

ON THE POSSIBILITY OF PESTS
BEING CONVEYED IN EXPORT
TIMBER

SURVEY OF BIOLOGICAL REQUIREMENTS

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Recent developments in the sphere of plant protection have led in many countries to the enactment of plant protection laws or statutes embracing within their scope the timber imported into a country, both raw wood and processed timber. This has naturally caused a certain amount of inconvenience to the international timber trade, sometimes of considerable significance. On the other hand, as there are indications that the subjection of timber to *general* plant protection regulations has sometimes been rigidly insisted on, although inexpedient, and with insufficient factual cause, there seems reason to establish legislation and practice in this connection that will not constitute a purposeless and unjustified obstacle to the international timber trade. Necessary and purposeful protection against the spread of pests from one country to another via export timber must naturally be considered fully acceptable, but the provision of such protection should be based on actual need and correctly related to biological facts.

An examination of the biological conditions under which pests existing in the exporting country and occurring in wood are assumed to be conveyable in timber from there to the importing country and of thriving in the latter country, i.e. living and propagating, will show that a considerable number of factors are involved. Firstly, as regards processed or barked raw timber, only species that pass at least the major part of their individual development in the woody tissues (inside the stem) enter into question. It is these species also that are mainly involved with unbarked raw wood and hewn or sawn timber with unbarked waness, although some species principally inhabiting the bark (cambium and phloem) may also in certain cases be conveyed. Without attempting to classify the other conditions in order of priority, the most important of them can be given in consistence with some kind of biological order as follows: (1) the tree species of the importing country and the affinity of the pest in question; (2) the climatic conditions of the importing country: a) the range of the pest; b) the adaptability of the pest to climatic conditions; (3) biological factors regulating population; (4) the suitability of the individual development of the pest for transmission: a) the length of generation cycle; b) the quality of

propagation material. In the following a brief survey is made of the nature of these requirements and their bearing on the possibility of pests being conveyed in export timber and adapting themselves in the importing countries.

(1) The affinity of most insects to one special or several tree species is very marked. Tree species occurring in geographically foreign conditions may serve as host plant (place of propagation) for the pest in question generally only in so far as they represent the same species or species of the same families close to each other in the home country of the pest or in its area of distribution in general. It is very unlikely that an insect species would find a new host plant of even passable suitability for itself among plant (tree) species totally unrelated to or distant from the host plants it is accustomed to. Especially in countries where there are few tree species — e.g. the Northern Countries — the affinity of pests varies very slightly and the extent of its variation is very well known. Moreover, the affinity of species present in coniferous trees is in general rather limited, that of species inhabiting deciduous trees somewhat broader. The relatively few species which, contrary to the general rule, have either a very broad affinity (e.g. for most coniferous trees or for coniferous trees in general, or correspondingly for deciduous trees) or lack it completely are already well known as regards their requirements and, furthermore, they are usually generally spread over extensive areas of the globe.

Hence it can be concluded that the determination of the question of affinity provides a fairly clear solution to the possibilities of adaptation of the species in the importing country, and that there is generally little chance of surprise in this respect. This being the case, we must ascertain on the one hand the normal affinity of the pest in question and the known extent of its variation and, on the other hand, the tree species in the importing country, particularly those tree species and families which are phylogenetically close to tree species for which the pest species show an affinity.

(2) a) Apart from the above-mentioned question of affinity, »geographical barriers» and climatic conditions also determine the range of insects. This applies specifically to species present in trees. Species can also be encountered whose range, for reasons of distribution history, has not yet reached the limits dictated by the factors already mentioned. The most important of the geographical barriers proper are the seas. As regards other barriers such as mountains, deserts, etc., the nature of the geographical barrier is to be found rather in climatic factors although such

obstacles must also always be taken into consideration as geographical. If there is no geographical barrier »isolating» an area (importing country) from the actual range of the species, climatic conditions must be regarded as the most important and most common factor limiting the range of the species. This is why the definition of the range of a pest at the same time generally also states the climatic requirements of the species for subsistence and propagation. On the other hand if it is conveyed in timber to some importing country the species naturally is only of significance as a pest danger in areas outside its natural range, since only there would it constitute a new pest introduced into the country.

It can consequently be concluded that the definition of the range of a species generally indicates its chances of adapting itself in an importing country and at the same time reveals the absence of such chances should the importing country, and the country of export be geographically bounded by the same obstacles. Where this is not the case the range provides information on the normal climatic requirements of the species, and deviations of any great extent from requirements need hardly be considered (see 2 b).

(2) b) However, the climatic conditions of the range of the species do not suffice, especially if we are concerned with countries beyond the geographical barriers, to give a perfectly clear and reliable picture of the ability of the species to adapt themselves to climatic factors in the importing country. Most species are able, to a greater or smaller extent, to adapt themselves to climatic conditions deviating from the normal for them. This ability varies with the different species and may moreover be connected to some extent with other biological conditions.

The ability of a species to adapt itself is based principally on the variation of the individuals of its population as regards this characteristic. This variation, however, is capable of making itself felt only in the generation that has developed in the importing country. Among these individuals those belonging to the extreme variants of the population might possess requirements differing from the normal climatic requirements of the species; in some of these individuals these differing requirements might naturally favour the conditions prevailing in the importing country. These individuals, then, would at any rate be better able to adapt themselves than the population as a whole of the species occurring in the exporting country. The same situation might arise with mutants present among the offspring. However, each case would presuppose that once conveyed to the importing country the species would be capable of developing at

least one generation there (its first offspring). As the conveyance of a species in export timber is in any case limited to single individuals at most, there is a very slender chance of even the first offspring developing in conditions not conforming to the natural climatic environment of the species. That the individuals conveyed might represent just the extreme variants that favour the importing country is of course a very remote possibility. Hence the significance of adaptability to climatic conditions requires no great emphasis. In areas situated within the limits of the same geographical barriers adaptability is of course less important.

It can be concluded, then, that within certain limits adaptability may to some extent detract from the reliability of deductions concerning the chances of acclimatisation of a species in the importing country, especially in overseas countries of import, which have been based on the climatic conditions of the distribution area of the species. In practice, however, this possibility will probably not be considerable (Cf. 4 b). On the other hand even a moderate deviation in the climate of the importing country from the climatic conditions of the range of the species may surely be considered an obstacle to its adaptation.

(3) Where an insect species has been able to spread to areas completely new to it (e.g. overseas areas) and has there proved capable of propagating — maybe in both the respects touched upon in the foregoing (see items 1 and 2) in conditions differing considerably from the optimal — sometimes even more than in its original range, this has generally been due to the absence of biological factors regulating the population. The new area has not had — at least not in sufficient force — factors regulating the numbers of the newly arrived species, and its propagation, even if attended by otherwise somewhat unfavourable circumstances, has in any case been able to develop more vigorously than usual. At any rate, provided that the conditions discussed above (item 1—2) can be considered at least somewhat favourable for the species, the presence or absence of suitable biological regulative factors becomes of decisive importance as regards the adaptability of the pest in the importing country. However, it is difficult to predict their possible occurrence and danger in the importing country; at the most the natural indigenous occurrence of some closely related species of the pests in question in the importing country might give some indication.

Although the biological regulative factors may actually prove important in the question of pest adaptability we must probably accept the fact that they cannot give any indication of adaptability.

(4) The nature and requirements of the individual development of a pest in the exporting country constitute the basis for an assessment of the claim of a species to be considered as one that can on the whole be conveyed in export timber. With this is naturally associated also the method and time of manufacturing export timber, and consequently also the stage of processing. For species possessing a certain biology these circumstances also effect the possibility of adaptation of the pest to the importing country.

a) The generation cycle of a species, especially the length of its larval and pupal periods, is of decisive importance in the assessment of its conveyability in export timber. With this is naturally also associated the time normally consumed in the manufacturing, storing and transportation of the goods in the exporting country, firstly up to the moment of shipment at a harbour in the exporting country and secondly until the arrival of the goods at the country of import and often even until they have reached the place of consumption (utilisation) in that country. This period naturally varies slightly in different exporting countries. The matter can be viewed in the present connection principally in relation to Finnish conditions only, but this in itself will probably suffice to illustrate its effect and significance.

Let us take forest insects first (species living in growing trees). The preparation of sawn timber in the forest from the felling of the raw material (growing trees) (or, for unbarked raw timber: from the June following the felling) to the shipment of the finished sawn timber regularly takes a period of over 12 months. This means that all species possibly present in growing trees (or in green unbarked raw wood) which have a generation cycle of only one year, since they have already emerged from the larval stage and left the timber before it is shipped, must be excluded from the list of pests conveyed in export timber. In Finland shipments are generally made from depots where the goods have been stored; as, moreover, shipments are chiefly confined to the summer the timber often has to remain in the country until the second summer after felling. This being the case, the majority, even, of the species with a 2-year generation cycle which have attacked growing trees are excluded from possible conveyance in the timber to an importing country since they too have left the timber on emerging from the larval stage either before shipment or during the charter period. By thus establishing the time taken to prepare export timber calculated up to the time of shipment (or arrival in the importing country) and by accounting for all the species theoretically capable of occurring

in the trees in question, the lengths of their generation cycles and their times of emergence, it is possible, in Finland for instance, to eliminate immediately the majority of forest pests from among the species which in their mode of living can be regarded theoretically as conveyable in sawn export timber. Moreover, it must be noted that in the sorting of sawn timber the majority of boards and planks damaged by such species are observed and eliminated and that kiln-dried sawn timber is exposed to such high temperatures that all potential pests contained in the timber have died. Similar data can easily be assembled also for the period between the shipment of other kinds of export timber (hewn timber and raw wood etc.) and their felling (or the felling of their raw materials) in the forest and also concerning the stage of the season at which logging and shipment are made. The number of all forest pests which can enter into question as species conveyed in export timber can then be limited fairly strictly on the basis of these data.

Another group consists of species which do not attack the timber until after the felling in the forest, appearing in raw material stocks, at the processing site, or during transportation and at the temporary storages used. This group of pests may perhaps be classified briefly as timber pests. In addition to the length of the generation cycle the issue for these species is greatly affected by their biological requirements for the quality of the propagation material (both for propagation and for individual development) and hence the examination of this group can be conducted in its entirety under item (4 b) below.

For the actual forest insects, when the lengths of their generation cycles and times of occurrence are known, the time required for the preparation and transportation of export timber (from logging to shipping) is a factor that limits the number of species quite considerably and indicates the species that are to be considered as conveyable in export timber. These answers also are easily obtained.

b) In so far as we are concerned with unbarked or barked timber (raw wood or different kinds of semi-processed or processed timber) the quality of the propagation material becomes a very important factor, often itself of decisive importance in determining whether most pests of the species in question can be conveyed in the timber to the importing country. The affinity of the species for various kinds of timber is also usually so closely connected with its propagation, and especially with its attack (choice of propagation material), that it also decides the changes of the species to adapt itself to the importing country if it happens to be carried there.

Taking the forest pests occurring in Finland — and in the Northern Countries in general — an essential requirement for most of them which can be regarded as species conveyable in export timber is unbarked timber (or a growing tree) as a site for propagation (attack) even where the larval development of the species can continue in barked and even in processed timber. The conditions of adaptability of such species is consequently the continuous availability of tree material of this type. Although the species in question can generally be conveyed to the importing country in barked (processed or unprocessed) timber, the importing country is often completely devoid of tree material suitable for their propagation. Even in cases where they are conveyed in unbarked timber the commodity has generally lost its usefulness by the time of arrival in the importing country as propagation material for the species in question and the adaptability of the pest to its new environment may therefore be prevented. Further elimination thus occurs among the species of forest insects which might otherwise be eligible for consideration as species conveyable in export timber. The few species which, for instance in the Northern Countries are exceptions to the above rule are easy to pick out and their likelihood of being conveyed to the importing country and adapting themselves there can be ascertained separately.

As far as the second group under item (4 a), i.e. timber pests, is concerned, in addition to whether the timber is unbarked or barked their conveyability will also be affected by the length of their generation cycles a factor which was not discussed for timber pests in the preceding item. The fact that, as regards these species, timber may be attacked at different times in the course of the processing, storage, transportation and shipment of the timber (in other words after felling in the forest) signifies that side by side with the length of the generation cycle the stage at which the pest attacks the timber is not infrequently a very important factor. Both these considerations must always be taken into account for each species of this group in deciding its conveyability.

The timber pests which require unbarked timber as their propagation material generally attack processed timber immediately after felling (i.e. before processing). These species can consequently be correlated to a great extent with forest insects proper (cf. above item 4 a). Some of them may, however, use unbarked wanes of timber as points of attack even after processing. In practice this depends very much on the extent to which the pre-shipment storage of waney timber in the exporting country coincides with the time of attack of the species in question. As regards these last-

mentioned species, of which there are only extremely few in Finland, knowledge of both the time of the processing (with the possible storage prior to shipment) and the time of attack (and the length of the generation cycle of the species) is consequently essential for a determination of its chances of conveyance in export timber.

On the other hand the timber pests that are capable of attacking and do attack barked timber can naturally appear in timber at any time prior to shipping (naturally according to the time of their attacking). As far as they are concerned the possibility of being conveyed in the timber is approximately equal to the possibility of this important commodity becoming contaminated by them during the period between processing and shipment. Only an especially long preshipment storage period (relative to the length of the generation cycle of the species) could affect the issue. Under these circumstances the time of attack of the species must coincide with the period between processing and shipment to permit contamination to occur in the exporting country before shipment. If the timber in question is barked raw wood or if barked raw wood has been used as raw material for the processed goods the period mentioned, during which contamination must occur, should be calculated from the barking of the raw timber until shipment. These relationships indicate to what extent it is possible for pests attacking barked timber to spread.

Of timber pests the species attacking unbarked timber naturally continue to require unbarked (at any rate unbarked waney) timber for reproduction sites in the importing country if the species is to adapt itself. The species attacking barked timber are obviously least restricted in this respect in the importing country.

It can be concluded from the above that in so far as the pest requires unbarked timber as its propagation material it is only in certain particularly favourable conditions that the species can be conveyed in export timber and, similarly, only in certain cases has it a chance of adapting itself to the importing country. These probabilities can be deduced in advance, given the point of time of attack of the species (and its generation cycle) and the processing (or barking of its raw material) and shipment times. We can also establish in advance the likelihood of these species adapting themselves to the country of import if their propagation material requirements are known, just as can be done for forest insects proper. It can likewise be established that the species most likely to be conveyed and to adapt themselves, as far as quality of propagation material, length of generation cycle and time of attack are concerned, are those that attack

barked timber. Information on these species, though it often has little to do with the matter in question here, is generally easy to obtain.

We have dealt briefly with the four most important groups of biological requirements to be taken into consideration in deciding on the chances of an insect pest being conveyed via export timber and of its adaptability in the importing country. We saw that it was possible very largely to eliminate the species that might be conveyed via export timber. This can be done by means of the last-mentioned data (item 4) and information on the nature of the timber and the period between processing (or other treatment) and shipment. On the other hand only a knowledge of the affinity and climatic requirements of these pests in their area of distribution and of the conditions in the importing country corresponding to these requirements (plus knowledge of the quality of the propagation material of the species) can provide a sufficient factual basis for assessment of their adaptability. It is thus often possible to decide in advance what danger threatens the importing country from species that might be conveyed via export timber. It is obvious that fairly few of the species in question will prove exceptions to such predictability. Indeed, for very many exporting and importing countries not a single species remains uncovered.

If the intention is to draw up plant protection regulations governing timber in such a way as to hinder as little as possible the timber trade in the different countries concerned — by maintaining the protection provided by them sufficiently effectively — these countries should prepare reports on the points introduced above. This would make it possible to adapt plant protection regulations to suit the relations between the different exporting and importing countries. At any rate completely pointless and unnecessary barriers to the timber trade could be removed.

As such barriers do exist, and are even quite formidable obstacles to the international timber trade the question really deserves consideration. In any case it does seem that at least the majority of unnecessary or ill-conceived plant protection regulations between countries, often introduced simply because the importing country has given a general application to regulations that may very well be necessary for the specific trade between a few exporting countries and itself, might be eliminated by this means. It is this generalising of the range of regulations that has led to the erection of quite unnecessary barriers between certain countries to the trade in timber that would otherwise be both desirable and acceptable.