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Health effects associated with exposure to oak processionary moth larvae: a systematic review

Summary of findings

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Public Health England
Wellington House
133-155 Waterloo Road

London SE1 8UG
Tel: 020 7654 8000
<http://www.gov.uk/phe>
[Twitter: @PHE_uk](https://twitter.com/PHE_uk)

Prepared by: Emer O'Connell, SpR SWL Health Protection Team; Thomas Inns, Field Epidemiology Training Programme; Barry Walsh, Director SWL Health Protection Team

For queries relating to this document, please contact: Emer O'Connell.

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| Author(s) | Title | Species of moth considered, country & Summary. | Results/Summary | Strengths | Weaknesses |
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| Anon, 1979.(1) | Editorial | Misc spp: Editorial describing current understanding of lepidopterism. | "Little or no evidence of an allergic response developing from repeated exposures". Describes 'nursemaid's disease' occurring in Hyde park London around 1930 - urticaria and conjunctivitis from sitting under trees containing larvae of vapourer moth. | Oldest record available. Describes urticaria associated with caterpillars as historical issue in London's Hyde park i.e. this is not a novel issue to London. | Generic lepidopterism only, level of detail insufficient to add to risk assessment, OPM/PPM not mentioned. |
| Artola-Bordas et al., 2008.(2) | Outbreak of dermatitis caused by pine processionary caterpillar (<i>Thaumetopoea pityocampa</i>). | PPM, Spain: Outbreak report of dermatitis following exposure of a group of children (average age = 10yrs) to PPM larvae and nests beside a swimming pool, and towels contaminated with PPM setae – some direct contact with caterpillars reported (i.e. caterpillars on the towel). A post-outbreak questionnaire was conducted. | 70 school children and 3 adult teachers affected. They were staying at a rural farm holiday centre situated in a clearing in a large pine forest. Notification was via the A&E department of a local hospital. Dermatitis was reported in 6/70 (Attack rate = 8.6%). All 6 cases needed medical attention; some were prescribed antihistamines, corticosteroids (intramuscular), and used cold showers (without drying themselves afterwards) to reduce the pain. 50% (35/70) of the group were female; 100% (6/6) of all affected were female; 17% (6/35) of all females were affected. Symptoms lasted an average of 7 days. Estimated OR for dermatitis following contact with the insect = 157.2 (95% CI 18.4, -∞) | Indicates that exposure to setae can occur via indirect contact (towels that the caterpillars had processed across were identified as the source). The authors attempted to quantify the risk of dermatitis following contact with the insect through calculation of Odds Ratios. | This is an outbreak report with little additional epidemiological information to add. |

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| Battisti et al., 2011. (3) | Urticating hair in arthropods: Their nature and medical significance. | Misc spp. Review paper | <p>Processionary moths have 'true setae'. Setae start to develop in Larval stage 3 (L3), numbers increase in successive moults. Larval exuvia carry setae.</p> <p>Setae can exist in the environment for a long time, in the soil, in collection material and in contaminated clothes.</p> <p>The authors state that the delayed nature of skin reactions suggests that histamine not involved & postulate that chitin in the setae may be responsible for the inflammatory/immunological response, with a low molecular weight chitin also potentially playing a role in asthma.</p> <p>The authors note the dearth of epidemiological studies on the topic.</p> | Relatively recent comprehensive review, detailed information about setae, population dynamics, & medical aspects of exposure. | Not specific to OPM, no additional epidemiological information. |
| Bhat et al., 2010.(4) | Systemic allergic reaction to a caterpillar in a 3-month old infant. | Other spp., India: Case report of systemic reaction to close contact with <i>Kambali hulu</i> species. | <p>Generalised rash, severe respiratory distress, tachycardia, delayed capillary refill time in infant following prolonged (3-6hrs) close contact (inside clothing) with a caterpillar - spp. <i>Kambali hulu</i> (not endemic to UK/Europe)</p> <p>Recommend treatment of symptoms, washing skin with running water, removal of spines from skin with fine forceps or tape-stripping.</p> <p>Intravenous hydrocortisone and pheniramine maleate given, with symptoms resolving after 30-60 mins of therapy.</p> | Well documented treatment history. | <p>Case report only.</p> <p>Species is not endemic in UK.</p> <p>Adds little to our understanding of OPM.</p> |
| Bosma & Jans, 1998.(5) | A severe anaphylactic shock caused by spraying the oak | OPM, Netherlands: Case report of 72 year old man who was resuscitated with ventricular defibrillation | History: Symptoms started 3 hours after patient drove his car through a stretch of road being sprayed for OPM (cloud of mist hanging over the roadway). Closed the windows and had fan in his face. An hour | <p>OPM-specific.</p> <p>Includes detailed history of exposure and detailed clinical information about possible</p> | <p>Unclear which exposure (OPM or Dimilin) was responsible for the reaction.</p> <p>Delayed symptom onset may</p> |

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| | <p>processionary caterpillar (<i>Thaumetopoea processionea</i>) in North Brabant.</p> | <p>after exposure to OPM and Dimilin SC-48 (active ingredient diflubenzurone).</p> | <p>later, itching on head, itching then spread all over body, accompanied by severe redness. Initial symptoms – abdominal pain, with nausea and vomiting, felt a ‘ball in throat’, deteriorated quickly and became shortness of breath, confused and incoherent.</p> <p>Had to be defibrillated twice in ambulance and on admission had exanthema all over the body, facial cyanosis, inspiratory stridor, & body temp 33C, BP 65/40. Signs of transmural ischaemia and possible acute infarction.</p> <p>Patient had cardiac surgery a year previously for angina pectoris (with stent put in). Worked as a chef.</p> <p>Patient had watched OPM spraying from ~30m away 10 days earlier with no symptoms (potential for previous exposure and sensitisation).</p> <p>Treatment: dexamethasone, epinephrine, clemastine intravenously. Inspiratory stridor improved 15mins later. Exanthema cleared within 12 hours.</p> <p>Authors conclude that OPM was the more likely cause of his reaction as Dimilin has only a weak sensitising effect on the skin. However, they note that in previous years where ~100,000 people were affected by OPM there were no reports of anaphylaxis. They postulate that a cell-mediated immune response (delayed or Type IV hypersensitivity) could be responsible.</p> <p>Note: Authors state that setae remain active for about 5 years in the environment (but this statement is not referenced).</p> | <p>anaphylaxis.</p> | <p>suggest a pseudo-allergic reaction as opposed to a true anaphylaxis, as argued by subsequent letters to the same journal commenting on this paper (see Licht and Jonker (1998) below).</p> |
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| Bosma and Jans, 1998. (6) | A severe anaphylactic shock caused by spraying the oak processionary caterpillar (<i>Thaumetopoea processionea</i>) in North Brabant. Author's response. | OPM, Netherlands: Authors response to letter from Licht and Jonker (1998). | The authors of the original article (case report) argue that not all anaphylaxis reactions are immediate and not all are IgE mediated, but can also develop via the formation of IgE and massive mast cell activation, as well as via immune complexes and complement activation via a Type IV reaction. | Detailed argument regarding the possible role of IgE v's non-IgE mediated response following exposure to OPM. | Does not clarify the role of IgE/non-IgE mediated response following exposure to OPM – ambiguity on this aspect continues. |
| Burgess & Chetwyn, 1983. (7) | The biology, medical significance and control of processionary caterpillars. | OPM & other processionary spp.: Overview of the 4 species of processionary caterpillars; <i>Thaumetopoea pityocampa</i> , <i>T. wilkinsoni</i> , <i>T. processionea</i> and <i>T. pinivora</i> . | OPM differ to the other species in the shape of their head and their preferred food source (oak as opposed to pine). OPM larvae are less hairy than the other species. The spines of all species are readily detachable and are either primitive or modified. Detached spines can be found on adults that have newly emerged and on pupal cases – i.e. exposure to setae may occur after the larvae have pupated. The authors state that the severity of the reaction depends on the species, the amount of poison injected and the sensitivity of the individual. | Information on all 4 species. Overview of entomological perspective. | Limited usefulness for risk assessment as no specific information on OPM and no epidemiological data. |

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| <p>deJong, 1988. (8)</p> | <p>Hairy caterpillars and pseudo-allergic reactions.</p> | <p>Hairy caterpillar spp., European focus: Review of the health effects associated with exposure to hairy caterpillars.</p> | <p>Various reactions following exposure to processionary caterpillars are described:</p> <ul style="list-style-type: none"> • Dermal: Erythematous maculae, urticae, papules, vesicles, occasionally bullae and necrosis can occur. Serious itching is also reported associated with pruritic papules. Dermatitis usually appears within 8 hours of contact and spontaneously resolves within 2 weeks if no further exposure. • Ocular: Setae can cause acute conjunctivitis, and also chronic ophthalmia nodosa. CON may occur many months after the exposure, & may involve only 1 seta so the diagnosis may be easily missed. • Inhalation: Airborne setae can cause rhinitis, dysphagia and possibly pseudo-allergic bronchitis. The author attributes reaction following exposure to a combination of microtraumatic and pharmacotoxicological effects and refers to the reaction as a 'pseudoallergenic' reaction. <p>Exposure may continue via contaminated clothes and towels, no direct contact is necessary.</p> <p>Generic treatment advice is detailed (although this is not well referenced so it's unclear what the evidence-base is for these recommendations):</p> <ul style="list-style-type: none"> • Tape the skin to remove setae and reduce on-going exposure. • Local application of calamine. | <p>Useful overview.</p> <p>Illustrates that the medical literature for the role of allergic/non-allergic response is ambiguous.</p> | <p>Not OPM specific.</p> <p>No new information.</p> <p>No epidemiological insights.</p> <p>Old paper (1988), the information has been superseded by more recent publications.</p> |
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| | | | <ul style="list-style-type: none"> • In serious cases, short-term treatment with corticosteroid can provide relief. • Oral anti-histamines are not very effective but “worth a try” | | |
| Diaz, 2005. (9) | The epidemiology, diagnosis and management of caterpillar envenoming in the Southern US. | Misc spp., Southern USA: Literature review of epidemiology and outcomes associated with venomous caterpillars in the southern US. | <p>Identifies and describes the syndromes associated with exposure to venomous caterpillars: erucism, lepidopterism, ophthalmia nodosa.</p> <ul style="list-style-type: none"> • Erucism - dermatitis characterised by localised, pruritic maculopapular to bullous contact dermatitis and urticaria from contact with or airborne exposure to hairs, spines or toxic haemolymph. • Lepidopterism - systemic illness characterised by generalised urticaria, headache, conjunctivitis, pharyngitis, nausea, vomiting, bronchospasm, wheeze, and rarely dyspnoea. • Ophthalmia nodosa - chronic ocular condition, initial conjunctivitis followed by pan-uveitis due to corneal penetration and anterior chamber migration of the urticating hairs. These need to be referred to an ophthalmologist for assessment and treatment, and may require surgical treatment. <p>Includes treatment advice: Soap and water washing of site, no touch drying with hair dryer and stripping. Antihistamine and corticosteroids. Symptomatic and supportive care only for lepidopterism <i>T. wilkinsoni</i> is the US pine processionary moth</p> | Detailed description of range of health effects associated with different species as well as advice about treatment. | <p>Little direct information on OPM/PPM.</p> <p>Details of the search strategy used were not included.</p> <p>Only considers species found in the Southern states of USA.</p> |
| Diaz, 2005.(10) | The evolving global epidemiology, syndromic | Misc spp., Southern USA: Review of global literature on venomous encounters with | <p>Lists five categories of clinical syndromes associated with caterpillar exposures (these may overlap or combine with one another):</p> <ul style="list-style-type: none"> • Erucism – caterpillar dermatitis | Methods used to conduct literature review are fully explained. | <p>A bit out of date (literature review up to 2004).</p> <p>A lot of the information not relevant</p> |

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| | classification, management, and prevention of caterpillar envenoming. | caterpillars 1966-2004 | <p>characterised by localised, pruritic, maculopapular to bullous contact dermatitis and urticaria caused by contact with or airborne exposure to caterpillar urticating hairs, spines or toxic haemolymph.</p> <ul style="list-style-type: none"> • Lepidopterism – systemic illness caused by a constellation of effects from direct or indirect contact with caterpillars, cocoon or moth urticating hairs, spines or body fluids and is characterised by generalised urticaria, headache, conjunctivitis, pharyngitis, nausea, vomiting, bronchospasm, wheezing, and, rarely, dyspnoea. • Dendrolimiasis – chronic form of lepidopterism associated with contact with the Asian pine-tree lappet moth caterpillars or their cocoons. • Ophthalmia nodosa – chronic ocular condition characterised by initial conjunctivitis and subsequent pan-uveitis caused by corneal penetration and subsequent intraocular migration of urticating hairs from lymantriid caterpillars and therapsid spiders. <p>Advises that processionary caterpillars more commonly cause lepidopterism than erucism.</p> <p>Includes generic treatment advice: Following exposure - do not flick, squash or brush the caterpillar with a bare or gloved hand. This may release more setae, use a pen or other long thin object to gently remove the caterpillar. Removal - Strip skin of embedded hairs (rapidly drying nail polish, rubber cement,</p> | <p>Detailed information on health effects associated with caterpillar exposures generally, and also includes specific information about the processionary species.</p> <p>Details on prevention and treatment. These are well referenced.</p> <p>Of note: The report describes other spp. of caterpillar which have also been responsible for large outbreaks of dermatitis that are also endemic to the UK e.g., Gypsy moth caterpillars, Browntail moth caterpillars</p> <p>The author also advises that while identification of the spp. associated with any particular outbreak is useful, the outbreak management, prevention and treatment will be the same.</p> | to UK e.g. <i>Lonomia</i> spp. endemic to South America. |
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| | | | <p>impregnated tapes, commercial facial peel solutions could all be used). Supportive care - Do not rub contact site. Wash loose hairs off skin (soap & water), no touch dry. Remove rings and other restricting bands on watches etc. in case of swelling. Apply ice packs and initial topical swabbing with isopropyl alcohol or ammonia if needed. Topical and oral corticosteroids. Oral or intramuscular antihistamines or corticosteroids if indicated by prolonged allergic reactions.</p> <p>For lepidopterism i.e. systemic reactions: Symptomatic and supportive – oral and intramuscular anti-pruritics and anti-inflammatory agents including antihistamines and corticosteroids. Nebulised and parenteral bronchodilators for asthmatic bronchitis with bronchospasm and wheezing.</p> <p>For CON: remove all setae that are visible under microscope or split lamp examination. Topical/systemic corticosteroids for pruritus from allergic response to remaining hairs. Prolonged topical ophthalmic corticosteroid therapy, rather than corneal excision is often indicated for CON due to embedded caterpillar hairs. Follow up by ophthalmologist with periodic slit lamp examinations, visual acuity and intraocular pressure measurements.</p> <p>Prevention (for the public): During peak larval season, close exterior doors and windows. Don't hang wet clothes out to dry. Indoors: rely on air conditioning, heating and circulations systems [<i>these systems are less common in the UK than the US so</i></p> | | |
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| | | | <p><i>not widely practicable</i>]. Avoid unnecessary contact with live/dead caterpillars or their cocoons (nests). When working in the garden, wear long sleeves and trousers, with cuffs tucked in.</p> | | |
| Erich & Meulenbelt, 1993. (11) | Letter to the Editor. | <p>OPM: Review of health effects associated with OPM in light of increasing calls to the Dutch National Poisons Centre and infestations of OPM in northern Brabant.</p> | <p>Describe the various health effects following exposure: Generalised complaints include malaise, fever, dizziness and vomiting. Other research with the brown-tailed moth indicated a similar reaction, sensitisation after repeated exposure but with no specific immunity – these are referred to as ‘pseudo-allergic’ reactions. Ophthalmia nodosa – rare (but media reports have overstated its importance – possible insight into public concerns at the time). If a seta penetrates the mucous membrane of the eye, it can cause a chronic inflammatory reaction which may result in blindness if the hair is not removed surgically.</p> <p>No deaths following exposure to OPM have been documented.</p> <p>Include treatment advice:</p> <ul style="list-style-type: none"> • Prevent further spread of hairs – rinse skin with water, clean clothes (they don’t indicate how this should be done). • Calamine, anti-pruritics like phenol or menthol for the itch. • For severe local symptoms, hydrocortisone or triamcinolone cream for a few days but no RCTs have been done to evaluate their effectiveness • Local treatment with antihistamines is ‘useless’ but general antihistamines could be considered. • When serious, the generalised effects | <p>Specific to OPM.</p> <p>Useful treatment information although this is not well referenced so the basis for this evidence is not clear.</p> | <p>No novel information</p> <p>No additional epidemiological information, much of the information is similar to deJong’s paper (1988).</p> <p>Not particularly well referenced (e.g. no indication as to how the authors determined that there has never been a documented death following exposure to OPM).</p> |

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| | | | <p>can appear to resemble an anaphylaxis and should be treated as an anaphylaxis (epinephrine).</p> <ul style="list-style-type: none"> Corticosteroids not useful in acute event but may be helpful for persistent bronchial spasms and hypotension. | | |
| Everson et al., 1990. (12) | Caterpillar envenomations : A prospective study of 112 cases. | <p>Misc spp. (no OPM/PPM), Louisiana US.</p> <p>1 year prospective study of data from Louisiana Regional Poisons Centre to identify incidence and type of symptoms associated with caterpillar envenomations.</p> <p>Patient's symptoms at 2, 4, 24hrs post-exposure were recorded.</p> | <p>6 spp identified; none OPM/PPM.</p> <p>Distinct seasonal effect – short periods (weeks) of notifications associated with each individual spp.</p> <p>30% of cases were ≤5yrs old. A similar incidence & extent of symptoms across age groups was observed but atypical symptoms reported more often in adolescents & adults.</p> <p>Clinical effects observed were: local pain (96%), erythema (89%) & swelling (72%). 0% with moderate-severe systemic symptoms. 16% of patients had history of allergy but none in this subgroup had 'hive-like' dermatological effects or anaphylactic allergic response.</p> <p>Most common site was: hand (27%), foot (26%) and arm (19%). No correlation was observed between sting site and the extent of symptoms that developed (apart from 3 cases with stings to the back who had radiating pain & dizziness).</p> <p>Evidence of pre-existing allergy was not found to be a predictor of allergic response or more severe response; 8 patients had prior history of reaction to insect sting – none had allergic response to envenoming.</p> <p>61% had symptoms 24hrs post-event. Initial symptom was largely reported as severe</p> | <p>Prospective approach used.</p> <p>High response rate. High rate of follow-up (91%).</p> <p>Looked at whether there were any predisposing factors for sensitisation i.e. existing allergies.</p> <p>Followed-up with patients for 2, 4, 24hrs post-exposure to ascertain symptoms.</p> | <p>Self-reported extent and severity of symptoms.</p> <p>Study was not able to address the issue of hypersensitivity.</p> <p>NOTE: this paper has been referenced in other literature as supporting evidence for anaphylaxis reactions associated with exposure to processionary species; however, the study did not include any individual with exposure to processionary caterpillars.</p> |

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| | | | <p>pain.</p> <p>Apparent lack of effective treatment: there was no reported reduction in symptoms from oral anti-histamines, topical steroids or over the counter analgesics. Anecdotal evidence suggested that Sting Eze and meat tenderiser with papain, IM meperidine may be effective (other reports have suggested IV calcium gluconate).</p> | | |
| Fagrell et al., 2008. (13) | <p>Skin reactions induced by experimental exposure to setae from larvae of the northern Pine Processionary Moth (<i>Thaumetopoea pinivora</i>).</p> | <p>Northern PPM, Sweden: The purpose of the study was to improve understanding of the mechanisms of action for reactions to skin exposure to setae. Drops of setae solution were applied to the forearm of 6 volunteers (& rubbed in); 5/6 had been previously heavily exposed, 2 of these had experienced severe symptoms following previous exposure to Northern PPM, 4 had experienced mild symptoms and 1 had never been previously exposed.</p> <p>Patients were followed up for a max of 42 days post-exposure and examined for: clinical symptoms, vital</p> | <p>In all patients (6/6): Local flare and swelling in 6/6 within 24hrs Marked local blood perfusion within 2 days. No IgE or IgG4 antibodies to larval antigens identified. Setae had penetrated the outer layer of skin.</p> <p>The 2 individuals with history of severe symptoms had: Marked symptoms with oedema in the exposed area and surrounding skin. Numerous blisters within 48hrs that increased in size during first 7 days. Blisters faded then followed by desquamation in the 2nd week and severe local symptoms. Skin perfusion peak at D2 (4/5 fold increase). 1 patient reported general malaise for 2 weeks following exposure, with light erythema and itching persisting after 7 weeks. Under the microscope: At D2, some setae surrounded by specific micro-oedema. At D14, outer layer of skins had been partly rejected indicating marked local inflammatory reaction, few setae left in the skin implying they had been removed with the desquamated skin layer.</p> <p>3/6 with history of mild symptoms (1 had no previous exposure):</p> | <p>Thorough description of methods used (i.e. repeatable).</p> <p>Use intact setae applied to the skin to simulate exposure – other studies have used extract of setae/caterpillar prepared so that it can be applied as a pin prick to the skin. This approach reflects the way in which individuals are likely to be exposed in reality.</p> <p>Thorough description of clinical symptoms including macro and micro-morphological skin changes.</p> <p>Individuals followed up regularly with maximum of 42 days post-exposure.</p> <p>Included sensitised and non-sensitised individuals.</p> <p>Construct compelling case that reactions are likely not due to a toxin.</p> | <p>Small sample size; 6 individuals only.</p> |

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| | | <p>skin microscopy, & skin blood perfusion by LD scan.</p> | <p>Rash and itch resolved within 3 weeks. Skin perfusion peak at D2, slight increase only.</p> <p>Under the microscope: almost unchanged during follow-up. Setae remained in skin (in decreasing numbers) despite numerous showers.</p> <p>Magnitude of symptoms & signs of inflammation were similar in the heavily exposed and those with mild/severe reactions. They conclude that setae or substances attached to them are the key to the reaction.</p> <p>No solid evidence for fluid in the setae shaft – they didn't observe any broken setae under the microscope. Other studies have indicated that heat and alcohol treatment of setae do not remove setae toxicity. They conclude that mechanical irritation is more likely the mechanism involved - early phase of the reaction mimics a foreign body reaction with release of effector substances such as histamine or other mediators (Lamy et al. also report histamine-releasing compounds in setae from PPM (14)).</p> <p>Conclusions:</p> <ul style="list-style-type: none"> • Setae have strong pro-inflammatory properties. • Initial reaction mimics a "foreign body" reaction that varies depending on individual predisposition. • Sensitisation by previous exposure is not required for a reaction to occur. | | |
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| <p>Fenk et al., 2007. (15)</p> | <p>Dispersion of the bio-aerosol produced by the oak processionary moth.</p> | <p>OPM, Simulation modelling:</p> <p>A simulation model was used to estimate concentrations/density of setae around a colony (i.e. the atmospheric lifetime). Setae from old nests (with dead caterpillars & excrement) were assumed to have an aerodynamic diameter of 19µm (diameter 6µm and length of 190µm). The Eulerian model was applied to estimate the settling velocity (i.e. dispersion) of the setae.</p> | <p>Maximum concentrations in the atmosphere on a typical summer's day were estimated to reach 20-30% of the concentration found directly at the source.</p> <p>Maximum concentrations were estimated to be reached at 174-562m from the source, depending on atmospheric stability and settling velocity.</p> <p>Wide SD for settling velocity estimate (± 0.5cm/s) due to the variation in the size of the setae; this reflects the reality as nests will have debris from multiple instar phases with setae of different sizes present.</p> | <p>Specific to OPM.</p> <p>The only paper identified that attempts to understand exposure to OPM setae.</p> | <p>The model assumed a maximum distribution with nests positioned at the top of the oak tree - nests are generally observed at branch points, where they are relatively protected from the elements and are not restricted to the top of the canopy. This assumption is likely to over-estimate the dispersion of setae.</p> <p>The authors have not included any sensitivity analyses to indicate the impact of their assumed model inputs (such as nest positioning) on their findings.</p> <p>The findings have not been validated using environmental sampling.</p> |
| <p>Fournier et al. (2011) (16)</p> | <p>Cornea imagery and keratitis by processionary caterpillar hairs.</p> | <p>OPM, France: Case report of 13yr old boy treated for ocular exposure. Exposure was via OPM present in the neighbourhood of his school i.e. indirect.</p> | <p>Presented to A&E with painful, itchy right eye (RE), palpable oedema which appeared suddenly and developed over 3 days.</p> <p>Clinical assessment of RE: Visual acuity (VA) = 5/10, conjunctival hyperaemia associated with corneal oedema, in absence of intra-ocular inflammation.</p> <p>Microscopic examination of RE: numerous hairs set in the corneal epithelium and stroma, and associated with a superficial punctate keratopathy.</p> <p>Slit-Lamp exam identified nothing unusual.</p> <p>Treatment:</p> | <p>Detailed classification of ocular lesions related to setae exposure.</p> <p>Detailed classification of treatment options for each class of ocular lesion related to setae exposure.</p> <p>The authors recognise the limitations of the evidence upon which their advice is based.</p> <p>Very useful paper for a clinician who is managing a patient with ocular exposure to OPM setae.</p> | <p>Not possible to determine which element of the non-surgical intervention was effective (if at all).</p> |

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| | | | <p>Corneal de-epithelialisation was done under general anaesthetic with setae extracted using a 30g needle. Topical tobramycin, dexamethasone, antihistamines and lubricants for 3 weeks.</p> <p>Functional recovery, VA = 10/10 but 4 hairs persisted in the corneal stroma so topical dexamethasone was continued for several months.</p> <p>Difficult to remove all hairs, despite surgical intervention. Authors state the child may require treatment for several months.</p> | | |
| Fuentes Aparicio et al., 2004.(17) | Non-occupational allergy caused by the Pine Processionary caterpillar (<i>Thaumetopoea pityocampa</i>) | PPM, experimental: 4 patients attending an allergy clinic with suspected previous exposure to PPM resulting in wheals/dyspnoea underwent Skin Prick Test (SPT) (4/4) and bronchial challenge (1/4). | <p>All 4 patients had positive SPTs; indicates an IgE response may be involved.</p> <p>3/4 patients were atopic and all 3 of these tested positive for specific IgE against PPM</p> <p>The non-atopic patient had a positive response to the bronchial challenge.</p> | The results provide some new evidence to suggest that atopic individuals without previous occupational exposure may have an IgE mediated response to exposure. | <p>Small sample size (n=4)</p> <p>Selection bias (small group of patients identified by the investigators as potentially having been exposed previously, all attend allergy clinic already i.e. not representative of wider population).</p> <p>The patients themselves attributed their previous reaction as having been the result of exposure to PPM; this may have affected the way in which they reported their exposures.</p> <p>'Non-occupational' exposure was defined as someone who spent time in a pine forest; how the patients spent their time in the forest is not described i.e. how the exposure is defined is not clearly detailed.</p> |
| Fuentes Aparicio et al., 2006.(18) | Allergy to pine processionary caterpillar (<i>Thaumetopoea</i>) | PPM, experimental: SPTs were done on 16 children aged 6-15yrs who presented to the | 100% (16/16) of children had a positive SPT. 69% (11/16) of the children were found to be atopic. | <p>The study looks specifically at the response in children.</p> <p>Include a control group.</p> | <p>Only considers PPM.</p> <p>Self-selected sample of children – all had presented at an allergy clinic for</p> |

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| | <p><i>a pityocampa</i>) in children.</p> | <p>author's allergy clinic with symptoms thought to be related to PPM exposure.</p> <p>SPTs were also done on 30 control subjects (both atopic and non-atopic) using sterile .</p> <p>A positive response was recorded where mean wheal ≥ 3mm measured 15mins after puncture.</p> <p>Researchers used extract from whole PPM larvae in L5.</p> <p>They measured specific IgE and used SDS-PAGE immunoblotting to examine the presence of specific proteins.</p> | <p>One of their patients (14yr old) reported having asthma & another reported an anaphylaxis (9 yr old) following exposure. In both cases, symptoms appeared several hours after being in a pine area affected by PPM. The authors do not provide any clinical detail about the reported episode of anaphylaxis but the information on Table 1 indicates the patient did not have a positive reaction to the allergens tested for using SPT (ollen, animal epithelials, moulds, mites and cockroaches).</p> <p>Western blotting indicated several IgE binding bands 17.5-168kDa. The pattern of mol wt proteins was not consistent with that observed by Lamy et al. (1986), Werno et al. (1993) or Moneo et al. (2003). This may be due to the methods used. 15/16 children's sera tested positive for specific IgE >0.35kU/L</p> <p>The authors conclude: The reaction is a toxic-irritative one: setae enter the skin and break, causing basophil degranulation which results in histamine release. Mechanical effects are more common but an IgE response is possible, along with an immediate hypersensitivity as a result of previous exposure. Immediate hypersensitivity can also occur in children.</p> | | <p>investigation (this is reflected in the high proportion of children in the group who were found to be allergic to pollen).</p> <p>Limited description of the control group – e.g., their age, the proportion with history of atopy. Importantly, the authors do not describe how they identified their controls.</p> |
| <p>Gottschling & Mayer., 2006.(19, 20)</p> | <p>An epidemic airborne disease caused by the Oak Processionary Caterpillar.</p> | <p>OPM, Germany: Outbreak report of individuals who stopped at a recreational area in Saarland, Germany where there was an oak tree infested with</p> | <p>A group of about 90 people went to a recreational area which was ~20m away from the infested tree. The group stayed there for several hours during which time a small number of children played with the caterpillars. Later that day several of the group developed severe pruritus.</p> | <p>Rare OPM-specific paper.</p> <p>Useful descriptive information about treatment given.</p> <p>Useful descriptive information about how an outbreak related to exposure to OPM</p> | <p>Authors have not included a denominator and only state that the group had about 90 people in it. The number of people affected is not stated, the authors merely state that 42 individuals saw a Doctor.</p> <p>The timeline from initial exposure to</p> |

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| | | OPM. | <p>42 people saw a doctor. Symptoms reported included itching, visible weal and flare lesions, pin-sized red papules. Respiratory distress reported in 5 patients (bronchoconstriction, cough and wheeze).</p> <p>One patient reported Quincke's oedema (not stated whether this individual was known to be atopic). [Note: QE is not always allergen-mediated, it can be a non-allergen mediated response (e.g. to medicine) & can have a genetic component.]</p> <p>All patients were treated successfully with anti-histamines with or without topical or systemic steroids. 6 received systemic steroids; 2 children aged 4 & 6yrs who had been in direct contact with caterpillars and 4 adults with no direct contact. Symptoms resolved within 1hr of steroids being administered; all were seen as outpatients.</p> <p>Treatment recommendations: Most symptoms can be treated with topical steroids and systemic anti-histamines. In rare cases, systemic steroids with or without inhalation beta-mimetics may be needed for patients with respiratory involvement.</p> <p>The authors suggest that outbreaks have the potential to affect large numbers of people.</p> | can come about. | <p>onset of symptoms not clearly described.</p> <p>Insufficient data to make meaningful deductions that can be applied more generally.</p> <p>Most of the people with severe symptoms did not have direct contact with a caterpillar; it's not possible to deduce whether their exposure was indirect via airborne setae or through contaminated clothes from those who had direct contact.</p> <p>The authors don't state whether or not there had been any complaints about the site prior to this visit.</p> |
| Gottschling et al., 2007.(20) | Outbreak report of airborne caterpillar dermatitis in a kindergarten. | OPM, Germany: Parents of children who attended a kindergarten with 3 infested oak trees on site were surveyed to | <p>A questionnaire was handed out to all parents (n=47) whose children attended the kindergarten.</p> <p><u>Results</u> 51% (24/47) response rate.</p> | <p>Rare OPM-specific paper.</p> <p>A rare published report example of an outbreak of erucism associated with an infestation of OPM.</p> | <p>Low response rate to the survey: potentially biased sample, parents of children affected are potentially more likely to respond, inflating the estimated incidence because the denominator doesn't include all of</p> |

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| | | <p>estimate the incidence of caterpillar dermatitis in the children attending the kindergarten.</p> | <p>67% (16/24) of respondents were female (authors do not state whether this was representative of the distribution of gender among kindergarten attendees i.e. whether there was a gender based selection bias). 42% (10/24) reported symptoms.</p> <p>Of the 10 individuals who reported symptoms, symptoms reported were: 80% (8/10) - dermatitis 50% (5/10) - pruritic 50% (5/10) - respiratory distress 40% (4/10) - malaise and/or fever 10% (1/10) - conjunctivitis</p> <p>[Symptoms reported as a %age of all respondents (not included in the published paper): 33% (8/24) - dermatitis 21% (5/24) - rash 21% (5/24) - respiratory distress 17% (4/24) - malaise/ fever 4% (1/24) – conjunctivitis]</p> <p>29% (7/24) of all respondents were known to be atopic. Of these, 43% (3/7) were asymptomatic & 57% (4/7) were symptomatic</p> <p>Healthcare burden: 70% (7/10) of those who reported symptoms consulted a doctor – 29% of all respondents. 57% (4/7) received medication (topical and/or systemic antihistamines and/or steroids) – 17% of all respondents.</p> <p>The authors state that children may be more susceptible to exposure through their natural curiosity and tendency to play close to the ground.</p> | <p>Specifically looks at the potential risks for children exposed to OPM setae.</p> <p>Survey asked for:</p> <ul style="list-style-type: none"> - Symptoms before and after the trees were removed. - Whether the child had a history of atopy or not. - Information on healthcare seeking behaviour. <p>The authors include a number of recommendations for avoiding exposure and what to do following exposure.</p> | <p>the children who may have attended and not had any symptoms.</p> <p>Exposure is defined as attendance at the kindergarten but there is no information about the extent of contact in the children who reported symptoms and those who did not e.g. direct contact, how long children spent in the garden where the OPM was found.</p> <p>There is no information about the number of nests in the 3 trees (this would give an idea of potential dose/intensity of exposure).</p> <p>Information bias: Survey was conducted after the removal of the infested trees, i.e. the questions about symptoms before/after were retrospective. Retrospective self-reporting of symptoms in a study where respondents are aware of the outcome of interest may lead to exaggeration of symptoms &/or symptoms being falsely attributed to the exposure under investigation (recall bias).</p> <p>None of the self-reported symptoms were clinically validated. The authors state that 7/10 who reported symptoms went to a doctor but the 'correct diagnosis was not posed in any case'. It is not clear whether this statement means that none of the Doctors diagnosed the presenting symptoms as being the result of exposure to OPM.</p> <p>All of the symptoms described are</p> |
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| | | | <p>Authors suggest that children may be more likely to experience general symptoms following exposure as there was a higher proportion reporting fever/malaise and airway involvement than has been observed in other studies involving adult exposure to OPM.</p> <p>The authors describe thaumetopoein as a histamine releasing toxin and conclude that the mechanisms involved are direct non IgE-mediated release by thaumetopoein & mechanical irritation caused by penetration of the skin or mucous membranes.</p> <p>The authors provide advice for management:</p> <ul style="list-style-type: none"> • Avoid touching the caterpillars, avoid infested woods/forests and paths near infested woods and forests • Have nests removed by specialist. • Wear long-sleeved clothing when gardening. • Wash contaminated clothes - Wash skin extensively following potential exposure. | | <p>non-specific and difficult to attribute with certainty to caterpillar exposure, e.g. Children reporting respiratory distress (cough, wheeze) – the study took place in June with children aged 2-6years, who may have been predisposed to wheeze. These symptoms could be attributed to a range of alternative exposures, e.g. pollen.</p> <p>Results are reported as the proportion of respondents with each specific symptom out of all of those who reported any symptoms at all, as opposed to the proportion of all respondents. This gives the impression of a higher proportion of cases with these specific outcomes than was observed in the group overall. These results may have been more usefully presented as a secondary table with the proportion of all respondents with each outcome presented as the primary results.</p> <p>Small sample size - difficult to analyse for significance e.g. whether atopic children more likely to experience symptoms.</p> <p>Didn't include information on whether the treatments used were perceived to be effective.</p> <p>The advice to avoid forests and woods has not been considered in a balanced way in terms of the health benefits of outdoor space.</p> <p>Advice following exposure is not</p> |
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| | | | | | referenced and it's unclear what the evidence-base to support it is (expert opinion or otherwise). |
| Haddad et al., 2012.(21) | Tropical dermatology: Venomous arthropods and human skin. Part I. Insecta. | Misc spp. No processionary spp.: Review of dermatological effects of exposure to insect species, including ant, bee and caterpillar/moths. | Low reporting of lepidopterism/erucism hinders a complete understanding of outcomes associated with exposure. The authors state that the mechanism for caterpillar venom is not known. | | No information specific to processionary spp. Focus is on tropical species. |
| Holm & Larsson (2006).(22) | Allergy to eastern pine processionary moth (<i>Thaumetopaea pinivora</i>) – increased density of larvae increases the risk of allergic reaction. | Eastern PPM, <i>T. pinivora</i> (a species closely related to the spp. found in the Med.), Sweden: Summary report of authors understanding of PPM biology and associated medical complaints. | The Eastern PPM lifecycle is somewhat different to OPM; 2-year cycle. Similarly to OPM, they hatch in early summer, feed nocturnally, and pupate in late July/early August. Unlike OPM, they burrow into the ground to pupate. The soil where their cocoons have been laid have a high density of setae. The population in Gotland have high densities in even-numbered years. Density of the moth has been increasing, with density-dependent regulatory factors unable to keep population numbers down e.g., more land given to pine forests, climate change. Despite high density of the pest, awareness among healthcare professionals is limited (although evidence for this statement is not offered). Treatment: Antipruritic and antihistamine treatments have been used. | Detailed review of lifecycle allows for comparison with OPM lifecycle to be made. | Limited number of papers reviewed and these are generally based on the Mediterranean spp. No additional epidemiological information. Some of the observations appear to be anecdotal. Information on treatment indicates what the authors understand has been used previously but doesn't include any information on effectiveness or perceived effectiveness of these treatments. |
| Holm et al., 2009. (23) | Pine processionary caterpillar | Northern PPM, <i>T. pinivora</i> (Northern PPM is closely | Questionnaire sent to owners of 1,373 properties, with reminder. 70% (963/1,373) response rate for properties, providing | The largest epidemiological study of a processionary species to date. | Not OPM. Survey conducting using buildings |

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| <p>(<i>Thaumetopae a pinivora</i>) – a significant health problem in southern Gotland.</p> | <p>related to the spp. found in the Med.), Sweden:</p> <p>Aim of the study was to estimate the number of individuals affected by exposure to PPM, & the type and severity of symptoms experienced.</p> <p>A 2007 survey asked about symptoms experienced the previous summer (2006). A questionnaire was sent to the owners of all properties registered in the 7 parishes in Gotland where the moth is present. One person in the household completed the questionnaire on behalf of all of those present in summer 2006.</p> <p>Questionnaire included: demographic information, where & how they felt that their exposure had occurred, atopy, symptoms, severity, whether they visited a doctor and/or used medication.</p> | <p>information for 4,277 individuals who were resident during the study period.</p> <p>17.9% (766/4,277) of individuals reported symptoms associated with exposure to the caterpillar. 35% (271/766) of individuals with reported symptoms rated their symptoms as severe (6% of all respondents).</p> <p>Prevalence: Reported prevalence of symptoms experienced in summer 1996 (i.e. period prevalence) ranged from 4-41% in the 7 parishes surveyed: the authors suggest that the range in prevalence of reported symptoms may be associated with local density of larvae but that other factors are also likely. The proportion of residents with symptoms was highest in the areas with highest density of caterpillars. 75% of the individuals who reported symptoms and lived in lower density areas indicated that they developed their symptoms after visiting the heavily infested areas.</p> <p>Among all individuals surveyed: Proportion of individuals reporting different symptoms:</p> <ul style="list-style-type: none"> • Redness, itching, blistering – 17% (731/4,277) • Other skin symptoms – 4% (190/4,277) • Cough, SOB, squeak in the chest, asthma – 2% (92/4,277) • Nasal itching or watery discharge – 2% (101/4,277) • Irritation, itching or pain in mouth or throat – 1% (56/4,277) • Eye inflammation – 2% (83/4,277) • Fever without known infection – 1% | <p>Collected information on range of symptoms and perceived severity of these.</p> <p>Attempted to assess the dose-response relationship by relating prevalence to the estimated density of PPM present.</p> <p>Large number of people provided information about symptoms in a heavily infested area – no reports of anaphylaxis or keratitis reaction. This provides reassurance that severe reactions are rare even where people are living in a heavily infested area.</p> | <p>as the unit for dissemination so it was not possible to calculate a denominator and thus prevalence estimates for the proportion of the population affected.</p> <p>Classification of moth density (i.e. exposure): Unclear how the survey area was selected or how the methods used were derived [Note: OPM nests are difficult to find even by experienced individuals, searching a pine tree stand for 10mins may miss nests and thus underestimate exposures.]</p> <p>Chance: The authors have not included confidence intervals for the estimates of period prevalence; there is large variation between the different parishes in the proportion who experienced symptoms</p> <p>Bias: Selection bias: Although the per household response rate was high, it's not clear what population denominator to use for calculating a population-based response rate (i.e. 4,277 responses/total population of the regions).</p> <p>The prevalence estimate is based on number of individual reports of symptoms/number of total individuals for whom a report was received. It is possible that those individuals who experienced exposure and/or symptoms were more likely to complete the questionnaire thus inflating the estimate.</p> |
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| | | <p>Tree surveys were conducted to measure moth density in the study area; a study area was selected (it's not clear how this was identified) & 3 pine stands were each searched for 10mins to count colonies. Areas were classified as low/medium/high density.</p> | <p>(62/4,277)</p> <ul style="list-style-type: none"> • Other symptoms – 2% (65/4,277) <p>Healthcare demand:</p> <ul style="list-style-type: none"> • 2% (103/4,277) visited a doctor. • 6% (276/4,277) took medication <p>No cases of anaphylaxis or keratitis were reported. Asthmatic bronchitis was reported but could not be distinguished from asthma from other causes.</p> <p><u>Among the individuals who reported symptoms, the most commonly reported symptoms were:</u></p> <ul style="list-style-type: none"> • Redness, itching, blistering – 95% (731/766) • Other skin symptoms (swelling/eczema) – 25% (190/766) • Cough, SOB, squeak in the chest, asthma – 12% (92/766). • Nasal itching or watery discharge – 13% (101/766). • Irritation, itching or pain in mouth or throat – 7% (56/766) • Eye inflammation – 11% (83/766) • Fever without known infection – 8% (62/766) • Other symptoms – 8.5% (65/766) <p>Healthcare demand:</p> <ul style="list-style-type: none"> • 13% (103/766) visited a doctor. • 36% (276/766) took medication <p>Risk factors for health effects following exposure: The authors conclude that a considerable proportion of the population do not experience symptoms in spite of</p> | | <p>Recall bias: Retrospective questionnaire about signs and symptoms have the potential for recall bias as also identified by Rots-de Vries and Jans (24) in their study which asked about retrospective health complaints.</p> <p>Proxy reporting by a single member of the household for signs and symptoms experienced the previous summer may have resulted in inaccurate information.</p> <p>Other comments: The study includes severity scale for symptoms experienced but no questions about the impact on daily living.</p> <p>No formal analysis was applied to explore this reported potential association between reported symptoms and density of larvae.</p> |
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| | | | <p>exposure to setae, whilst others can have a severe reaction to their first exposure; the parts of the body exposed as well as genetic or other factors, such as sweating may be important in determining severity. There is large variation in the response to exposure which may be the result of genetic polymorphism, which affect the presence of chitinases.</p> | | |
| Hossler, 2009.(25) | Caterpillars and moths. | <p>Misc spp., with limited reference to processionary spp., International review.</p> <p>Review of health effects associated with exposure to moth and caterpillar species.</p> | <p>Review of the range of health effects associated with various moth and caterpillar species.</p> <p>Prevention & management advice given (generic advice for any caterpillar spp.):</p> <ul style="list-style-type: none"> • If sensitised, avoid infested areas. • Wear long sleeves and gloves, especially if working in and around the insect. • Remove setae with sticky tape, stripping or forceps. • Wash immediately with soap and water. • Remove constricting clothing. • Remove constricting jewellery (in case of swelling) <p>Treatment advice:</p> <ul style="list-style-type: none"> • Topical treatments - anti-pruritics, anaesthetics, aspirin or steroids may be used. Topical antihistamines are not advised due to their sensitising potential. - Oral exposure - Examination under microscopy, removal of setae, endoscopy under sedation for patients with drooling/dysphagia, some evidence for the use of systemic corticosteroids, systemic antibiotics and antihistamines. | <p>Thorough review.</p> <p>Detailed treatment recommendations, including a consideration of the level of evidence supporting the advice given.</p> <p>This review indicates that the treatment recommendations are derived from consensus, opinion or case studies; no intervention studies have been done to date.</p> | <p>No detail given regarding the methodology used to conduct the review: e.g. search terms or databases used, years included in the review.</p> <p>Limited reference to processionary species specifically.</p> |

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| | | | <ul style="list-style-type: none"> • For anaphylaxis – Epinephrine, nebulised bronchodilators. • For CON – removal of setae, topical/oral steroids, surgery. | | |
| Kozer et al., 1999.(26) | Hypertension and abdominal pain: uncommon presentation after exposure to a pine caterpillar. | T. wilkinsoni, Israel Case report of 3 patients aged 10, 16 & 14 yrs who attended A&E following direct exposure to caterpillar when camping in a pine grove (they reported playing with the caterpillar) in Israel. | All 3 individuals reported dermatitis, itching and swelling. 2/3 (female) reported abdominal pain. 1/3 (female) had hypertension. | Describes unusual symptoms associated with exposure to a processionary caterpillar. | Not OPM. 3 case reports; no additional epidemiological information. No denominator: i.e. no indication of the number of other people who were at the camp site who were not affected (so it is not possible to deduce an attack rate). |
| Lamy et al., 1986. (14) | Thaumetopoein : an urticating protein from the hairs and integument of the pine processionary caterpillar (<i>Thaumetopoea pityocampa</i> Schiff., Lepidoptera, Thaumetopoeidae). | PPM, experimental: Distillation of cuticle, hair and haemolymph from PPM in the last instar (L6) were analysed using electrophoretic and immunological techniques. | Numerous proteins were identified in the setae, some of which were also present in cuticle and haemolymph but one protein fraction (28,000 mol wt.) was unique to setae (thaumetopoein). The compound consisted of two subunits of 13,000 and 15,000 mol wt. This protein caused a skin reaction in guinea pig identical to that produced by whole hair extract. Immunological reactions: They used Ouchterlony's double diffusion test with setae anti-serum (from rabbits): identified an additional precipitin arc with setae extract but none with other proteins from cuticle and haemolymph. Immunoelectrophoresis: Same unique precipitin arc was observed for setae extract. Electrophoresis: Dissociation of thaumetopoein into two subunits of mol wt 13 & 15,000 | Assesses the different proteins present in the cuticle and haemolymph as well as the setae; establishes that thaumetopoein is only present in the hair. | Considers PPM, not OPM. Old paper, techniques may be outdated. Exposure is simulated through the crushing of hairs into a solution and injecting this solution into the skin; exposures experienced naturally will differ to this. Does not discuss the possibility that the reaction associated with exposure could be a non-protein one i.e. assumes that because this protein is the only one unique to the hair that it is responsible for the reaction. |

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| | | | <p>Skin reactions (guinea pig): -ve reaction with cuticular extract; +ve reactions with total hair extract and thaumetopoein fraction.</p> <p>The authors deduce that because there are no pores or holes in setae that the 'toxin' is only released when the setae is broken and the substance within is released.</p> <p>An earlier study by Lamy et al. (1983) indicated that degranulation of mast cells was dose-dependent and heating slightly reduced those effects – supporting their theory that the causative agent is a protein (27).</p> | | |
| Lamy et al., 1988. (28) | The oak processionary caterpillar (<i>Thaetopoea processionea</i> L.) and man: urticating apparatus and mechanisms of action. | <p>OPM, experimental:</p> <p>Microscopic examination of setae.</p> <p>Microscopic investigation of the L1-L6 larvae of OPM.</p> <p>Analysis of proteins in OPM setae and comparison with those found in PPM using immunoblotting with PPM immune serum.</p> <p>SPT on guinea pigs with whole setae extract and with isolated protein extract (& controls)</p> <p>thaumetopoein</p> | <p>Setae of OPM are 100-250µm long, the end attached to the cuticle is very sharp, the other end has a sharp point with lateral barbs pointing towards the point. There are no pores at either end or along the length of the setae.</p> <p>They describe & characterise development of setae with instar development: L3 – small tuft of hairs; L4 – small zone of urticating setae; L5 – setae in the same place on the abdomen but had gotten larger; L6 – 4 areas of the 8 mirrors (where the hairs can be released from) are entirely colonised with setae.</p> <p>Proteins, biochemical investigations: 19 protein bands detected, the strongest band in OPM was made up of 2 proteins of 17,000 Daltons and 14,000 Daltons each (the protein fractions reported for the two species (OPM/PPM) are not the same).</p> <p>Immunological comparisons with PPM: PPM-derived anti-protein antibody for thaumetopoein also recognises an antigen in OPM. The diffusion fronts suggest that</p> | A rare source of OPM specific- research, detailing the development of setae across the lifecycle as well as new information about the proteins in OPM v PPM and their potential toxicological properties. | Describe dermatitis and a couple of individuals with more generalised symptoms (fever & non-pyretic diarrhoea, respectively) but do not mention any of the other symptoms that have been reported. |

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| | | | <p>the antigens recognised are either identical or very similar.</p> <p>Immunoblotting: denatured extract from OPM and PPM. PPM – 2 fractions, 15,000 Daltons protein has high immunoreactivity. OPM – only 1 reactive band visible, 14,000 Daltons.</p> <p>SPT on guinea pig: control & whole setae extract and 2 extracts from fractions separated using electrophoresis: +ve response for both samples.</p> <p>Clinical & epidemiological observations: Dermatitis – itchiness, temporarily calmed by water, immediately followed by the appearance of firm papules which can have a characteristic orange-tinted appearance.</p> | | |
| Lee et al. (1999). (29) | Oropharyngeal manifestations of lepidopterism. | <p>Misc spp (no OPM), US: Retrospective case series of 733 paediatric cases exposed to caterpillars. Review of all patients exposed to caterpillars reported to the regional Pittsburgh Poisons Control Centre Jan 1994 to Nov 1997, & review of case notes from children who presented with oropharyngeal exposure to a tertiary children's hospital, Jan 1996 to Oct., 1997</p> | <p>Poisons centre data: 92% (675/733) reported dermal exposure, 7% (55/733) oral exposure, 0.4% (3/733) ocular exposure</p> <p>Tertiary hospital data: 26 cases had oropharyngeal exposure to a caterpillar, 8 ingested the caterpillar.</p> <p>Many reported multiple symptoms: dysphagia, 88% (23/26); erythema at site of contact, 85% (22/26); pain, 69% (18/26); oedema, 65% (17/26); drooling, 58% (15/26); pruritus, 58% (15/26); and shortness of breath 4% (1/26).</p> <p>Where contact with a caterpillar had occurred there were buried setae with focal erythema. The most commonly affected sites were: Tongue, 88% (23/26); Lips, 46% (12/26); Buccal mucosa, 46% (12/26); Palate, 42% (11/26); Oesophagus, 31% (8/28).</p> <p>For the children who had ingested the caterpillar, direct laryngoscopy, bronchoscopy and oesophagoscopy with microscopic removal of the caterpillar setae was conducted. Spines were difficult to see</p> | <p>Review of oropharyngeal manifestations of lepidopterism (providing new information).</p> <p>Although the sample is not representative or generalisable, it supports other reports that indicate that dermal exposures are probably most common, followed by oropharyngeal and then ocular.</p> <p>Includes useful information about treatment of oropharyngeal exposure, although no information on efficacy/effectiveness of these treatments.</p> | <p>Not about OPM specifically, or any specific processionary spp. No additional epidemiological information.</p> <p>The treatment applied doesn't appear to be consistent and the authors did not collate information about what treatment was perceived to be most effective.</p> |

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| | | | <p>(embedded in tissue) and needed magnification to identify for removal, a number of children required the removal of the spines under conscious sedation. No post-operative complications were reported (short follow-up, 48 hours)</p> <p>Treatments used: Steroid (dexamethasone, prednisone), 54% (14/26); Antibiotics, 19% (5/26); Antihistamines, 46% (12/26).</p> | | |
| Licht & Jonker, 1998.(30) | <p>Serious anaphylactic reactions in connection with combating the oak processionary caterpillar (<i>Thaemetopoea processionea</i>) in North Brabant: Comment</p> | <p>OPM: Comment on previous paper by Bosma and Jans (1998) (31).</p> | <p>The authors argue that Bosma and Jans were too speculative about the cause of the reaction described, which they feel occurred too long after the exposure to OPM and Dimilin to be a true anaphylaxis.</p> <p>The development of the reaction started about an hour after initial exposure with the full strength reaction occurring about 3 hours later. They argue that the authors have not been able to characterise the reaction as a Type 1 or IV reaction.</p> <p>They suggest some methods for testing this patient for hypersensitivity.</p> | <p>Illustrates the difficulty with attributing a reaction to a specific exposure (OPM v's Dimilin).</p> | <p>No additional epidemiological information.</p> <p>Comments represent the opinion of the authors – no additional evidence presented.</p> |
| Maier et al., 2003. (32) | <p>Contact Dermatitis and Allergy. The oak processionary caterpillar as the cause of an epidemic airborne disease: survey and analysis.</p> | <p>OPM, Vienna: Authors identified 3 isolated infested trees (100m apart) near Vienna (instar L3-L6), conducted a telephone survey of all households and institutions within 500m of an infested tree & collected information on demographics, symptoms</p> | <p>67% (230/342) households/institutions responded, involving 1,025 people.</p> <p>5.6% (57/1,025) reported experiencing 1 or more symptoms of lepidopterism: - 35% (20/57) male; 65% (37/57) female.</p> <ul style="list-style-type: none"> • Reported symptoms • Pruritis, 96% (55/57) • Dermatitis, 95% (54/57) • Conjunctivitis, 14% (8/57) • Upper resp symptoms, 14% (8/57) • Respiratory distress, 4% (2/57) | <p>Well-conducted study, specifically about OPM.</p> <p>Thorough site investigation in addition to the survey & questionnaire.</p> <p>Attempt to estimate the magnitude of the health burden [<i>but methods do not allow estimate of prevalence or incidence</i>].</p> <p>Asked those affected about a</p> | <p>No estimate of the number of individuals corresponding to the denominator (342 household/institutions) so it is not possible to estimate the person response rate, although the response rate per household/institute is relatively high.</p> <p>Possible selection bias for the small sub-section who completed the extended questionnaire – they may not be representative of the wider group with symptoms e.g. those with</p> |

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| | | <p>experienced, treatment received.</p> <p>Individuals who reported cutaneous symptoms received a detailed postal questionnaire to get information on possible exposure, onset, clinical appearance, frequency & duration of rash, atopy, and treatment.</p> <p>Inclusion criteria: onset of symptoms correlated to the larval period of OPM.</p> | <p><u>Clinical presentation:</u> Of the 54 who experienced dermatitis, 69% (37/54) completed the extended (postal) questionnaire:</p> <ul style="list-style-type: none"> • 22% (8/37) were atopic, 5% (2/37) had a history of polymorphic light eruption. • 35% (13/37) experienced 1 attack, 43% (16/37) reported repeated attacks. • All (37/37) reported immediate itching without visible lesions. • 16% (6/37) reported delayed weal formation within 1-2 hours & all but 1 of these were children • 22% (8/37) reported delayed (6-8 hrs later) toxic irritant dermatitis with pin-sized red papules, pustules and erythematous streaks which cleared in 3-5 days. • 49% (18/37) reported persistent itchy papules which cleared in <10 days; • For 5/37 (13%) the reaction was not defined. • 6/37 (24%) reported a dual reaction – initial weals then one of the delayed reactions 6-8 hours later. <p>Most severe cases (2): 1 - Previous history of allergic asthma & had direct contact with larvae/exuviae – reported respiratory distress when he had contact with setae. 2 – History of COPD made worse with contact with setae, acute exacerbation of lung disease following removal of exuviae.</p> <p><u>Treatment</u> 35% (13/37) received external therapies (antipruritic lotions, topical corticosteroids), 35% (13/37) received a combination of systemic (antihistamines and corticosteroids) and external therapy.</p> | <p>range of symptoms.</p> <p>Actively considered whether progressive sensitivity with IgE mediated Type 1 response was experienced by this cohort – concluded that none was reported even among individuals with repeated exposure.</p> <p>Lepidopterism – conclude that mechanical irritation or non-specific mediator releases was the mechanism for this group (but don't rule out late stage development of Type 1 hypersensitivity).</p> | <p>more severe symptoms may be more likely to respond.</p> <p>Possible recall bias; the individuals responding will have known the purpose of the study and this may have affected their recall of events, especially if asked to recall symptoms that may have occurred a year or more earlier.</p> <p>Self-diagnosis of the symptoms based on provision of pictures and description of various rash types: Accurate diagnosis and classification of rash is notorious difficult even among healthcare professionals, there may have been misclassification of rash types. The authors did not validate a sub-section of the self-diagnosed rash reports.</p> <p>Not clear what time period they used for individuals to report symptoms; ever experienced symptoms? Symptoms experienced the previous season?</p> |
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| | | | <p><u>Route of exposure</u> Exposure to the caterpillars occurred via: Passing infested trees on foot, 97% (36/37); passing infested tree on main road, 97% (36/37); existence of infested tree in neighbouring garden, 57% (21/37); existence of an infested tree in their own garden, 32% (12/37); & direct contact with larvae or exuviae, 38% (14/37).</p> <p>The authors describe experiencing symptoms themselves (mild itching, conjunctivitis, malaise) following a site visit where the owner was loosening the soil; a child was also thought to have been exposed through this activity and presented with urticaria, followed by a rash with a toxic irritant appearance. They collected tape-strip samples from the gardens and identified setae.</p> <p>Several individuals reported experiencing symptoms when working in their gardens, throughout the year.</p> <p>The most severe symptoms were reported as occurring on windy days.</p> <p>Leidopterism – the authors argue that it would be more accurate to refer to the systemic reactions observed (pruritic dermatitis as well as mucosal inflammation and upper respiratory distress) as lepidopterism.</p> | | |
| Mindlin et al., 2012. (33) | The arrival of oak processionary moth, a novel cause of itchy | OPM, England: Outbreak report for an outbreak of itchy rash reported in residents of an apartment complex | An outbreak of itchy rash was reported in residents of an apartment complex. The source of the exposure was identified as OPM infestation of oak trees planted 30m away from the residential block. | First and only formal report of health complaints associated with exposure to OPM in the UK. | Limited review of the literature. The absolute numbers of cases reporting different symptoms are included but not the denominator, |

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| | <p>dermatitis, in the UK: Experience, lessons and recommendations.</p> | <p>in South West London in June 2006</p> <p>A questionnaire was delivered to all households in the buildings near the affected trees & case finding was conducted through GP alert, dermatologists and hospital emergency departments.</p> <p>Includes a discussion of the implications for public health of this newly arrived spp.</p> | <p>Response rate: 63% (20/32) of households. Attack rate among respondents: 68% (47/69). Symptoms reported among those affected:</p> <ul style="list-style-type: none"> • Rash, 100% (47/47) • Itchy eyes, 30% (14/47)* • Breathing problems, 4% (2/47)* <p>Few reported symptoms having occurred in previous years.</p> <p>Residents from 10 households had sought medical care & 5 different diagnoses were received, none of which were caterpillar dermatitis. No individuals were referred to secondary care or required hospital treatment. 2 of the workers removing the caterpillars developed symptoms as inadequate PPE used.</p> <p>Investigators observed maculopapular rash on 2 residents.</p> <p>Control measures: Source of OPM found to be oak trees imported from Netherlands in 2004 and planted on the site. The pests were removed & the trees ultimately cut down. A public information campaign including leafleting all households in the Borough.</p> | <p>Clearly described outbreak management & case definition.</p> <p>Of the 47 people affected, none reported symptoms similar to anaphylaxis.</p> | <p>the figures included in this table have been calculated using the absolute numbers provided in the paper with the number affected as the denominator (i.e. 47).</p> <p>The number of individuals who sought medical care is not included, just the number of households so it not possible to calculate the proportion of people affected who sought medical care.</p> |
| <p>Moneo et al., 2003.(34)</p> | <p>Isolation and characterisation of Thap 1, a major allergen from the pine processionary caterpillar <i>Thaumetopoea pityocampa</i>.</p> | <p>PPM, experimental: Immunoblotting using SDS-PAGE was conducted on purified extract from L5 PPM to identify the specific PPM allergen.</p> <p>Used sera from patients previously</p> | <p>Purified a protein with mol wt ~15kDa.</p> <p>This purified protein was recognised by IgE antibodies from 9/11 of the patients with previous history of symptoms following contact with PPM, strong detection. Authors state that this has high clinical relevance.</p> <p>(their findings reflect those of Lamy et al. (14)who found a non IgE mediated mast</p> | <p>Compared immunoblotting using crude larval extract and purified Thap 1.</p> | <p>Small number of patients.</p> |

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| | | reporting symptoms following contact with PPM. Atopic patients with no symptoms relating to PPM exposure were used as controls. | cell degranulator with mol wt 28kDa, consisting of 2 sub-units of 13 & 15kDa.) | | |
| Neumann & Koekkoek, 1996. (35) | Dermatitis from the Oak Processionary caterpillar (<i>Thaumetopoea processionea</i>) | OPM: Practice note. | Provides a historical overview of OPM in the Netherlands. The Netherlands had a significant issue with OPM in the last century, then the spp. died out but came back in 1978 and has reached epidemic levels since that time, with the numbers increasing year on year [Note: <i>This pattern of invasion of the species reflects the 'invade, establish, explode, die' population dynamic.</i>] | The report highlights the lack of information in the literature about the dermatological effects. Review of state of knowledge at the time of publication. | Practice note only, no additional epidemiological information. |
| Rebollo et al., 2002. (36) | Pine Processionary Caterpillar allergenicity increases during larval development. | PPM, experimental: 13 patients with a previous history suggestive of allergy & +ve SPT to PPM. 1 patient with clear history of allergic response & -ve SPT was also included. Controls were selected as previously non-exposed patients; 1 atopic, 1 non-atopic. IgE immunoblotting was conducted using extracts from Instar 1-5 and serum from the patients. | Allergens with mol. Wt. 10-45kDa were detected in L5. Highest concentration of proteins <20kDa in larval extract were in L1-4. In L5, most proteins were >30kDa but IgE binding proteins <20kDa were only found in in L5. => suggests no correlation between protein pattern and allergenicity. Dramatic increase in allergenic potency L4-5. In 5/14 patients only allergens to L5 could be detected. 5/6 (83%) occupationally exposed patients L1-L5 allergens were detected; 1/8 (13%) non-occupationally exposed patients L1-L5 allergens detected. | Identified increasing potential for allergenicity with increasing instar development. SPT used as well as immunoblotting. Suggests that even among patients with previous history suggestive of allergic-type reaction, IgE binding proteins may not be present. | Small number of patients – not possible to draw any clear conclusions. Their definition of occupational/Non-occupational exposures is not described. Results not presented/analysed clearly e.g. the difference between occupational/non-occupational exposed patients reported as absolute numbers, then %age. |

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| | | 6/14 had a history of 'occupational' exposure. 8/14 had no history of occupational exposure. | Sensitised individuals may experience a reaction at other stages in lifecycle i.e. out of season. | | |
| Rots-de Vries & Jans, 2000.(24) | Oak processionary caterpillars in the Netherlands and Belgium: Development of an epidemic and evaluation of an awareness campaign. | OPM, Netherlands: A survey was conducted in southern Netherlands and Belgium to evaluate the effectiveness of public information campaigns that took place in 1997 & 1998, following a 'plague' year in 1996. Doctors, schools, camping sites and tourism offices were targeted for the information campaign. A survey of physicians was first conducted but had a very low response rate. Then a random population based survey of 5,000 households selected from the national postcode registries in both regions was conducted. In 1997, 2,500 households in Netherlands and 2,500 in Belgium. In 1998, 3,650 (73%) | During the 1996 outbreak GPs reported having to deal with dozens of people each day, health complaints were reported to all agencies & the Tour de France was affected. Physician survey: 1 st survey – selected physicians (24% response rate). 2 nd survey – all physicians in the area (n=476), 34% response rate. Based on the estimates from these (limited) responses, ~1.5% of the population visited their G P with an OPM complaint; this rose to 3.3% in the worst affected region. <u>Population-based survey:</u> Responses received in 1997 =64% (3,185/5,000) & 1998 = 62% (3,090/5,000). Proportion of respondents reporting complaints attributable to OPM: 1997, 6.0% (191/3,185); 1998, 7.5% (232/3,090). <u>1998 detailed survey</u> Complaints (specific symptoms): Dermal - 89% (206/232); ocular - 39% (90/232); respiratory – 21% (49/232). 7% (17/232) individuals stated that they had the 'red herring' symptom (muscle pain); all but 1 of these respondents also listed other complaints. Severity of symptoms (average across complaints): Fair (51%), severe (12%). | Well conducted study, OPM-specific. One of few epidemiological studies where an attempt has been made to quantify the burden. Ask about impact on daily living of the exposure (informs 'severity'). Take into account (and try to measure) recall bias. Includes a 'red herring' question, asking about health effects (muscle pain) not related to OPM exposure to identify false responses (dummy question included). Includes some information as to which awareness-raising media were more effective: radio and TV seem best [<i>Note: may be specific to that population</i>]. Despite the intensity of this outbreak and the large number of people surveyed, the authors have not included | Low response rate in the physician survey (used to estimate the population prevalence of complaints). Household is used as the unit for the survey delivery, the precise method is not clear. The translation states that the eldest in the house asked to complete it but then that if this is a child that the parents did it. There was no systematic recording of complaints to GPs; survey of primary care was not possible. Population-based sample but men were over-represented & <25yrs were under-represented. Retrospective collection of data (although for the 1998 survey the survey was sent out immediately after the OPM season in an effort to minimise this). The authors don't include measure of uncertainty for their point estimates for prevalence. Information bias: given the well-publicised outbreak and that the questionnaire was known to be |

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| | | <p>households in Netherlands, 1,350 (27%) in Belgium. In 1998, OPM had spread so the distribution of sampling was altered to be more representative.</p> | <p>Healthcare burden: 30% (70/232) consulted a doctor. Of these, 86% (60/70) were given a prescription & 1 was referred to a specialist. <i>Self-treatment:</i> 42% (97/232) thoroughly washed clothes skin and eye; 20% (46/232) used medication from around the house; and 10% (23/232) bought over the counter treatments. <i>Reported impact on daily living:</i> Little or none –63% (146/232); moderately impeded – 33% (77/232); severe – 4% (9/232). <i>Circumstances of assumed exposure:</i> Leisure activities – 69% (160/232); in wilderness/wooded land – 53% (123/232). 16% (37/232) said that their enjoyment of recreational activities was reduced.</p> <p><i>1997 v 1998 seasons</i> The number of people who did nothing despite having complaints attributable to OPM rose from 13% in 1997 to 27% in 1998 & purchasing over the counter treatments fell from 23%-10%. Otherwise, results across the 2 surveys were very similar.</p> <p><i>Evaluation of the information campaign:</i> 1997 - 63% had not seen any information; 1998 – 52% had not seen any information. Those who reported complaints were more likely to be aware of the public information (may be more likely to report a complaint because they had seen the information or may be more likely to have seen the information as they frequent areas where the information was available and therefore more likely to have been exposed). Sources of information: Television (1997 – 55%; 1998 – 51%), radio (1997 – 63%, 1998, 52%). Awareness of information material was low: posters (12%), pamphlets</p> | <p>any reports of anaphylaxis or anaphylaxis-type reactions.</p> <p>Includes recommendations for communications:</p> <ul style="list-style-type: none"> • Information panels in places where OPM is present. • Include information on OPM along with other health risk information published by the government for the environment (e.g. ticks). | <p>about OPM, it is possible that some complaints which were not related to OPM were falsely attributed to it – this would result in an over-estimate of the prevalence of complaints.</p> <p>Include questions about what individuals did following possible exposure but not whether any of these were perceived to be effective (e.g. washing clothes).</p> <p>Have not conducted statistical analysis to look at any potential differences in behaviours or attitudes in the response before and after their information campaign (e.g. reduction in over the counter purchases), or in awareness of OPM-related information.</p> |
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| | | | <p>(15%) and panels (23% & 29% in 1997 & 1998, respectively).</p> <p>Retrospective questions in 1997 regarding complaints in 1996: %age with complaints roughly doubled indicating significant recall bias.</p> <p>The authors conclude that the problem is primarily a recreational one; most complaints were associated with woodland/wilderness during recreational activities.</p> | | |
| Santos-Magadan et al., 2009.(37) | Adverse reactions to the processionary caterpillar: irritant or allergic mechanism? | PPM, Spain: Case report including SPT and immunoblotting. | <p>24 year old woman with a history of rhinoconjunctivitis had urticarial reaction after staying in pine tree area (indirect exposure).</p> <p>She had a second reaction following another exposure 2 months later (the authors do not detail the nature of the exposure). She developed severe facial angioedema, erythema, wheezing, chest tightness, nausea and sickness. Received repeated systemic therapy.</p> <p>SPT: tested +ve to dust mites and +ve to whole larval extract. Immunoblotting with SDS-Page: +ve band around 59kDa.</p> | Rare report of suspected anaphylaxis in non-occupationally exposed individual following exposure to a processionary spp. | <p>Case report, no additional epidemiological information.</p> <p>Limited clinical information: no information about speed of onset; no information about the level/nature of the 2nd exposure; no detail of treatment provided or trajectory of recovery.</p> |
| Shkalim et al., 2008.(38) | Systemic allergic reaction to tree processionary caterpillar in children. | PPM, Israel: Describes systemic reaction in a 12year old boy following repeated exposure to a PPM nest (boy had repeatedly tried to remove a nest). | <p>Reaction following intense (tried to manually remove a nest) & repeated contact.</p> <p>Child presented on 1st day with pruritic rash on face & neck, and tightness and itching of throat with conjunctival hyperaemia. Vital signs, O₂ saturation normal and chest X-</p> | Detailed clinical information. | <p>Case report – no additional epidemiological information.</p> <p>The authors do not include details about how they identified papers for inclusion in their review of systemic reactions in children. They have included a paper by Inal et al. (39)</p> |

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| | | Includes a review of the literature on systemic reactions in children. | <p>Ray all were normal. Rash was alleviated with systemic corticosteroids and antihistamines.</p> <p>Presented the following day with rash and swelling all over body, dyspnoea & wheezing on auscultation. Treated with bronchodilators, systemic corticosteroids, antihistamines led to gradual improvement.</p> <p>Allergy clinic follow-up: Mild eosinophilia, normal serum IgE, no specific IgE antibodies for standard allergens.</p> <p>Authors include treatment advice:</p> <ul style="list-style-type: none"> • Wash exposed area with water, no touch dry (hairdryer or air dry). Strip site with duct tape, swab with isopropyl alcohol or ammonia and cover with ice pack. • Topical/oral antihistamines or corticosteroids, or for severe/prolonged symptoms inject intramuscularly. • For systemic reactions with bronchospasm and wheeze: intramuscular epinephrine, nebulised bronchodilators and supplemental O₂. | | <p>although the authors of that report explicitly state that the reaction observed was not systemic but localised (caterpillar on the tongue causing oedema, mimicking an allergic reaction).</p> <p>The treatment advice is not referenced and it is not clear whether this advice is based on their own experience as clinicians practicing clinicians in a location known to have PPM (they reference Diaz (10) which suggests that this is generic supportive advice for exposure to any caterpillar species.</p> |
| Spiegel et al., 2004. (40) | Case report: A non-infectious airborne disease. | OPM, Austria (Vienna): A case report of a 60-year old man with history of COPD who as exposed to large numbers of OPM in his back garden (no direct contact). | <p>The patient developed pruritus immediately (i.e. when walking in his garden) and 2 hours later developed wheals which rapidly developed to papules and pustules. He also reported malaise, loss of appetite and nausea.</p> <p>The patient experienced shortness of breath, cough, wheeze and rapid breathing when further exposed during the disturbance of a nest in his garden when he was standing nearby. Suggests</p> | Case report about health effects related to exposure to OPM specifically. | Single case report, no additional epidemiological information. |

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| | | | sensitisation following repeat exposures. | | |
| Vega et al., 1997.(41) | Anaphylaxis to a pine processionary caterpillar. | <p>PPM, Spain: Case report of non-atopic 41 yr old male who experienced an anaphylactic reaction after knocking down nests while working in the pine forest.</p> <p>SPT conducted using whole caterpillar extract, caterpillar faeces and silk. SDS-PAGE & immunoblotting conducted using whole caterpillar extract, caterpillar faeces and silk.</p> | <p>The patient experienced sudden onset of itching rash, starting on the neck and spreading to the whole body. Reported tongue oedema, SOB, weakness, blurred sight, and nausea. Blood pressure on physical examination was 80/50.</p> <p>The patient had complained of rash and conjunctivitis for several years (indicates possible sensitisation). SPT: +ve for whole caterpillar extract, -ve to pollens, molds and mites. 0/38 control sera were SPT-ve to all caterpillar extracts. SDS-PAGE: Insufficient protein in faeces and silk, several bands 10-200kDa. Immunoblotting: 2 reactive bands for whole larvae with mol wt of ~25 & 35kDa. Non-specific IgE to faeces and silk detected. Treatment: 1mg subcutaneous epinephrine, & IV methylprednisolone and dexchlorpheniramine.</p> | Indicates that an anaphylaxis reaction is possible in sensitised, non-atopic individuals. | <p>Not OPM.</p> <p>Case report, does not include any additional epidemiological information.</p> |
| Vega et al., 1999. (42) | Occupational reactions of immediate hypersensitivity to pine processionary caterpillar. | <p>PPM, experimental: SPT, immunoblotting and clinical observations were performed on 3 patients who had reported different levels of response to previous exposure.</p> <p>The aim of the study was to confirm the presence of an IgE-mediated mechanism in 3 patients who were occupationally exposed to PPM</p> | <p>All 3 cases reported that they had no direct contact with caterpillars. All reported very itchy papular rash, located at the neck & forearms (i.e., exposed skin), which worsened with heat, sweating and scratching.</p> <p>Case 1: Age 13yrs, experienced symptoms when helping father to collect pine cones. Dermal symptoms only.</p> <p>Case 2: Age 24yrs, collects firewood in pine forest. Experienced occasional pruritus and ocular reddening, rarely nasal pruritus. Episodes of palpebral, labial and (rarely) genital angioedema.</p> <p>Case 3: Age 23yrs, a professional pine forest worker. History of rhino conjunctivitis due to flour sensitivity. Some episodes of</p> | <p>Indicates that direct contact is not necessary for a reaction to occur in sensitised individuals.</p> <p>Unexposed areas of the body can be affected through contamination from hands and clothes.</p> <p>Rare description of anaphylaxis potentially associated with PPM exposure.</p> | <p>No information about what Case 3 was doing just prior to the reported episode of anaphylaxis; i.e. it's not possible to explore what may have triggered this extreme reaction as compared with the less extreme reactions experienced. The authors do not state whether Case 3 continued to work in the pine forest following their episode of anaphylaxis or whether subsequent severe reactions occurred.</p> <p>No information about the controls used for SPT, how these were identified for use as controls or how these individuals compared to the 3</p> |

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| | | through their work in infested forest. | <p>palpebral angioedema, pruritus, bilateral ocular reddening. One episode of anaphylaxis when working in the forest: generalised urticaria, facial angioedema, nausea, clouded vision. Treatments in A&E with systemic cortico-steroids and antihistamines.</p> <p>All displayed immediate hypersensitivity: Symptoms with rapid (minutes) onset following exposure (commencing work / entering the forest).</p> <p>SPT: 3/3 +ve test with the size of the rash increasing in correlation with the severity of symptoms experienced previously (Case 1: 10x7mm; Case 2 20x10mm; Case 3 12x12mm. Only 1/30 controls tested positive (4x4mm)</p> <p>Immunoblotting: Various bands detected 8-35 kDa in Cases 1-3. No band detected in 2/2 controls.</p> <p>Authors conclude that the allergy tests indicate an IgE mediated mechanism.</p> | | <p>Cases (e.g., age, atopic or not).</p> <p>No information about the control serum (x2) used for immunoblotting.</p> |
| Vega et al., 1999. (43) | Allergy to the pine processionary caterpillar (<i>Thaumetopoea pityocampa</i>). | <p>PPM, experimental: 55 individuals with previous history of exposure were tested for an IgE mediated response using SPT to whole caterpillar extract and immunoblotting.</p> <p>Individuals were selected on the basis of having experienced cutaneous, ocular or respiratory symptoms</p> | <p><u>SPT results (+ve SPT = diameter >3mm):</u> 58% (32/55) tested SPT +ve; 60% (19/32) of those who tested +ve reported previous exposure (i.e. were potentially sensitised); 1/30 controls tested +ve.</p> <p><u>Duration of cutaneous lesions:</u> 26hrs in SPT +ve patients v's 78hrs in SPT -ve patients; (p<0.005).</p> <p><u>Generalised eruption:</u> 47% (15/32) of SPT +ve patients v's 17% (4/23) of SPT -ve patients; p<0.05.</p> <p><u>Dyspnoea:</u> 13% (4/32) of SPT +ve patients v's 4% (1/23) of SPT -ve patients; p = not stat sign. Dyspnoea reported by those who</p> | <p>Include significance tests for the difference between individuals with +ve/-ve SPT.</p> <p>Include control subjects and control SPTs.</p> <p>Use more up to date immunoblotting technique than the older papers.</p> <p>Include useful detail about the life cycle of PPM.</p> | <p>PPM, not OPM.</p> <p>Limited demographic information about the overall study group (n=55) provided, e.g. age, gender.</p> <p>Symptoms and exposures were self-reported and do not appear to have been validated by a clinical examination; however, differential reporting between SPT +ve and SPT -ve individuals is unlikely unless these individuals were advised of their SPT result before completing the clinical survey.</p> |

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| | | <p>that presented within 24hrs of working or walking in a pine wood. The study was conducted in an area with extensive defoliation due to PPM, so they assume high density of insects.</p> <p>28 individuals agreed to provide a serum sample for immunoblotting with ELISA to detect specific IgE using crude Whole PPM extract. 30 controls were used (15 atopic, 15 not atopic).</p> | <p>experienced an anaphylaxis. <u>Oedema</u>: 50% (16/32) of SPT +ve v's 17% (4/23) of SPT-ve patients. <u>Anaphylactic reaction</u>: 13% (4/32) in SPT +ve v's 0% (0/23) in SPT -ve patients; p = not stat sign. 2/4 who reported an anaphylactic response reported that they only experienced these symptoms with exercise.</p> <p><u>Atopy</u>: 47% (15/32) of SPT +ve patients were atopic; 27% (6/23) of SPT -ve patients were atopic; not stat. sign. <u>Latency of response</u>: 36mins in SPT +ve patients v's 232mins in SPT -ve individuals (p<0.0001). <u>Immunoblotting +ve result</u>: 72% (13/18) in SPT +ve v's 0% (0/10) in SPT-ve patients; p <0.001.</p> <p><u>Sub-analyses</u>: Among SPT +ve patients, more severe symptoms (conjunctivitis, dyspnoea, and anaphylaxis) appear to be more common among occupationally exposed individuals; however, the numbers are small and it was not possible to detect a statistically significant difference.</p> <p>Occupationally exposed workers with SPT +ve were statistically more likely than non-occupationally exposed SPT +ve individuals to experience symptoms Oct-Dec i.e. outside the period during which the larvae are present. This suggests that exposure to setae via empty nests and environmental contamination may be sufficient to trigger a reaction (note: this question was only asked of SPT +ve individuals).</p> <p>Occupationally and non-occupationally</p> | | <p>Anaphylaxis episodes are not well described or explored, no clinical detail or history is provided for the 4 individuals who reported anaphylaxis. It may be that the episodes were self-reported.</p> <p>Half of those who reported anaphylaxis reactions reported only experiencing these symptoms when exercising; possible mechanisms or reasons for this association are not explored. It may be that individuals who are exercising inhale a greater volume of setae and thus have a more severe inflammatory response in the mucous membranes.</p> <p>Occupational and non-occupational exposures are not well defined or described.</p> <p>Immunoblotting was done using whole setae (i.e. reactions may be due to another component in the hair, e.g. chitin).</p> |
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| | | | <p>exposed individuals who were SPT +ve all reported itching and urticarial dermatitis.</p> <p>1 of the occupationally exposed individuals who tested SPT –ve reported dyspnoea: this may have been due to bronchial exposure (mechanical irritation).</p> <p><u>Immunoblotting results:</u> Results were inconsistent and weak, multiple proteins detected. 72% of the SPT +ve individuals had some specific IgE, but there was variation in the patterns between patients (the authors state that this also occurs with other allergens). They suggest that an IgE-dependent response as well as an IgE-independent response may be possible.</p> <p><u>Misc information</u> The authors provide some detail regarding the occupational exposures to PPM in Spain. Valladolid province has large tracts of <i>Pinus pinea</i> & is a major region for Spanish pine nut production. About 500 workers are employed. This figure is not referenced but other resources indicate that there is also a significant informal pine harvesting industry in Spain. Collectors often knock PPM nests when they're collecting pine cones with a stick.</p> | | |
| Vega et al., 2003.(44) | Skin reactions to pine processionary caterpillar. | PPM, experimental: 5 children (2-9 yrs) who had been diagnosed with cutaneous lesions due to exposure to/ contact with PPM were given SPTs, 10 control children were given | 1/5 had a positive SPT and was diagnosed with IgE-mediated urticaria according to a recognised standard. | SPT was used to test for an IgE reaction. | <p>PPM, not OPM.</p> <p>Nature of previous exposure/contact (i.e. sensitisation) to PPM not described.</p> <p>Very small number of cases.</p> |

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| | | SPTs (controls = children not previously exposed to PPM). | | | |
| Vega et al., 2003. (45) | Cutaneous reactions to pine processionary caterpillar (<i>Thaumetopoea pityocampa</i>) in paediatric population. | <p>PPM, Spain: Survey of a paediatric school population in a region with large zones of pine trees.</p> <p>Questionnaire delivered to 1,101 children. Those who reported having experienced cutaneous reactions were invited for a follow up SPT.</p> | <p>Estimated total population of children 3-17yrs in the area = 1,303 (it is not clear whether this was an attempt to survey all children in this age range in the region i.e. sampling frame not clear). Response rate = 59% (653/1,101).</p> <p>Males = 45% (297/653); Females = 55% (356/653).</p> <p>9.2% (60/653) reported that they previously experienced a cutaneous reaction.</p> <p>Of those who reported cutaneous symptoms (n=60): Contact urticaria (65%, 39/60) was most commonly reported, followed by contact dermatitis (35%, 21/60). 55% (33/60) reported papular or whealing lesions of <24hr duration, 30% (18/60) reported lesions lasting >24hrs, & 15% (9/60) were not able to specify the duration. Site of lesions: extremities (72%, 43/60), trunk (35%), neck (13%, 8/60), head (12%, 7/60).</p> <p>52% (32/60) had +SPT to common aeroallergens, 22% (13/60) had +SPT to caterpillar extract. 33% (4/12) of +SPT had +ve immunoblotting result (it was not possible to get serum from 1 patient). 75% (3/4) of patients with +SPT and +ve immunoblotting were also +ve SPT to common allergens.</p> <p>The authors conclude that children's responses differ to adults; less severe</p> | <p>Rare investigation of effects on children following exposure to PPM.</p> <p>The authors recognise the limitations of the SPT and poor correlation between +ve SPT and +ve immunoblotting result.</p> <p>Reasonably good review paper of PPM generally - provides information about the lifecycle, possible reasons for PPM as an increasing hazard, includes useful photos of setae and human rash.</p> | <p>PPM, not OPM.</p> <p>Study population not clearly defined or described; it is not possible to establish whether the sample was representative or not.</p> <p>Method for distributing questionnaire is not described (postal or telephone?).</p> <p>Criteria used to select whether a child responded themselves or through a proxy is not stated but seems to have been a mix; the quality of the response may have been affected by the use of proxy respondents and also potentially by not using proxy respondents in younger individuals.</p> <p>The retrospective self-reporting of symptoms with individuals aware of the purpose of the study may have resulted in an overestimate of the health effects.</p> <p>There are very specific criteria for regarding a reaction as a contact urticaria; for a retrospective questionnaire, there may have been significant misclassification.</p> <p>They do not state the period covered by the questionnaire – 'ever' experienced symptoms or experienced symptoms in the</p> |

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| | | | <p>symptoms (no case reports of anaphylaxis), involvement of the extremities, probably as they come into contact with setae through play. Hypersensitivity appears to be less common (6.8% in children v's >50% in adults).</p> | | <p>previous PPM season? Therefore, the reported 'prevalence' seems to be a period prevalence but without the period in question being clearly stated.</p> <p>Of the original 60 individuals who had SPT done, only 4/12 with +SPT had +ve immunoblotting; the authors extrapolate this to indicate that 4/59 (6.8%) of the total sample had an IgE mediated reaction – a more accurate reflection would be that (4/12) 33% of those with +SPT also had +ve immunoblotting as we don't know how many in the larger group would have tested –ve to SPT and then +ve with immunoblotting.</p> <p>The study methods are not clearly described.</p> |
| Vega et al., 2004.(46) | Occupational immunological contact urticaria from pine processionary caterpillar: experience in 30 cases. | <p>PPM, experimental: SPT and immunoblotting were conducted on 30 individuals from the Valladolid region of Spain who were identified as having occupational immunological urticaria related to exposure to PPM.</p> <p>Results were analysed to identify occupational risk factors for occupational urticaria.</p> | <p>All male, mean age 37.3yrs. 90% (27/30) usually resided in rural area. 12/30 (40%) had history of atopy.</p> <p>Groups at risk were characterised by occupation: pine cone collectors/woodcutters (14), farmers /stockbreeders (8), other forestry personnel (4), construction workers (2), residential gardeners (1) and entomologists (1).</p> <p>Reported symptoms (retrospective): angioedema (facial\palpebral\genital), 60% (18/30); papular lesions lasting several days, 10% (3/30); conjunctivitis, 33% (10/30); rhinitis, 20% (6/30).</p> <p>40% (12/30) reported anaphylaxis reactions with cutaneous involvement and at least</p> | The only study that assesses groups at risk for exposure to PPM. | <p>PPM, not OPM.</p> <p>Selected small sample of high risk individuals; not possible to deduce which occupational groups are most at risk more generally.</p> <p>All male study group.</p> <p>No additional epidemiological data but some useful information on occupationally exposed individuals.</p> <p>Results of the immunoblotting were not consistent, difficult to deduce a pattern; of particular interest are the 3 cases of serious anaphylaxis with the bands outside of those identified as thaumetopoein but this is not</p> |

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| | | | <p>one other symptoms: rhinitis (50%, 6/12); conjunctivitis (83%, 10/12); dyspnoea (12%, 3/12); or hypotension (8%, 1/12).</p> <p>58% (7/12) who reported anaphylaxis worked as pine collectors/wood cutters, 42% (5/12) were farmers/stockbreeders – possibly due to heavier exposure experienced in these occupations.</p> <p>Immunoblotting: Most frequently detected bands: 15kDa (70%, 21/30), 17kDa (57%, 17/30), 12kDa (50%, 15/30). 40% (12/30) of the sera detected other bands < 12kDa; 27% (8/30) detected bands >33kDa – these bands were present in the 3 most serious cases of anaphylaxis.</p> <p>3 of the workers had changed their occupation in order to avoid further exposure.</p> | | explored further by the authors. |
| Vega et al., 2011.(47) | Skin reactions on exposure to the Pine Processionary caterpillar (<i>Thaumetopeo a pityocampa</i>). | PPM, Spain: Review of life cycle and epidemiology of PPM in Spain. | <p>The authors state that clinical practice and formal literature are likely to underestimate the impact of PPM as most people experience mild and transient symptoms, and will self-treat. More serious reactions may occur and not be correctly attributed to PPM.</p> <p>Evidence indicates that epidemics can & do occur in heavily infested areas; PPM may remain in chrysalis for several years with multiple generations emerging together.</p> <p>The authors explore possible mechanisms for the health effects associated with exposure: <u>Pathogenic mechanisms:</u> <i>Toxic mechanism:</i> Penetration of skin leads</p> | <p>The most comprehensive review paper for the health effects associated with exposure to PPM.</p> <p>Summary of the epidemiological data.</p> <p>Good summary of the evidence around possible pathogenic mechanisms.</p> <p>Useful photos of setae, microscopic skin reactions, different rashes and angioedema.</p> | <p>PPM, not OPM.</p> <p>*The references used to support the statement on anaphylaxis are multiple references to the case report published by the same authors (41) & another paper by the same authors (46) which states that 40% of exposed workers experienced anaphylaxis but provides no clinical detail for these cases. Another reference (37) (also summarised in this grid) is a single case report with suspected anaphylaxis following repeat exposure, limited clinical information is provided & no information about the level/type of exposure.</p> |

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| | | <p>to basophil degranulation and subsequent histamine release. IgE-independent degranulation has been associated with thaumetopoein (as described by Lamy et al. (14)). However, the slow the onset demonstrated in other studies (e.g., Fagrell et al. (48)) suggests that fast mediators such as histamine are not always involved. Additionally, denaturing the protein (heat &/or chemical) doesn't remove their inflammatory action, suggesting that the mechanism is not a toxic one.</p> <p><u>Allergen mediated mechanism:</u> <i>SPTs:</i> many studies have demonstrated +ve SPTs to whole larva extract and while SPTs have high sensitivity but poor specificity the authors suggest that SPTs could be useful in assessing sensitivity. <i>Immunoblotting:</i> IgE antibodies have been identified against crude larval extract (42, 45, 46) and against purified thaumetopoein (34). <i>Role of chitin/chitinases:</i> the variability in reactions to exposure may be explained by phylogenic variations in chitinase, which is a promotion and regulation of immune reactions (3).</p> <p>The authors conclude that mechanical irritation of the skin is responsible for skin complaints in all individuals but for a sub-group of exposed individuals, a more severe IgE-mediated allergic reaction may be involved (i.e. where the reaction is more severe and has a faster onset).</p> <p><u>Pathology & Clinical manifestations</u> <i>Skin:</i> Most common complaint, typically on exposed areas but may be on covered areas. Reactions are non-specific and several are involved – contact urticaria and</p> | | <p>This paper contains little additional information to the other papers published by the same group of authors. The publication of multiple papers containing the same basic information may give the impression of a stronger evidence base than exists in reality.</p> <p>Much of the clinical detail and treatment advice provided is not referenced; however, the authors have published extensively on the subject so it is possible that these observations are their own from their clinical practice in a region with significant infestation of PPM.</p> |
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| | | | <p>dermatitis (papular, vesicular and pustular). Pruritic papular dermatitis is the most common presentation, contact urticaria which is generally more localised may also be present. Urticaria – presents as itchy bumps lasting minutes-hours, often in association with angioedema esp on the eyelids. Lesions sometimes show infiltration and last for several days. Papular dermatitis – popular erythematous rash, severe pruritus, lesions from scratching, eczematous areas; usually appear within hours of contact and last for several days. Papularvescicular lesions also reported; vesiculopustular presentation is more common in children. Children more affected on palms and interdigitally. Non-specific inflammatory reaction is observed in epidermal oedema and perivascular lymphohistocytic infiltrate with eosinophils (as seen in other bites and stings). Physical activity and scratching may increase irritation.</p> <p><i>Ocular:</i> conjunctivitis, aggravated by itching and increases penetration of setae. Cases of keratitis and ophthalmia nodosa also reported (less frequently).</p> <p><i>Respiratory:</i> less common, mainly dyspnoea. Anaphylaxis with systemic involvement reported in a small number of case reports (*see comment in 'Weaknesses' column)</p> <p><u>Sensitised/allergic individuals (i.e. +ve SPT):</u> Immediate onset, experience symptoms following limited exposure, symptoms are shorter lasting but increasingly more intense. Presentation: urticaria (with angioedema in ~50%). Lesions appear with 1st hour, and can become generalised. Respiratory symptoms are more common (this statement is not referenced).</p> | | |
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| | | | <p><u>Diagnosis:</u> History of contact with PPM, itchy bumps with/without angioedema, very pruritic. Identification of hairs on skin using microscope, exclusion of differential diagnoses, +ve SPT and/or immunoblotting for caterpillar extract.</p> <p><u>Prevention advice:</u> Avoid walking through infested forests during processionary phase of lifecycle, especially on windy days. Keep children away. Don't touch/disturb caterpillar or their nests. Don't collect objects from infested forest land (e.g. pine cones). Don't leave washing out to dry during late larval stages. Occupational – use PPE, including goggles/mask. Allergic individuals should not work in infested forest.</p> <p><u>Treatment advice:</u> Oral antihistamines to control pruritus, contact urticarial and angioedema. Topical steroids for eczema lesions and papular dermatitis. Oral corticosteroids for extensive/refractory lesions. Avoid scratching. Anaphylaxis – immediate treatment with epinephrine, corticosteroids and antihistamines.</p> | | |
| Vega et al., 2011.(49) | Prevalence of cutaneous reactions to the pine processionary moth (<i>Thaumetopoea pityocampa</i>) in an adult population. | PPM, Spain: Telephone survey of residents in an area of Spain where PPM is endemic. A random sample (from the phone directory) was stratified by urban/semi-urban/rural area, 3 age groups, | <p>Response rate = 24% (1,224/4904).</p> <p>Point prevalence* reported as 10.5% (125/1,224) overall: 12% for rural areas, 9.6% for semi-urban, 4.4% for urban areas.</p> <p>Risk factors with a statistically significant association with self-reported PPM reaction: Males (OR 1.84, 1.2-2.8); daily visits to</p> | <p>Attempt to measure prevalence of symptoms in an area with PPM.</p> <p>Respondents reporting symptoms potentially associated with PPM exposure invited for in-depth investigation in hospital.</p> | <p>Low response rate to initial survey.</p> <p>Self-reported symptoms & respondents were told the purpose of the survey which is likely to lead to information bias.</p> <p>Issues with attributing the reported symptoms with exposure to PPM; 'exposure' not clearly defined.</p> |

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| | | <p>and sex.</p> <p>The outcome of interest was cutaneous reactions to PPM exposure.</p> | <p>pinewood areas (OR 2.1, 1.4-3.2); Occupational exposure (OR 5.04, 2.8-10.2); & pine collectors (OR 7.75, 2.9-20.8).</p> <p>Atopic disease was not associated with self-reported reaction (OR 1.29, 0.7-2.3).</p> <p>Of those who reported having experienced symptoms (n=125), 38% (48/125) agreed to be clinically assessed at the hospital and for further questions to be asked. The most common symptoms reported were pruritus (100%, 48/48) & conjunctivitis (29.2%, 14/48). 19% (9/48) required treatment at A&E. 64.6% (31/48) had 'direct' contact with setae. 27% (13/48) reported symptoms occurring throughout the year and 96% (46/48) had symptoms in the months during which larval instars present.</p> <p>*More accurately described as a period prevalence as asked about 'ever symptoms'.</p> | <p>Includes a consideration of risk factors for reactions to PPM.</p> <p>Odds Ratios are calculated along with measures of uncertainty for these estimates (Confidence Intervals).</p> | <p>Information on how the telephone survey was conducted is not described.</p> <p>It is unclear how the authors have defined 'prevalence' – respondents asked about having 'ever' experienced symptoms but the authors then report that 83.3% report 'having had symptoms in the previous 5yrs'.</p> <p>Presence of existing atopic disease not detailed.</p> |
| Werno & Lamy, 1990.(50) | Animal atmospheric pollution: the urticating hairs of processionary caterpillar (<i>Thaumetopeo a pityocampa</i> Schiff.) | <p>PPM, experimental/France: Passive and active sampling methods were used to measure the concentration of PPM setae in a heavily infested area of Aquitaine and a control area in Bordeaux.</p> <p>Methods: For the fixed apparatus, measurements were taken beside undisturbed nests,</p> | <p>An S.A.S biological sampler was used. A 1m³ column of air was taken in and particles collected on a Vaseline coated petri dish.</p> <p>Number of hairs collected: 30cm away from disturbed nest = ~10,000 hairs; beneath pine tree with caterpillars outside the nest at 1.2m above ground =45; beneath trees with caterpillars inside nests=12; and 5 at another site.</p> <p>They used an Andersen apparatus to simulate human breathing with 300l of air taken in beside the disturbed nest. The number of setae in each layer was counted: 2600 in the top layer, 146 in 2nd layer, 26 in 3rd layer (corresponds to an aerodynamic</p> | <p>Provides new insights into the dispersion and ambient density of setae.</p> <p>Lowest observed density of hairs was with undisturbed nests when the caterpillars were inside. If this can be assumed to be true for OPM also, as it is a nocturnal feeder the density of hairs should be lowest during the day i.e., at the time when human exposure is most likely to occur.</p> <p>The authors use sampling in</p> | <p>PPM, not OPM.</p> <p>PPM caterpillars have a higher density of setae than OPM so the absolute counts may not be directly comparable.</p> <p>Do not state how close they are to the disturbed nest during the Andersen simulator tests or the Durham apparatus tests.</p> <p>Most of the sampling was done beside disturbed nests – this provides some information about likely exposures to individuals who may be removing nests, or</p> |

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| | | <p>beside caterpillars outside of their nest (i.e. feeding) and beside opened (i.e. disturbed) nests.</p> | <p>diameter of 3.3-4.7µm). The authors conclude that the setae move on their axis in a flux of air and thus may be able to penetrate the trachea and primary bronchi.</p> <p>They used a gravimetric sampler (Durham apparatus) with a surface trap of a glass slide covered in silicon paste. The slide was removed weekly over a period of 4 months. Two peaks were observed, a pattern that seemed to recur in the different sampling locations. They used a volumetric sampler (Hirst-Burkard) with 10l air/minute to simulate human respiration rate. Particles were deposited on a drum with adhesive paper which rotated slowly (1 full rotation/week). Low counts of setae (max count of 29) with two peaks observed.</p> <p>The highest airborne concentrations occurred during the later stages (L5) in the lifecycle. The number of setae captured depended on the distance from the source and the local meteorological conditions (highest concentrations during anticyclonic weather conditions).</p> | <p>Bordeaux as evidence that there is long-range dispersion of the setae (presumably assuming this area to be free itself from PPM). However, Bordeaux is within the same region, with infested areas to the Southwest and Southeast so it is possible that Bordeaux was also colonised by PPM.</p> | <p>accidentally disturb them, but less for individuals who are using the forests recreationally.</p> <p>The authors state that the areas in which sampling took place had different degrees of infestation but do not provide any further information on nest density or the number of trees infested.</p> <p>Both the Durham & Hirst-Burkard apparatus qualitatively produced two peaks; the authors do not provide any suggestions as to why this might be.</p> |
| <p>Werno et al., 1993. (51)</p> | <p>Caterpillar hairs as allergens. Letter to the Editor.</p> | <p>Misc spp. Letter to the editor summarising their two recent papers. These detailed the isolation of thaumetopoein from setae of PPM, identification of specific IgE antibodies against PPM thaumetopoein in the sera of 4/21 pine forest workers, and similar results for extract from</p> | <p>OPM and PPM were assayed using ELISA; 19% (4/21) of pine forest worker subjects had antibodies that bound to purified thaumetopoein.</p> <p>3/4 of the positive samples had significant levels of IgE directed against the protein: in these 3 samples, the reactive bands were located at 18,000 kDa with another strong band at 45,000 kDa. In the 1/4 sample without IgE antibodies the strongest reaction was in the heavier band, 45,000 KDa.</p> | <p>Good summary of the work of Werno and Lamy, who have contributed a considerable proportion of our understanding of the health aspects related to processionary species.</p> | <p>Editor's letter only, no new evidence & no new epidemiological information.</p> |

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| | | OPM hairs. | The authors conclude that the setae from processionary moths should be considered important airborne allergens. | | |
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Abbreviations

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| CON | Chronic ophthalmia nodosa |
| IM | Intramuscular |
| LD | Laser Doppler |
| Misc | Miscellaneous |
| Mol wt | Molecular weight |
| PPE | Personal protective equipment |
| SD | Standard deviation |
| SOB | Shortness of breath |
| SPT | Skin prick test |
| Stat. sign. | Statistically significant |
| VA | Visual acuity |

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