

EDITORIAL

Oilseed rape sensitivity

Cultivation and use of oilseed rape (OSR)

OSR is a widespread and ancient crop with evidence of cultivation in India (from 2000 BC), and in China and Japan [1]. In Europe, oilseed rape and other Brassica seed crops have been cultivated since at least the 15th century [2], originally for the production of lamp oil. These crops were mainly cultivated in Northern latitudes where the climate would not support the growth of olives and sunflowers, the main sources of oil at that time. The word 'rape', as applied to these oilseed plants, is from the Latin *rapum* meaning turnip.

Since the second world war, when edible oils were at a premium, there has been a policy to encourage home production of OSR because the oil contains a good nutritional balance, and since 1973 this crop has been subject to EEC/EU subsidy. The crop has increased in economic value and is now the most important oilseed crop in Western Europe, with about 6–10% of arable land in the UK given over to its cultivation. Two crops can be harvested in one season. One species, *Brassica napus* comprises about 95% of the crop and has two forms. One is sown in autumn, overwinters and characteristically flowers yellow in spring and the other is sown in spring and flowers in late summer. The small remaining proportion is *B. campestris* which is also spring sown. There are many varieties of these species which have been bred for specific characteristics, for example to eliminate toxic glucosinolates.

The seeds are harvested and crushed to release oils which are used in the production of margarine, cooking oil and in food blending. The oils can be converted to a methylester which is an efficient diesel substitute. Some of the oils with long chain fatty acids, erucic acid (C22:1, cis-13) have suitable viscosity and are robust enough to use as machine oil, and as a base oil in the plastics industry, for example in the manufacture of cling-film. These oils have a great advantage over traditional oils in that they are readily biodegradable. After the oil has been extracted there is a high-protein seed meal residue which has increasing value as a vegetable source of animal feed. In addition, OSR is an excellent break crop, i.e. its use in crop rotation results in soil improvements. A more recent use of the OSR crop is for biotechnology, for example in the pharmaceutical industry OSR is used as a vehicle for recombinant hirudin (blood clotting factor) production. This crop is clearly of great economic importance and any associated public health concern should be investigated seriously.

The clinical interest

There is a broad perception in the UK that OSR is associated with allergic disease among populations living in proximity

to its cultivation. However, this perception is not reflected by any substantial body of scientific evidence proving the association. Furthermore, there is diverse opinion among investigators as to the scale of this specific clinical problem. In this regard the paper by Hemmer and colleagues in this issue [3] is important in that it is the first report from continental Europe to address this topic. Their conclusion, based on an impressively large data set, was that OSR is a modest but true source of sensitization, and this should help establish a consensus of opinion among those working in this area. There is no dispute that OSR can cause specific clinical sensitization; there is compelling evidence from case reports [4], and symptomatic surveys in communities living close to OSR cultivation [5–7]. That OSR can cause specific immunological sensitization is also not in dispute; there is compelling evidence summarized in Table 1.

The various populations studied are different in many ways yet several points emerge. The prevalence of IgE-mediated allergy to OSR appears to be low, especially in the general urban population where the degree of exposure is low, and allergy is largely confined to those subjects already atopic (i.e. with IgE antibody to common inhalant allergens). Increasing exposure to OSR either by proximity [5–7], during the flowering season [10] or by occupational exposure [11], results in increasing symptoms. Similarly, in studies of immunological sensitization there is an increasing incidence of specific IgE antibody activity against OSR with increasing exposure (IgE activity measured by skin-testing and by radio-immunoassay (RAST) testing, Table 1).

Differences in the degree of sensitization are reported by different groups and it is important to try to get to the bottom of this. One contributory factor is the difficulty in deciding what are the significant symptoms, and the descriptive terms used such as 'allergic', 'hay fever' and 'irritant' are probably too general. One consequence of this is that there can be marked difference in clinical assessments, for example in two unselected populations the reported symptom prevalences varied from 1.6% [11] to greater than 25% [6]. This is important because these values were used as denominator levels. This type of problem will tend to be a limiting factor in comparing studies from different centres.

One improvement which would be broadly applicable would be the standardization of allergen preparations. In this regard the paper by Hemmer and colleagues [3] is important in that they have demonstrated some OSR-specific allergens using immunoblots developed using patients' sera. This now opens the way for comparing OSR preparations between users, and assessing the specificity and

Table 1. The prevalence of IgE sensitization to oilseed rape allergens as assessed by skin-testing or by radio-immunoassay of serum (RAST) in different populations. Prevalences are marked as percentages in those studies with greater than 100 subjects

Ref.	Assessment	Prevalence	Population
3	Skin-test	140/4458 (3.1%)	Suspected inhalant allergy
		140/1974 (7.1%)	Pollen allergic
8	Skin-test	85/366 (23%)	Atopic asthmatics
9	Skin-test	4/81	Suspected OSR allergy
10	RAST/skin test	2/37	Symptomatic *
		0/24	Asymptomatic*
11	RAST/skin test	9/27	Occupational exposure
		3/20	Symptomatic*
		1/70	Population in OSR region
7	RAST	1/17	Symptomatic *
12	RAST		Allergic patients:
		11/141 (7.8%)	not in OSR region
		46/175 (26.3%)	in OSR region
		16/37 (43%)	in OSR region*

* = during OSR flowering season.

stability of the allergens, as well as any cross-reactivity with other allergens.

There is a good association of IgE sensitization to OSR and perceived allergic sensitization [11]. However, there are also symptoms, mainly described as irritant in nature, reported among many non-atopic individuals [4,10]. This led to the suggestion that the plant's volatile organic compounds (VOC) have an irritant capacity. OSR disperses only modest pollen levels, being largely insect pollinated. To attract insects for this purpose the plant secretes volatile chemicals, and the characteristic pungent odour of OSR is due to these. Interestingly, the ability to recognize this smell is genetically absent from some individuals. The volatiles are low molecular-weight compounds consisting of mainly terpenoids, aldehydes, nitriles, and high levels of sulphur-containing compounds (isocyanates and isothiocyanates) which are almost unique to the Brassicas. One example of a terpenoid is alpha-pinene which is the source of the smell of pine. A recent study has identified VOC mainly emitted during flowering of OSR [13]. For many of these compounds health and safety information for COSHH regulations is incomplete. For some, they are toxic or irritant, based mainly on the information obtained from industrial exposure to, for example, isocyanates. Of interest, these VOC can also be components of perfume and it is not uncommon for patients to report this as a cause of symptoms. These compounds may also be immunogenic in the same way that ethylene oxide can generate specific IgE antibodies to neoantigens in some renal patients exposed to this compound in dialysis machines.

More work is needed to try to establish methods to identify and accurately measure the airborne concentrations of these compounds, and a promising start has been reported in a recent article in this journal [13]. If the constituent VOC can be catalogued and purified it may be possible to identify their clinical relevance by appropriate bronchial challenge. An *in vitro* counterpart to this would be testing sensitized or unsensitized basophils or mast cells [14]. If a particularly potent compound is identified then this can be bred out of the plant as has been done already for the glucosinolates. With the recent Government initiative to improve air quality and the increasing interest of scientists looking at the role of factors like volatiles in the pathogenesis of lung diseases, then the approach and technology reported for the study of OSR volatiles [13] is likely to find more broadly based applications.

Conclusion and prospect

OSR allergy or sensitivity is a public health concern with economic and political interest. The degree of concern should not be overstated and it is likely that the paper by Hemmer *et al.* [3] will be a prototype for studies in other countries; for example, Canada is currently the largest exporter of rapeseed but there is little evidence of a problem. This could be due to the wide Canadian spaces dissipating the pollen and VOC, or perhaps in common with other countries there may be a natural reluctance to acknowledge even a trivial problem with such a valuable commodity. This subject still needs more work. Probably the best

prospect will be a coordinated multi-disciplinary approach, with respiratory physicians, clinical scientists and plant biologists who have the confidence of the community and local authority in the areas studied. It is important that sensitization among farmers is investigated since they are at the front line of contact with OSR. The role of VOC in the exacerbation of asthma symptoms, analogous to traffic pollution, will need clarification. There is also the possibility that fungi associated with OSR, e.g. *Botrytis cinerea* and *Alternaria alternata* are an additional source of sensitization. We must keep an open mind as to the extent of OSR sensitivity until we have more data.

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C. McSHARRY

University Department of Immunology
West Glasgow Hospitals and University NHS Trust
Glasgow G11 6NT
UK