number of climatic zones.

It may be recalled that the establishment of fish farm ponds on the outskirts of Yaoundé coincided with proliferation of Biomphalaria camerunensis and the appearance towards 1956 of intestinal schistosomiasis, which had previously been regarded as insignificant in the region (Personal observation).

3.1.5 Deforestation and reforestation

The forest is threatened by farmers in search of new land and by woodcutters eager for wood for industry, handicrafts and domestic fuel and power. The search for firewood is even a factor that worsens desertification in arid zones. Conservation of the forest heritage is now regarded as a priority by most countries of the world.

However, it was not always so, and deforestation followed by agricultural exploitation was the basis of tsetse-fly control in Africa for more than half a century. Although the success of this prevention by farming techniques was localized, it was undeniable. Nevertheless, such procedures are scarcely acceptable anymore from the ecological point of view. The same could be said of the deforestation recommended in South-East Asia for Anopheles dirus control, at least when it goes beyond ordinary scrub clearance.

Moreover, deforestation is most often conducive to the proliferation of sun-loving vectors such as A. gambiae and intermediate hosts of schistosomes (18), and to the appearance and development of the diseases that they transmit.

Replanting with Eucalyptus trees has long been used to dry out marshy land that is a source of vectors. In India, the villagers plant trees on the site of filled-in marshes; this measure is fully supported by the forestry services, which are very concerned to promote reforestation (28).

3.2 Industrial development

Industrial development has produced a pathology all of its own aggravated by the considerable etiological impact of pollution by factory waste. Although vectors are in general of little concern, we should emphasize instances of the proliferation of Culex quinquefasciatus, the vector of Bancroft's filariasis, in the waste-water discharged by agricultural processing plants, more especially sugar refineries; such proliferation, which was recorded on the Island of Réunion in the 50s (10), has since been reported in most countries where sugar-cane is grown. The waste of dairies in Europe may lead to the proliferation of black flies, whose bites alone kill the cattle of riverside farmers (21); as yet, no anthropophilous species would appear to have been associated with this pollution. The installations that would avoid these detrimental influences (purification plant, collectors, drains) should be provided by the industrialists, who should additionally ensure their operation, which is unfortunately not always the case.

The carrying out of major engineering works, particularly road-building, involves changes that provide breeding places for mosquito larvae. The borrow pits that line the roads are rarely filled in or drained and are very considerable producers of anophelines and sometimes of Mansonia.

Conversely, the repair of dirt roads does away with ruts as breeding places. In some of the forest regions of Central Africa, where such ruts are the main sources of A. gambiae, this measure may suffice to interrupt the transmission of malaria locally (personal observation in the Cameroon).

Lastly, in India, the gathering of algae (used for the manufacture of paper) has enabled A. subpictus and the malaria of which it was the vector to be eliminated from a coastal village near Pondicherry. Although this example remains an isolated one, it is interesting because it is a case of the direct financial motivation of members of a community for a vector control activity (25).

3.3 Urban development

Runaway, uncontrolled urbanization is one of the most striking phenomena of this century. Municipal services are usually swamped by an influx of migrants who establish themselves in shanty towns without water supply, without disposal systems for solid and liquid waste, and without a health centre. Most of the rules of hygiene go by the board for lack of infrastructures. Furthermore, the social organization of these groups is not always such as to enable them to be motivated to carry out community tasks. Vector control in the suburbs of large towns calls for solutions that remain to be found.

The starting point for such solutions must be situations that have currently been mastered. The municipal services play a key role in preventing the rapid spread of vectors and then in their destruction. It is practically impossible to carry out coordinated vector control without close collaboration between municipalities, health services and the population (25). This collaboration is involved for the construction of water supply and sewage disposal infrastructures, which are beyond the capabilities of either the health services or the communities on their own. Collaboration then continues for the operation and upkeep of these structures and respect for them, which is the task to which urban communities could give their support, although they rarely do so. Lastly, the municipal authorities are responsible for the greater part of the removal and destruction of household refuse and food wastes, which are sources of rats, flies and mosquitos.

Good staff must be selected and given specific training for this intersectoral vector control activity in the urban environment. To the best of my knowledge there are no training programmes that completely cover this subject, perhaps because it has not been given the priority that it deserves.

3.4 Health developments

Vector control cannot be dissociated from other types of activity for the control of vector-borne diseases, and, more generally, for the improvement of health. Many development projects have included the building of health centres that can solve some of the medical problems created by the new developments, for example the treatment and chemoprophylaxis of vector-borne diseases. These centres may be used as bases for health education applied to vector control and to protection against vectors and other harmful influences. The health services may assume full responsibility for their operation, or this may devolve partly on the communities and on development organizations.

The promoters of the Kou Valley rice-growing project in Burkina Faso constructed latrines and waste-water drainage systems, use of which is compulsory under threat of exclusion from the project; as a result of this policy, there has been a decline in schistosomiasis instead of the expected increase (7).

In South America, the building of dwellings with rendered walls, without cracks, is the best means of avoiding the presence of assassin bugs, which are vectors of Chagas' disease. However, many triatome individuals are too poor to construct such dwellings. An increase in the income of farmers could help to improve dwellings.

Such an increase in income also enables the inhabitants to provide for their individual protection, more especially by purchasing mosquito nets. When treated with pyrethrinoids (by the members of the community themselves) these mosquito nets are not only a good means of individual protection, but also of highly selective insecticiding as the mosquito net with humans under it acts as a trap according to the Chinese experience (13).

4. CONCLUSIONS

Intersectoral collaboration covers an extremely wide field because vector control activities cannot be isolated from the context in which they take place. Their promotion is admittedly dependent on the improvement of techniques or the input of new techniques, but may be even more dependent on the way in which they are applied in each epidemiological, ecological and socioeconomic context. Only the existence of a high-level interdisciplinary team (clinical practitioners, epidemiologists, entomologists, social scientists, agronomists, etc.) at the national level is capable of providing this promotional activity and adapting vector control to the new situations created by the evolution of societies and techniques.

Intersectoral projects ought to satisfy criteria of effectiveness capable of securing the support of the various partners. This effectiveness must be assessed almost constantly so that techniques and tactics may be modified as soon as they no longer give complete satisfaction. Activities must be essentially dynamic and not reduced to the mere and frequently slap-dash application of routine methods that are sometimes obsolete.

Multisectoral projects are a preliminary to some of the activities of primary health care systems before they become an integral part of the system, in which they are an investment before they become a functional element.

REFERENCES

1. Anonymous - 1985 - 10 years of onchocerciasis control. Doc. mimeog. OCP/GVA/85 1.A - (OCP.BP.549, Ouagadougou, Burkina Faso); 137 pp. (see p.74)
2. Brengues, J. - 1975 - La Filariose de Bancroft en Afrique de l'Ouest Memoire ORSTOM no. 79; ORSTOM Ed. Paris, 293 pp.
3. Carnevale, P. 1978, Le paludisme dans un village des environs de Brazzaville, République Populaire du Congo, Thèse Doc. Sc. Paris-Sud no. 2175: 120 pp.
4. Carnevale, P. Hervy, J-P., Robert, V., Hurpin, C., Baudon, D., Brandicourt, O., Gazin, P., Bouding, C., Ovazza, L. & Molez, J-F., 1983. La transmission du paludisme dans un périmètre rizicole et en zone de savane de Haute Volta. C.R. 2ème Conf. Int. Paludisme et Babésioses, Annecy, 12-22 Sept. 1983
5. Chandler, J.A. and Highton, R.B. - 1975, The succession of mosquito species in ricefields in the kisumu area of Kenya, and their possible control. Bull.ent.Res, 65, 211-21
6. Clarke, J., 1981, Paper presented at the Interregional Seminar on Integrated Control of Mosquito Vectors, Adana, Turkey. 2-14 Nov. 1981. In. Environmental management for vector control in rice fields, FAO irrigation and drain paper no. 41, p.54
7. Colette, J., Garrigue, G. & Sellin, B., 1977, Efficacité des règles d'hygiène dans les prophylaxie des schistosomiasis, étude parasitologique, sérologique et épidémiologique d'une zone rizicole africaine à haute risque d'extension bilharzienne. Médecine tropicale, 37: 521-529
8. Elding, B., 1986, Guinea worm eradication through community participation: an integrated approach. ICMR/WHO Consultation to review results on community participation for disease vector control, Delhi 3-9 Feb. 1986, 23pp.
9. Guigemdé, T.R., 1984, Éliminons le ver de Guinée, OCCGE Ed. Bobo-Dioulasso; 32pp
10. Hamon, J., 1953, Etude biologique et systématique des Culicidae de l'île de la Réunion. Mémoires Inst. Sc. Madagascar, Serie E, 5: 521-541
11. Hill, R.B. & Cambournace, F.J.C., 1941, Intermittent irrigation in rice cultivation and its effect on yield, water consumption and Anopheles production Am. J. trop Med, 21: 123-144
12. Jordan P., 1975, Schistosomiasis-Epidemiology, Clinical Manifestations and Control, Man-made lakes and human health, Stanley and Alpers, Academic Press London; 35-36
13. Li Zuzi, Zhang Mancheng and Li Guangxu, 1986, The study of the control of Anopheles sinensis, Anopheles dirus and malaria prevalence with deltamethrine. Part III Field trial of controlling Anopheles sinensis group and malaria prevalence by bed nets impregnated with deltamethrin. IV Congrès sur la Protection de la santé humaine et des cultures en milieu tropical, Marseille 2-4 juil. 1986, Rapp et Comm T. II
14. Luh Paoling, 1980, The present status of biocontrol of mosquitos in China. Biocontrol of medical and veterinary Pests, Marshall Laird ed. Praeger Special Studies, 54-77
15. Lun Pao-Ling, 1984, Effects of Rice-growing on the population of disease vectors, Environmental management for vector control in rice fields. FAO irrigation and drainage paper 41, 130-132.

16. Luh Pao-Lin, 1984, The wet irrigation method of mosquito control in rice fields. An experience of intermittent irrigation in China. Environmental management for vector control in rice fields. FAO irrigation and drainage paper 41: 133-136
17. Mather, T.H. & Trinh Ton That, Environmental management for vector control in rice fields: FAO irrigation and drainage paper 4: 1-93
18. Mouchet J., 1976, Les problèmes épidémiologiques posés par les maladies à vecteur dans les zones de forêt dense africaine. Wiadomosci Parazyt. 22: 557-567
19. Mouchet, J., Agriculture and vector resistance, VBC/ECV/EC/85-14 (a), 9 pp
20. Myers, L.E., 1984, Environmental management for vector control in rice fields in the context of an integrated approach. Environmental management for vector control in rice fields - FAO irrigation and drainage paper 41, 124-129
21. Noirtin, C., Boiteux, P., Guillet, P., Dejoux, C., Beaucournu-Saguez, F. & Mouchet, J., 1981, Les simulies, nuisance pour le bétail dans les Vosges: les origines de leur pullulation et les méthodes de lutte. Cah. ORSTOM. Ser. Ent. méd. Parasitol, 19: 101-113
22. Pesigam, T.P., Farocq, M., Hairson, M.G., Jaurequi, J.J., Santo, A.T., Santo, B.C. & Besa, A.A., 1958, Studies on Schistosoma japonicum infection in the Philippines. III Preliminary control experiments. Bull.Wld.Hlth.Org. 19: 223-261
23. Philippon, B & Mouchet, J., 1976, Répercussions des aménagements hydrauliques à usage agricole sur l'épidémiologie des maladies à vecteurs en Afrique intertropicale. Cahiers du CENECA, Colloque Inter. Paris 3-5 Mars 1976, Doc. 3.2-13, 14 pp
24. Pichon, G., Hamon, J., & Mouchet, J., 1969, Groupes ethniques et foyers potentiels de fièvre jaune dans les Etats francophones d'Afrique de l'Ouest; considérations sur les méthodes de lutte contre Aedes aegypti, Cah. ORSTOM Ent. Med. Parasitol, 7, 35-39
25. Rajagopalan, P.K. & Das, P.K., 1986, Filariasis control by integrated vector management, ICMR/WHO consultation to review research results on community participation for disease vector control Delhi, 3-9 Feb. 1986, 14 pp
26. Sellin B. & Mouchet, F, 1986, Recherches malacologiques menées par le CERMES dans les Etats membres de l'OCCGE. IVème Congrès sur la protection de la santé humaine et des cultures en milieu tropical, Rapp et Comm., 616-621
27. Service, M., W., 1977, Mortalities of the immature stage of species B of the Anopheles gambiae complex in Kenya: comparison between rice fields and temporary pools, identification of predators, and effects of insecticide spraying J. med. Entomol, 13: 173-195
28. Sharma, V.P. and Sharma, R.C., 1986, Review of the integrated control of malaria in khed District, Gujarat, India, ICMR/WHO Consultation to review research results on community participation for disease vector control, Delhi, 3-9 Feb. 1986, 17 pp
29. Sturrock, R.F., 1965, The development of irrigation and its influence on the transmission of Bilharziasis in Tanganyika. Bull.Wld.Hlth.Org., 32: 225-236
30. Whyte, A., 1983, Guidelines for planning community participation in water supply and sanitation projects, Doc. mimeog. WHO (Geneva) ETS/83.8, 60 pp

31. Wilbaux-Charlois, M., Yelnik, A., Ibrahima, A., Same-Eboko, A. & Ripert Ch., 1982, Etude épidémiologique de la bilharziose à S. Haematobium dans le périmètre rizicole de Yagoua, Nord-Cameroun. II Distribution et écologie des hotes intermédiaires. Bull.Soc. Path. exot., 75: 72-79
32. Youdeowei, A. & Service, M.W., 1983, Pest and vector management in the Tropics, Longman ed. London: 399 pp

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