Agents	Strength of		Reference	Level of	Occupa-	Allergic							EVIDEN	CE (patho	logical result	ts)								Remarks
	evidence per agent (three star system	of allergic asthma		evidence per study (revised	tionally exposed subjects	asthma cases due to mentioned		۷	VORK-RELATE	D SYMPTO	MS			LFT	NSB	HR	sPFT		SIC		SPT	Spe	c. IgE	-
	of RCGP)	cases per		SIGN grading system);		agent, n, prevalence (%).	Asthma	Rhinitis	Conjunct.	Cough	Skin	Tot	al						Reactio	n				
		agent, n		study type.		Cases with probable allergic asthma but specific sensitization not confirmed in parantheses [] or not indicated.	n/n Ast %	n/n Rhin %	n/n Conj %	n/n Cou 🤋	n/n % <mark>Skin</mark> %	n/n Tot	%	n/n LFT 9	n/n % NSBHR	%	n/n PFT %	n/n SIC	; % i (n) l (n) d	l (n) n/n SF	•т %	n/n lgE	%	
High-molecular-weight compounds																								
NIMALS (ANIMALIA)																								
JOINT-LEGS (ARTHROPODA)																								
ARACHNIDS (ARACHNIDA)																								
Mites (Acarina)																								
redatory mites (Phytoseiidae)	*[*]	35	Groenewoud, Veld et al., 2002	2-; cross- sectional	472	28 (5.9)	28/109* 25.	7 78/109* 71.	6 53/109 48.6	nd	14/109 12 *	8 83/109*	76.1	nd	nd		nd	nd		109/47	72 23.1	63/109	57.8	Greenhouse employees in bell pepper horticulture, exposed and co-sensitized to both sweet bell peppe pollen and/or plant (80/109 SPT) and Tyrophagus putrescentize (62/472 SPT+). and Tyrophagus subjects only, nasal Ch in 23 sensitized employees: those with VR thinis had sign. More frequently responses than employees without WR rhinitis, indiv results not isted
edatory mites (<i>Phytoseiulus persimilis</i> d Hypoaspis miles)	-		Kronqvist, Johansson et al., 2005	2-; cross- sectional	96	6 (6.3)	13/96 13.	5 32/96 33.	3 32/96 33.3	nd	nd	36/96	37.5	13/91* 14	4.3 nd		nd	nd		nd		17/96	17.7	Greenhouse workers. 'FEV1 <80% pred., none of asthmatics was LFT+; 23/96 IgE+ to <i>T. urticaria</i> , 1 IgE+ to <i>D. pteronyssinus</i> and/or <i>D. farinae</i> ; 6/13 asthmatics IgE+ to at least one predatory mite
edatory mites (Phytoseiulus persimilis d Hypoaspis miles)			Johansson, Kolmodin- Hedman et al., 2003	3+; cross- sectional	31	.*	nd	nd	nd	nd	nd	nd		nd	nd		nd	nd		nd		16/31**	51.6	Greenhouse workers employed at 9 randomly sele greenouses. "Only IgE sensitization is described. 1 SPT+ with Hypoaspis miles, 10/31 SPT+ with P. persimilis and 8/31 SPT+ with T. urticae; **SPT+ t least one of the 3 mites tested
irps mite (Amblyseius cucumeris and nblyseius cucumeris)			Skousgaard , Thisling et al., 2010	3,case report	1	1	1/1	1/1	1/1	1/1	nd	nd		1/1				1/1	1	1/1*		nd		Gardener,*SPT+ for A.cucumeris but not for A. californicus
ider mites (Tetranychidae)	*[*]	174																						
wo-spotted spider mite or red spider mite Tetranychus urticae)			Astarita, Gargano et al., 2001	2-; cross- sectional	960	28 (2.9)	23/960 2.4	32/960 3.1	nd	nd	11/960 1.	1 46/960	4.8	nd	nd		31/47* 66	6 nd		58/96	6.0	nd		Greenhouse and open-field farmers. *Serial PEFR i symptomatics and SPT+: 28/31 PFT+ were sensitiz SIC+ and SPT+ with tomato, SIC+ and SPT+ with cellery, 4 SIC+ and SPT+ with tobacco; sign. more symptomatics and SPT+ to <i>Luridcariae</i> among the greenhouse workers as farmers working in open fie
vo-spotled spider mite (Tetranychus ticae)			Navarro, Delgado et al., 2000	2-; cross- sectional	246	[17]	17/246 6.9	9 43/246 17.	5 43/246 17.5	nd	12/246 4.	9 69/246	28.0	nd	nd		nd	nd		61/24	1 25.3	3 29/110	26.4	Greenhouse workers. Sign. correlation between tim exposure and frequency of sensitized symptomatic: (n=46); spezific sensitization sign. increased among exposed. "Sensitized atshmatics not listed, 26% of workers were asymptomatic.
io-spotted spider mite (<i>Tetranychus</i> icae)			Jeebhay, Baatjies et al., 2007	2-; cross- sectional	207	11 (5.3)	54/207* 26.	1 49/207 23.	7 49/207 23.7	nd	30/207 14	.5 nd		nd	nd		nd	nd		42/19	90 22.1	32/201	15.9	Table grape farm workers. "WR wheeze; 19/207 h physician diagnosed asthma; 11/54 with WR whee were SPT+, 10/54 lgE+; 40/201 lgE+ to <i>D.</i> pteronyssinus, 26/201 lgE+ to <i>L. destructor;</i>
ider mites Panonychus ulmi			Kim, Lee et al., 1999	3+; survey	725	49 (6.8) 48	119/725 16.	4 129/725 17.	8 nd	nd	nd	nd		nd	nd		nd	nd		108/46	65 23.2	2		Apple-cultivating farmers. *SPT+ with at least one s mite; sign. increased prevalence of asthma among subjects; 37/118 SPT+ were asthmatics; 49/119
Tetranychus urticae Tyrophagus putrescentiae	-					32 25		+ $-$		\vdash	+		_ T							77/46	5 16.6	6		asthmatics were SPT+ to at least on spider mite
trus red mite (Panonychus citri)			Kim, Son et al., 1999	3+; cross- sectional	181	11 (6.1)		3 83/181 45.		nd	nd	nd		nd	22/55**	12.2	nd	nd		30/18		45/123		Citrus farmers. *Not clear whether WR; **NSBHR c in asthmatic subjects only, 12/22 NSBHR+ were [gf and SPT+; 11 NSBHR+ subjects had WR asthma a SPT+
trus red mite (Panonychus citri)			Park, Kim et al., 2000	3+; cross- sectional	136	11 (8.1)	45/136 33.	1 64/136 47.	1 nd	nd	nd	nd		nd	+*		nd	nd		+**		54/136	39.7	Citrus farmers. *NSBHR done in asthmatics only, 1 asthmatics were both NSBHR+ and IgE+; **all 11 C sensitive asthma cases and 25 CRM sensitive rhinti cases were SPT+

Agents	Strength of evidence per	Total no. of	Reference	Level of evidence per	Occupa- tionally	Allergic asthma cases										E\	/IDENC	CE (path	ological res	sults)									Remarks
	agent (three	allergic		study	exposed	due to mentioned				wo	ORK-RELATE	D SYMP	TOMS					LFT	NS	BHR	sPF	FT	SI	с	S	SPT	Spec	ic. IgE	
	star system of RCGP)	asthma cases		(revised SIGN grading	subjects studied,	agent, n,	Asthr	ma .	Phir	itie	Conjunct.	Cou	ab	Skin		Total							1	Reaction					-
		per agent, n		system); study	n	prevalence (%). Cases with probable			, com		oonjunot.	000	g	Chain	-	rotai								Houddion					
				type.		allergic asthma but specific sensitization																							
						not confirmed in parantheses [] or																							
						not indicated.	n/n Ast	%	n/n Rhin	%	n/n Conj %	n/n Cou		n/n Skin	% n/n T	Tot		n/n LFT	n/n % NSBH		n/n PFT	% n/n SIC	%	i (n) l (n) d (n)	n/n <mark>SPT</mark>	r %	n/n lgE	%	
Spider mites (Tetranychus urticae, Panonychus citri)			Burches, Pelaez et al., 1996	3+; case series	150	0	0/150		3/150	2.0	3/150 2.0	nd	2	150 1	1.3 5/15	50 3	3.3	nd	nd		nd	nd			54/150		54/54*		150 citrus farmers referred to an allergy unit. *All SPT+ subjects were IgE+; 48/54 sensitized were Conj. Ch+; all sensitized subjects were SPT+ to <i>D. pteronyssinus;</i> sign cross-reactivity between <i>Tetranychidae</i> and <i>D.</i> <i>pteronyssinus</i>
Tetranychus urticae	-		Astarita, Franzese et al., 1994	e 3+; case series	46	19 (41.3)	19/46	41.3	46/46	100	nd	19/49	41. 1 3	7/46 3	37 46/4	16 1	00	nd	nd		19/46*	41.3 nd			36/46	78.3	36/46	78.3	Farm workers: 30 field-workers, 16 greenhouse-workers. *PEFR+ were all sensitized
Red spider mite (Tetranychus urticae)	-		Delgado, Orta et al., 1997	3+; case series	24	14 (58.3)	15/24	62.5	14/24	58.3	nd	nd	5	/24 2	20.8 24/2	24 1	00	nd	12/13	* 92.3	nd	12/14*	85.7	6 6	16/24	66.7	16/24	66.7	Carnation greenhouse workers, all SPT- with carnation; *BHR and SIC done in 14/16 of sensitized asthmatics
Citrus red mite (Panonychus citri)	-		Kim, Son et al., 1999	3+; case series	16	16 (100)	16/16		15/16		nd	nd		nd	16/1	16	1	9/16	7/7*		nd	1/1		1	16/16		16/16		Farmers cultivating citrus fruit. *BHR done in all subjects with normal LFT
Citrus red mite (Panonychus citri)	-		Ashida, Ide at al., 1995 ABSTRACT	3+; case series	12	.*	-		-		-	•		-	-			-			-	-			10/12		7/12		Symptomatic fruitgrowers. *Immediate allergic symptoms not given in more detail
Red spider mite (Panonychus ulmi)	-		Kroidl, Maasch et al., 1992	3+; case series	6	6 (100)	6/6	100	6/6	100	6/6 100	nd		6/6 1	100 6/6	6 1	00	nd	nd		nd	4/4	100	4	6/6	100	3/6	50	Fruit tree workers
MacDaniel spider mite (Tetranychus macdanieli)	-		Carbonnelle, Lavaud et al., 1986	3+; case series	7	4 (57.1)	4/7	57.1	4/7	57.1	nd	nd		nd	7/7	7 1	00	nd	nd		nd	nd			7/7	100	nd		Vine growers
European red mite (Panonychus ulmi)	-		Michel, Guin et al., 1977	3+; case series	5	2 (40)	2/5	40	4/5	80	4/5 80	2/5	40 3	3/5 (60 5/5	5 1	00	nd	nd		nd	nd			5/5*	100	nd		Apple growers. *IC
Red spider mite (Tetranychus urticae)			Delgado, Gómez et al., 1994	3; case report	t 1	1	1/1		1/1		1/1	1/1		nd	1/1	1		nd	0/1		nd	1/1		1	1/1	-	1/1	-	Carnation nursery worker
Tetranychus urticae			Cisteró-Bahima, Enrique et al., 2000	3; case report	t 1	1	1/1		nd		nd	1/1		nd	1/1	1		0/1	1/1		1/1	nd			1/1		1/1		Flower cultivator with simultaneous OA to carnation
Panonychus ulmi	-		Erlam, Johnson et al., 1996 ABSTRACT	t 3; case report	: 1	1	1/1		-		-	-		-	-				-		-	-			1/1		1/1		Tomato growing greenhouse worker
Storage mites (Acaridae, Glycyphagidae	²⁾ **	130																									+	-	
Storage mites	-		Kronqvist,	2+; 12 cohort	1015	.•		9.8*		33.1*	33.1	•	nd	1	nd	4	1.7*	nd	nd		nd	nd			nd	1	-	8.1*	*Estimated prevalence for the whole population of dairy
Acarus siro	-		Johansson et al., 1999	study											_													6.1*	farmers (n=1015) based on a random sample of 461 farmers tested; estimated prevalence of asthma and
Glycophagus domesticus	-																											3.8*	asthma in combination with RC for all dairy farmers on Gotland had increased sign. during the previous 12 years
Lepidoglyphus destructor Tyrophagus putrescentia	-																+											6.6* 6.2*	(5.3% vs 9.8%) and (3.7% vs 7.0%; 25% of asthmatics and 25% of subjects with asthma and RC were IgE+
Storage mites	-		Hage-Hamsten van, Johansson et	2-; cross- sectional	440	26 (5.9)	128/440*	29.1	288/440	65.5	288/44 65.5 0	5 128/44 0*	29.	nd	310/4	140 7	0.5	nd	nd	+	nd	nd	+		nd	+			A random sample of 440 farmers on Gotland of a total of 2578. *Asthma and/or cough; 26/128 asthmatics were
Ararus siro	_		al., 1985	ocouona								-			_											+	26/440		InF L to / doctructor (monourod by MIAR Allorgo
Glycophagus domesticus Lepidoglyphus destructor	-					26 (5.9)				-	+				—									+		+-	25/440) 7.3	the whole population of Gotland was 6.2% and allergy to
Tyrophagus putrescentia	-					20 (3.9)																				1	30/440	6.8	storage mites among symptomatic farmers was 15.4%
Storage mite L. destructor	_		Hage-Hamsten van, Johansson et al., 1987	2-; cross- sectional	440	[30]	128/440	29.1	288/440	65.5	288/44 65.5 0	5 118/44 0	26. 8	nd	310/4	140 7	0.5	nd	nd		nd	nd			nd		30/440		A random sample of farmers on Gotland of a total of 2578, same as the study above. IgE measured with Phramacia Diagnostics Phadebas® RAST
Storage mites	-		Cuthbert, Jeffrey	2-; cross-	290	27 (9.3)	36/290	12.4	72/290	24.8	53/290 18.3	8 nd		nd	87/2	90 :	30	nd	nd		nd	nd						17.4	Farm workers from 102 randomly selected farms: 162
Acarus farris Lepidoglyphus destructor	-		et al., 1984	sectional					_						—										69/290	23.8	+-		dairy farmers and 128 stock-raising farmers. 27/36 asthmatics were SPT+
Tyrophagus longior	1				157	01 (/)	40.11.21	0.5		1		I .						-							74/290	25.5			
Storage mites			Blainey, Topping et al., 1989	2-; cross- sectional	133	21 (15.8)	43/133	32.3	nd	1	nd	nd		nd	43/13	33 3	2.3 5	b/116 4	4.3 24/11	ь 20.7	nd	1/1*		1					Grain-store workers. *SIC with storage mite mix; **SPT+ and IgE+ with at least one storage mite; 21 asthmatics
Acarus siro Lepidoglyphus destructor	-									1		1															9/128	7	SPT+ and 15 asthmatics IgE+; sign. association between WRS and sensitization; 13/130 SPT+ with at least one
Glycophagus domesticus Tyrophagus putrescentiae	-																								12/130	9.2	12/128	3 9.4	grain
Acarus farris	<u> </u>		1							1		1													4/130	3.1	21/128 15/128	11.7	<u>†</u>

Agents	Strength of evidence per	Total no. of	Reference	Level of evidence per	Occupa- tionally	Allergic asthma cases										EVIDE			cal results									Remarks
	agent (three	allergic		study	exposed	due to				WOF	RK-RELATE	D SYMPTO	OMS				LF1	r	NSBH	R sPFT		SIC	;		SF	т	Spec	. IgE
	star system of RCGP)	asthma cases		(revised SIGN grading	subjects studied,	mentioned agent, n,	Asthr		Rhinit		0	0		Skin	Tota					-			Dee					
		per agent, n		system); study	n	prevalence (%). Cases with probable	Astnr	na	RNINI	15	Conjunct.	Cougn		SKIN	Tota	1							Rea	ction				
		agent, n		type.		allergic asthma but specific sensitization																						
						not confirmed in parantheses [] or																						
						not indicated.					n/n		n/				n/n		n/n	n/n								
							n/n Ast	% r	n/n <mark>Rhin</mark>	%	Conj %	n/n <mark>Cou</mark>	% Sk	kin %	n/n Tot	%	LFT	%		% PFT	% n/n <mark>SI</mark>	<mark>C</mark> %	i (n) I (n) d (n)	n/n <mark>SPT</mark>	%	n/n <mark>IgE</mark>	
Storage mites			Patussi, Mazzucato et al.,	3+; cross- sectional	149		-		-		-	-	-	-	-		-		-	-	-				·		•	Cattle farmers. *Sign. higher sensitization to storage m among cattle farmers
			1994 ABSTRACT	36600181																								among came farmers
torage mites Acarus siro	-		Revsbech and Andersen, 1987	3+; cross- sectional	139	6 (6.3)	35/139	25.2	43/139	30.9	nd	nd	n	nd	43/139*	30.9	13/139	9.4	nd	nd	nd	_			18/94 14/94	19.2 14.9	3/139	0.2 Grain elevator workers. *Respiratory symptoms excluding cough; 6 subjects with respiratory symptoms
Acarus siro Lepidoglyphus destructor	-		Andersen, 1307	36600181																					5/94	5.3		were SPT+ and LFT-
Tyrophagus putrescentiae			Disiasu Tenning	2	404	44 (40.0)	04/4.04	20.0	45/404	44.0	0/4.04	+	0/1	104	24/404	22.0			nd						14/94 30/99	14.9	40/05	24.2 Arable formunduese 44/20 CDT: and 40/49 InF :
torage mites Acarus farris	-		Blainey, Topping et al., 1988	3+; cross- sectional	101	11 (10.9)	21/101	20.0	15/101	14.9	0/101	+	0/1	101	24/101	23.0	na		na	nd	nd				24/99	24.2	C0/01	21.2 Arable farmworkers. 11/30 SPT+ and 10/18 IgE+ subjects were asthmatic; sign. association btw. asthm
Acarus siro																									25/99	25.3		symptoms and IgE+
Lepidoglyphus destructor Glycyphagus domesticus	-																					_			28/99 25/99	28.3 25.3		+
Tyrophagus putrescentiae																									22/99	22.2		
torage mites Acarus siro	-		Cuthbert, Brostoff et al., 1979	3+; cross- sectional	38	11 (29.0)	11/38*	29.0	12/38	31.6	nd	nd	n	nd	23/38	60.5	nd		nd	nd	nd	_			38/38** 24/38	100 63.2	4/38	A sample of 13 farmers and their 25 family members 10.5 wives, 18 kids, 1 father) from a farming community of
Lepidoglyphus destructor			6t al., 1979	36600181																					33/38	86.8		220; results of farmers not separately given; *6/11
Glycophagus domesticus Tyrophagus putrescentiae	-																					_			31/38 29/38	81.6	20/38	52.6 asthmatics had exacebated asthma; **SPT+ with at le 15.8 1 mite
D. pteronyssinus																									27/38	71.1	11/38	28.9
Storage mites: Acarus siro,			Koistinen, Ruoppi	3+; cross- sectional	12	[1 (8.3)]	1/12 *	8.3	11/12		12/12	10/12	83. no	nd	12/12		nd		nd	nd	nd				6/12*	50	0/12	0 The entire personnel of a moisture-damaged grocery store. *SPT+ with at least 1 storage mite, 6/12 SPT+ t
Lepidoglyphus destructor, Tyrophagus putrescentiae			et al., 2006	sectional									3															<i>T. putrescentiae</i> as most reactive; 4/6 SPT+ subject
																												were nasal Ch+; sensitized asthmatics not listed. *One
																												addititonal subject had prevoius asthma, not clear whether work-related
Storage mites (Blomia tijbodas, Blomia ropicalis, Blomia kulagini, G. domesticus,			Müsken, Franz et al., 2000	3+; case series	86	-*	•		•		-	-	-	-	86/86		-		-	-	-				51/86	59	31/86	36 *86 farmers with rhinitis and/or asthma
T. entomophagus, Euroglyphus maynei,			ABSTRACT	50105																								
A. siro, L. destructor, T. putrescentia, A.																												
farris, Cheyletus eruditus)																												
Lepidoglyphus destructor			Armentia, Tapias	3+; case	31*	13 (41.9)	26/31	83.8	10/31	32.2	6/31 19.3	5 nd	4/3	31 13	31/31	100	nd		nd	nd	13/31	** 41.9	11 2	2	18/31	58	10/31	32.2 *31 bakers, pastry factory workers, grain store worker
			et al., 1992	series																								and farmers with wheat flour allergy (SPT+, IgE+, SIC- and 12 subjects with non-occupational wheat flour
																												allergy. **SIC+ were all sensitized; all 12 non-
																												occupationally exposed were SIC-
Storage mites (Acarus siro,	-		Revsbech and	3+; case	23	[9 (39.1)]	12/23	52.2	15/23	65.2	nd	nd	n	nd	23/23	100	nd		nd	nd	nd				x*		9/23*	39.1 Bakers. *Individual results not listed, no difference in S
Lepidoglyphus destructor, Tyrophagus			Dueholm, 1990	series																								and IgE between exposed and controls; 10/23 IgE+ with
putrescentiae) Acarus siro	-																					_					8/23	flour; sensitized asthmatics not listed
Lepidoglyphus destuctor																											8/23	34.8
Tyrophagus putrescentiae Lepidoglyphus destructor		·	van Hage-	3+; case	12	12 (100)	12/12	100	0/12	0	0/12 0	0/12	0 0/1	12 0	12/12	100	nd		nd	nd	12/13	2 100	10	2	12/12	100	2/23	8.7 100 12 farmers with asthma and IgE+ to L. destructor
Lopidogiypindo doon dolor			Hamsten, Ihre et	series		12 (100)	12.12	.00	0/12	Ŭ	0,12	0/12	0 0/1	.2 0	.27.12					i iu	.2			~	12/12	100	12/12	underwent bronchial provocation study
			al., 1988																									
Storage mites (L. destructor, T.			lversen, Hallas et	3; case	4	-*	-		-		-	-	-	-	-		-		4/4**	-	4/4				-		-	Farmers with SIC+ to at least one storage mite. *Aller
outrescentiae)			al., 1992 ABSTRACT	resports																								symptoms not described in the abstract. **NSBHR do every second month during a year showed sign. chang
																												but no association with mite counts or time of year
Storage mites (Acarus siro, Blomia			Armentia,	3; case	3		-					-	_	_	-		-											3 cases of "occupational allergy" caused by manipulat
kulagini, Euroglyphus maynei,			Fernandez et al.,	reports	Ŭ																							of food: cheese, chorizo and salty ham. *Allergy not
Tyrophagus putrescentiae)			1994 ABSTRACT																									further described in the abstract. **SIC, SPT and RAS were postive
	-																											
epidoglyphus destructor			Warren, Holford- Strevens et al.,	3+; case report with	1	1	1/1		nd		nd	1/1	n	nd	1/1		1/1		nd	nd	1/1		1		1/1*		nd	Grain worker. *Also SPT+ with grain dust. 100 asthma attending hospital clinic unterwent SPT, 31/100 were
			1983	screening of																								grain exposed subjects. Grain exposed had sign. high
				asthmatics																								SPT+
epidoglyphus destructor				3; case report	t 1	1	1/1		1/1		nd	1/1	1/	/1	1/1		0/1		1/1	nd	1/1		1		1/1		1/1	Miller working mainly with barley. SPT-, IgE- and SIC-
			et al., 1999																									with barley. SPT- with all other mites and flours
Lepidoglyphus destructor			(Garces) Sotillos,	3; case report	t 1	1	1/1	ΙT	1/1	Γ	1/1	1/1	n	nd	1/1	T	0/1	T	nd	nd	1/1	7	1	' T	1/1*	T	1/1*	Grain worker. *SPT+ and IgE+ with Lepidoglyphus destructor. Acagus size. Turophagus putrescentiae
			Carmona et al., 1991																									destructor, Acarus siro, Tyrophagus putrescentiae
			Vieluf, Przybilla et	3. case report	1 1 T	1	1/1*	I E	1/1*	Г	1/1*	nd	1/1	/1*	1/1	T	nd	E F	1/1	nd	nd	1 1	1	1 T	1/1**	1 T	1/1**	Thatcher. *Work-exacerbated symptoms; **SPT+ and
Storage mites (Acarus siro, G.			al 1003	5, 6836 Tepon								1		1	1	1												InE+ with all mites tested
Storage mites (Acarus siro, G. domesticus, Lepidoglyphus destructor, Tyrophagus putrescentiae), house dust nites (D. pteronyssinus, D. farinae)			al., 1993	3, 0836 TEPOT		·																						IgE+ with all mites tested

Agents	Strength of	Total no.	Reference		Occupa-	Allergic										EVID	ENCE (p	atholog	gical resul	lts)										Remarks
	evidence per agent (three	of allergic asthma		evidence per study (revised	tionally exposed subjects	asthma cases due to mentioned				WC	ORK-RELAT	ED SYM	PTOMS				L	FT	NSB	HR	sPF1			SIC			SPT	Spe	c. IgE	1
	star system of RCGP)	astnma cases per agent, n		SIGN grading system); study	studied,	agent, n, prevalence (%). Cases with probable allergic asthma but	Asthn	na	Rhin	itis	Conjunct	Co	ıgh	Skin	То	tal	-							-	Reacti	on				-
				type.		specific sensitization not confirmed in parantheses [] or not indicated.	n/n Ast	%	n/n Rhin	%	n/n Conj %	n/n Co	. %	n/n <mark>Skin</mark> %	n/n Tot	%	n/n	%	n/n NSBHR	%	n/n PFT	e .		av i	(n) (n)	d (n) n/n <mark>S</mark>			,	
Poultry mites (Macronyssidae)	(*)	12																70	NODIK	70	PFI	70		70		a (1) n/n 3	PI %		70	-
Northern fowl mite (Ornithonyssus sylviarum)	(*)		Bar-Sela, Teichtahl et al., 1984	3+; case series	16	12 (75)	14/16	87.5	15/16	93.75	nd	nd		nd	16/16	100	10/14	71.4	nd		nd		1/1*		1	9/1	6 56.25	10/16	62.5	Symptomatic poultry workers. 13/16 SPT+ and 12/16 IgE+ (14/16 sensitized) with at least one poultry related allergen (Northern fow mite, poultry feed, chicken serum, droppings or feathers), 12/14 asthmatics were sensitized to Northern fowl mite; "SIC+ subject was sensitized to NFM
House dust mites	٢*٦	14																												
House dust mites (D.pteronyssinus, D. farinae) See Alternaria			Menzies, Comtois et al., 1997	2-, cross sectional	214																									Office workers exposed to fungal (see Alternaria) and house dust mite aeroallergens. Higher total dust mite concentration was significantly associated with respiratory symptoms. The population- attributable risk for work-related respiratory tract symptoms was 7.7% for house dust mites.
Dermatophagoides pteronyssinus			Rimac, Macan et		41	[2 (4.9)]	16/41	39.0	16/41	39.0	14/41 34	.1 nd		12/41 29	.3 nd		2/34**		nd		nd		nd			3/4	1* 7.3	nd		Poultry worker co-exposed to mould and mite allergens.
Dermatophagoides farinae Lepidoglyphus destructor			al., 2009	sectional																						1/4				* No significant difference between poultry worker and controls in LFT and SPT but significant higher prevalence of work-related symptoms which might be also due to co- exposures.
House dust mites			Brunetto,	3+, cross-	144	14* (10.94)	14/144	10.94	39/144	30.23	39 30.	23 nd		17/144 13	.2 51/144	39.53	3 nd		nd		nd		nd			nd		29/144	20.14	** before work week: 3 LFT+ after work-week 2 LFT+
INSECTS (INSECTA)			Brescianini et al., 2009	sectional										8																
Australia sheep blowfly (Lucilia cuprina)	-		Kaufman, Gandevia et al., 1989	3+; Cross- sectional	54	[6 (11.1)]*	6/54	11.1	13/54	24.1	11/54 20	.4 nd		9/54 16	.7 15/54	27.8	nd		nd		nd		nd			nd	1	19/52*	36.5	Workers in a sheep blowfly breeding programme. *10/14 symptomatics IgE+; sensitized asthmatics not listed
8			Kaufman, Baldo et al., 1986	3; case report	1	1	1/1		1/1		1/1	nd		1/1	1/1		0/1		1/1		nd		nd			1/1	1	1/1		Entomological research laboratory worker
Bee moth larvae (<i>Galleria mellonella</i>), wax worm, wax moth	-	1	Stevenson and Mathews, 1967	3; case report	1	1	1/1		1/1		nd	nd		nd	1/1		0/1		nd		nd		1/1*		1	1/1		1/1***		Employee in a fishbait company. *SIC with wing extract; **scratch test with adult bee moth; HR+; ***PK+
Caddis fly (<i>Hydropsyche recurvata</i>), order Trichoptera	-	1	Kraut, Sloan et al., 1994	2-; Cross- sectional	28	1 (3.6)	14/28*	50	16/28	57.1	15/28 53	.6 9/28	32. 1	0/28	nd		x**		nd		1/20	5	nd			17/2	28 60.7	14/28	50	Workforce at a hydroelectric power plant. *14/28 WR wheeze. 3/28 with physician diagnosed asthma (not clear whether WR); **decreased FEV1 and FEV1/FVC in 18 highly exposed subjects; 1 PFT+ subject had SPT+
Champignon flies (Family: Phoridae and Sciaridae)	-	1	Cimarra, Martínez Cócera et al., 1999	- 3; case report	1	1	1/1		1/1		1/1	nd		nd	1/1		1/1		nd		1/1*		nd			1/1	1	1/1		Champignon cultivator. Clinical tests done with extract- mix of both flies (98% Phoridae and 2% Sciaridae); *PEFR at work and off-work for 15 days; 1/1 conj. Ch+
Cockroach (Blaberus giganteus)	-		Marraccini, Previdi et al., 2007 ABSTRACT	3; case report	1	1	1/1		-		-	-		-	-		-		-		1/1		-					•		Baker. *Sensitized to cockroach.
Cockroach (Blaberus giganteus)	-		Kanerva, Tarvainen et al., 1995	3; case report	1	1	1/1		1/1		1/1	nd		1/1	1/1		nd		nd		nd		nd			1/1	1	1/1		Animal attendant
American cockroach (<i>Periplaneta americana</i>) and German cockroach (<i>Blatella germanica</i>)			Steinberg, Bernstein et al., 1987	3+; case series	6	0	0/6		3/6		3/6	0/6		nd	3/6		nd		nd		nd		nd			4/6	3	2/4		Laboratory workers. All symptomatics were SPT+; 1/1 nasal Ch+
Common housefly (Musca domestica)	-	1	Focke, Hemmer et al., 2003	3; case report	1	1	1/1		1/1		1/1	nd		nd	1/1		nd		nd		nd		nd			1/1	1	1/1		Farmer
*			Tee, Gordon et al., 1985	3; case report	1	0	0/1		1/1		1/1	nd		nd	1/1		nd		nd		nd		nd			1/1	1	1/1		Scientific worker
Confused flour beetle (Tribolium confusum)	-		Alanko, Tuomi et al., 2000	3; case report	1	1	1/1		1/1		1/1	1/1		1/1	1/1		nd		nd		nd		1/1*		1	1/1	1	1/1		Employee in a rye crispbread factory. *SIC+ with <i>T.</i> confusum contaminated flour; IgE- and SPT- with flour and storage mites
Cricket (Acheta domestica)	-	4	Bagenstose, Mathews et al., 1980	3+; case reports with survey	13	2 (15)	2/13	15.4	2/13	15.4	1/2 7.	7 2/13	15. 4	nd	2/13	15.4	2/2		nd		nd		2/2		2	5/1	3 38.4	4/13	30.8	2 symptomatic amphibian facility workers and 11 asymtomatic co-workers. Both symptomatic were SPT+ and SIC+

Agents	Strength of	Total no.	Reference	Level of	Occupa-	Allergic asthma cases										EVIDEN	ICE (pathol	ogical results)									Remarks
	evidence per agent (three	of allergic asthma		evidence per study (revised	tionally exposed subjects	due to mentioned			W	VORK-RE	LATED	SYMPTO	OMS				LFT	NSBHR	sPFT		:	SIC		SI	PT	Spec	. IgE
	star system of RCGP)	cases		SIGN grading	studied,	agent, n,	Asthma	1	Rhinitis	Conj	unct.	Cough	SI	dn	Tot	tal		-		_		R	eaction				
		per agent, n		system); study	n	prevalence (%). Cases with probable allergic asthma but	e																				
				type.		specific sensitization not confirmed in	n																				
						parantheses [] or not indicated.				n/n			n/n				n/n	n/n	n/n								
Cricket (Acheta domestica, Gryllus			Linares,	3; case report	1	1	n/n Ast 1/1	% n.	/n Rhin % 1/1	Conj nd	%	n/n Cou nd	% Skin	%	n/n Tot 1/1	%	LFT %	NSBHR %	PFT 9	n/n		i (n)	l (n) d (n)		%	n/n lgE 1/1*	% *Spec. IgE+ for G.campestris, G.bimaculatus,
campestris, Gryllus bimaculatus)			Hernandez et al., 2008	3, case report			1/1		1/1	nu		nu	nu		1/1		na			1/	/1			1/1		1/1	Adomestica and crushed, fire bug, grasshopper, prav and squid but higher levels of specific IgE for the 3 species of crickets
Cricket (Acheta campestris)			Bartra, Carnés et al., 2008	3; case report	1	1	1/1		1/1	1/1		nd	1/1		nd		0/1	nd	1/1	1/	/1	1		1/1		nd	Assistant in a reptile shop monosensitized to cricket
Dermestidae spp. beetle (order Coleoptera)	-	2	Brito, Mur et al., 2002	3; case report	1	1	1/1		1/1	1/1		1/1	nd		1/1		nd	0/1	1/1*	1/	/1	1		1/1		1/1	Wool worker. *PEFR twice a day for 3 months; conj. C
Dermestid beetle larvae (order Coleoptera)			Sheldon and Johnston, 1941	3; case report	1	1	1/1*		1/1	nd		nd	nd		1/1		nd	nd	nd	+*				1/1		nd	Museum curator. *Work-exacerbated; **clinical asthm symptoms after SIC, LFT not tested; passive transfer
																											test+
Flour moth (Ephestia and Eurygaster)	[*]	8	Armentia, Lombardero et al., 2004	3+,cross sectional	15	7 (46.6)	15/15	100	7/15 46.6	6 nd		nd	nd		nd		nd	nd	nd	7/8	8* 87.	5		15/15	100	2/15**	13.3 15 asthmatic bakers or farmers exposed to cereal dus 8 refused SIC ** 2/15 positive with pure wheat
Flour moth (Ephestia kuehniella)			Mäkinen-Kiljunen,	3: case report	1	1	1/1		1/1	1/1		1/1	nd		1/1		0/1	1/1	1/1	n	nd			1/1		1/1	Baker. Nasal Ch+
· · · · · · · · · · · · · · · · · · ·			Mussalo- Rauhamaa et al., 2001	-,													-										
Fruit fly (Drosophila melanogaster)		3	Spieksma,	3+; cross-	22	3 (13.6)	4/22	18.2	7/22 31.8	8 3/22	13.6	nd	nd		7/22	31.8	nd	nd	nd	3/1	14* 21.	4	3	9/22**	40.9	10/22	45.5 Workers in a scientific laboratory. *Nasobronchial Ch,
	-		Vooren et al., 1986	sectional																							9/14 nasal reaction; **IC;
Grain weevil (<i>Sitophilus granarius</i>), order Coleoptera	-		Rosenau, Wittemann et al., 1993	,	53		*		•	•		nd	nd		53/53		nd	nd	nd	n	d			nd		8/53	Bakers with occupational airways diseases: *rhinitis, conj., and /or asthma, individual figures not listed
Grasshopper (<i>Melanoplus sanguinipes</i>)	-	4	Soparkar, Patel et al., 1993	3+; survey with index case	17	4 (23.5)	4/17	23.5	1/1*	1/1*		nd	9/17	52.9	10/17	58.8	0/1*	1/1*	nd	1/*	1*	1		7/16	43.8	nd	Research laboratory workers. "Tests done only in cass report; sensitization in exposed sign. higher; sign. correlation between WR asthma and SPT+: all asthmatics SPT+; clinical tests done with grasshopper droppings
Ground bugs (family Lygaeidae: Metopoplax ditornoides et Microplax albofasciato)	-	1	Lázaro, Muela et al., 1997	3; case report	1	1	1/1		1/1	1/1		nd	nd		1/1		1/1	1/1	1/1*	n	ıd			1/1		1/1	Employee bottling mineral water. *Serial PEFR at wor and off-work for 6 weeks; conj. Ch+
Gypsy moth caterpillar (Lymantria dispar)	-	2	Etkind, Thomas et al, 1982	3+; survey	17	2 (11.8)	2/17	11.8	nd	4/17	23.5	nd	10/17	58.8	10/17	58.8	nd	nd	nd	n	d			15/17*	88.2	nd	Laboratory workers. *Scratch test; both asthmatics we scratch test+
Herring worm (Anisakis simplex)	-	3	Armentia, Lombardero et al., 1998	3; case reports	2	2	2/2		1/2	nd		nd	nd		2/2		nd	1/1	nd	2/	/2	1	1	2/2		2/2	Chicken breeder and fish monger. 1/1 SPT- with fish
•	-		Scala, Giani et al., 2001	3; case report	1	1	1/1		0/1	0/1		1/1	1/1		1/1		1/1	nd	nd	n	id			1/1		1/1	Employee in a frozen fish factory. SPT- with all fish tes
Honeybee (Apis mellifera)	-	1	Ostrom, Swanson et al., 1986	3; case report	1	1	1/1		nd	nd		1/1	nd		1/1		0/1	nd	nd	1/	/1	1		1/1		1/1	Honey-processing plant employee. IgE- with pollen
Lentil pest (<i>Bruchus lentis</i>)	-	1	Armentia, Lombardero et al., 2003	3; case report	1	1	1/1		1/1	1/1		nd	nd		1/1		nd	nd	nd	1/*	'1*			1/1		1/1**	Agronomist. *SIC reaction type not listed; **IgE+ with infested lentil; SPT-, IgE- and SIC- with lentil
Lesser mealworm (<i>Alphitobius diaperinus</i> (Panzer)), order Coleoptera	-	2	Schroeckenstein, Meier-Davis et al., 1988	3; case reports	3	2 (66.6)	2/3	66.6	2/3 66.6	6 1/3	33.3	nd	2/3	66.6	3/3	100	nd	nd	nd	n	d			3/3	100	3/3	100 Research entomologists
ive fish bait (LFB) Bluebottle (Calliphora vomitoria)	*	16	Siracusa, Marcucci et al.,	2-; cross- sectional	76	3 (3.9)	3/76	3.9	5/76 6.6	5/76	6.6	nd	1/76	1.3	7/76	9.2	nd	nd	nd	n	d			24/76 19/76	31.6	6/64	18.8 50 workers in 8 LFB farms, 8 retailers, 18 laboratory workers. Sensitization to LFB and WRS were strongly
Beemoth (Galleria mellonella)	1		2003																					(5/7) 13/76		(3/7) 5/64	associated; IgE and SPT results for symptomatics in brackets
Gusano rojo (Cilecomadia moorei)	1																							(4/7) 8/76		(3/7) 5/64	┝──┤
Mealworm (Tenebrio mollitor)	1									-				-										(3/7) 8/76		(2/7) 2/64	
ive fish bait (LFB)	1		Siracusa, Bettini	3+; case	14	12 (85.7)	13/14	92.8	14/14 100) nd		nd	3/14	21.4	14/14	100	nd	7/13 53.8	5/7* 71	.4 n	d			(2/7) 13/14	92.8	(1/7) 13/14	92.8 3 workers of a fish bait farm and 11 anglers. *PEFR a
Beemoth (Galleria mellonella) Greenbottle (Lucilia caesar)	-		et al., 1994	series				-	_						1				+			\square		2/13 12/13		4/13 12/13	exposure day and non-exposure day (2 immediate, 3 late); 12/13 asthmatics sensitized; no cross-reactivity
Mealworm (Tenebrio mollitor)	1		1								1													3/13	1	3/13	larval extracts detected

Agents	Strength of	Total no. of	Reference	Level of	Occupa-	Allergic asthma cases										E	VIDENCE	E (patholo	gical results)										Remarks
	evidence per agent (three	of allergic asthma		evidence per study (revised	tionally exposed	due to mentioned				WORK-RI	ELATED	SYMPT	OMS					LFT	NSBHR	sPFT			SIC		s	РТ	Spe	ec.lgE	
	star system of RCGP)	cases		SIGN grading	subjects studied,	agent, n,	Asthma		Rhinitis	Con	unct.	Coug	h	Skin		Total							R	eaction					
		per agent, n		system); study	n	prevalence (%). Cases with probable allergic asthma but																							
				type.		specific sensitization not confirmed in																							
						parantheses [] or not indicated.				n/n			n					/n	n/n	n/n									
Live fish bait (LFB)			Stevenson,	3; case report	1	1	n/n Ast 1/1		Rhin 9 /1	% Conj nd	%	n/n Cou nd	% Sk			n Tot nd		FT %	NSBHR % nd	PFT 1		n <mark>SIC</mark> 1/1	% i (n)	l (n) d (n) n/n SPT 1/1	%	n/n lgE		Vorker of a commercial fish bait establishment
Beemoth (Galleria mellonella)			Mathews et al., 1967	o, case report			1/1		/1	nu		nu		u		iu ii		/1	nu -	nu			ľ		1/1		nu	, in the second s	
Locust (Schistocerca gregaria and Locusta migratoria), cicada	*[*]	19	Burge, Edge et al., 1980	2-; cross- sectional	90	11 (12.2)	13/90 1	4.4 20	1/90 22	2.2 nd		nd	17/	/90 18	8.9 r	nd	×	K"	nd	nd		nd			29/87	33.3	x**	re h d S	Nº exposed and 28 non-exposed (admin. staff) in a seaarch centre, 7/28 admin. staff SPT+ 'sathmatics ad a reduced mean FEV1; "IgE+ correlated sign. with legree of exposure and WR asthma, 11/12 asthmatics SPT+; co-exposure and co-sensitization (11/87 SPT+) to noth (<i>Chilo partellus</i>)
			Tee, Gordon et al., 1988	3+; Cross- sectional	15	5 (33.3)	5/15 3	13.3 9	/15 6	0 nd		nd	8/	15 53	3.3 9/	/15	60 n	nd	nd	nd		nd			10/15*	66.7	11/15**	le n	15 currently exposed in a research center. "SPT+ with at east one antigen; "IgE+ with a mixture of S. g. and L. n; all symptomatics were sensitized; sign. association setween SPT and exposure
					20		nd	r	nd	nd		nd	n	d	0/	/20	n	nd	nd	nd		nd			2/20*	10	7/20**	**	20 employees in a research center with past exposure. SPT+ with at least one antigen; **IgE+ with a mixture of S. g. and L. m.
African migratory grasshopper (<i>Locusta</i> migratoria)			Lopata, Fenemore et al., 2005	3+; Cross- sectional	10	3 (30)	4/10	40 4	/10 4	0 4/10	40	0/10	4/	10 4	40 6/	/10	60 n	nd	nd	nd		nd			7/9	77.8	5/10	50 S a	Scientists and technicians in research facility. 3/4 asthmatic subjects sensitized
Mealworm (larva of beetle Tenebrio molitor), order Coleoptera	(*)	5	Bernstein, Gallagher et al., 1983	3+; case series	5	2 (40)	2/5	40 4	/5 8	0 2/5	40	nd	1/	/5 2	20 4	4/5	80 n	nd	nd	nd	2	2/2* 1	00 2		4/5	80	2/5	40 F a	Fish bait handlers. *SIC done in asthmatics only; both asthmatics sensitized
d.			Rudolph, Kunkel et al., 1979	3; case reports	3	2 ('66.6)	2/3 6	6.6 3	/3 10	00 3/3	100	nd	n	d	3	3/3	100 1,	/2 50	nd	nd		nd			3/3*	100	nd	A	Animal breeders. *IC
			Friedrich, 1986	3; case report	1	1	1/1	1	/1	1/1		nd	n	d	1	1/1	n	nd	nd	nd		1/1	1		1/1*		1/1	Z	Zoologist. *IC; nasal Ch+
*			Schroeckenstein, Meier-Davis et al., 1990	3; case report	1	0	0/1	1	/1	1/1		nd	n	d	1	1/1	n	nd	nd	nd		nd			1/1		1/1	Ac	Animal handler. Cross-reactivity to A. diaperinus was confermed by RAST-inhibition assays
Mexican bean weevil (Zabrotes subfasciatus boh.), order Coleoptera	-	2	Wittich, 1940	3; case reports	2	2	2/2	2	/2	2/2		1/2	n	d	2	2/2	n	nd	nd	nd		nd			2/2*		nd	E	Bean sorters. *IC; 1/1 nasal Ch+ and 1/1 conj. Ch+
Mosquito larvae (Echinodorus plamosus)	-	1	Resta, Foschino- Barbaro et al., 1982		1	1	1/1	1	/1	1/1		1/1	n	d	1	1/1	n	nd	nd	nd		1/1	1		1/1		1/1	A	Aquarium keeper
Non-biting midges (Chironomus thummi thummi), main allergen Chi t I	*	34	Liebers, Hoernstein et al., 1993	2-; cross- sectional (retrospective)	225	34 (15.1)	37/225 1	6.4 54	225 2	4 52/225	i 23.1	nd	33/3	225 14	4.7 77/	225	34.2 n	nd	nd	nd		nd			51/94	54.3	76/225	a	Aquarists and workers in a fish-food factory. 34/37 isthmatics IgE+; IgE sign. associated with WRS; also issociation between symptoms and degree of exposure
Screwworm fly (Cochliomyia hominivorax)	[*]	10	Gibbons, Dille et al., 1965	3+; cross- sectional	182	10 (5.5)	+*		+*	+*		+*	n	d	46/	182* 2	25.3 n	nd	nd	nd		nd			10/11**	90.9	nd	*1	Vorkers of the screwworm fly eradication program. Indicated is the prevalence of symptoms (primarily sough, wheezing and shortness of breath), individual gures not listed; **SPT+ were all symptomatic
Sewer fly (Psychoda alternata)	-	1	Gold, Mathews et al., 1985	3; case report	1	1	1/1	1	/1	1/1		nd	n	d	1	1/1	0	/1	nd	nd		1/1	1		1/1		1/1	m	Worker at a sewage treatment plant. SPT+ with wax noth, deer fly, black fly, mosquito and cockroach; HR+; $^{\rm HC+}$
Silkworm (Bombyx mori), silk, sericin	*[*]	35	Harindranath, Prakash et al., 1985	3+; survey	243	29 (11.9)	41/243 1	6.9 r	nd	nd		nd	n	d	41/	/243	16.9 n	nd	nd	nd		nd			70/243	28.8	13/15*	86.6 V	Vorkers of 2 silk filatures. *IgE with silkworm cocoon; 2/15 IgE+ with pupa; 29 asthmatics SPT+
			Uragoda and Wijekoon, 1991	3+; cross- sectional	53	4 (7.5)	18/53	34 r	nd	nd		26/53	49. n 1	d	30	0/53 5	56.6 n	nd	nd	4/18*		nd			nd		nd	s	Silk processing workers. *PEFR in asthmatics
			Charpin and Blanc, 1967	3; case reports	2	2	2/2	2	2/2	nd		nd	n	d	2	2/2	n	nd	nd	nd	+	nd	\top		1/1		nd	F	lairdressers
Various insects Ephestia kuehniella Chrysoperla carnea Leptinotarsa decernlineata	-	3	Lugo, Cipolla et al., 1994	3+; cross- sectional	13	3 (23.1)	3/13 2	3.1 6	/13 46	5.2 2/13	15.4	nd	1/	13 7	7.7 7/	13 5	53.8 n	nd	nd	nd		nd			nd		8/13* 5/7 3/7 4/7	S	Employees in a production of beneficial arthropods. *All symptomatics IgE+ with at least one insect
Ostrinia nubilalis																											4/7		
Various insects/Grain pests L. destructor D. pteronyssinus D. farinae T. molitor	-	31	Armentia, Martinez et al. 1997	3+; cross- sectional	50	31 (62)	31/50*	62 40	/50 8	0 15/50	30	nd	2/!	50	4 r	nd	n	nd			Sensitiz		29/50 (3 29/50 (5 24/50 (4 25/50 (5	18) 18) 18)	and SIC			C	bakers, farmers, factory workers with daily contact with ereal and suffering from work- related nasal or sulmonary symptoms. *Most of them sensitized.

Agents		Total no.	Reference		Occupa-	Allergic										EVID	ENCE (p	oatholo	gical resi	ults)										Remarks
	evidence per agent (three	of allergic		evidence per study	tionally exposed	asthma cases due to				WOR	K-RELA	TED SYMP	TOMS				L	.FT	NSI	BHR	sPF	т	5	SIC		SP	т	Spec	c. IgE	
	star system of RCGP)	asthma cases		SIGN grading	subjects studied,	mentioned agent, n,	Asthr	na	Rhinit	is	Conjunc	t. Cou	gh	Skin	То	tal							_	Rea	ction					
		per agent, n		system); study		prevalence (%). Cases with probable allergic asthma but																								
				type.		specific sensitization not confirmed in																								
						parantheses [] or not indicated.	n/n Ast	% n	vn Rhin		n/n Coni	% n/n Cou		n/n Skin %	n/n Tot	%	n/n		n/n		n/n									
CRUSTACIANS (CRUSTACEA)							IVII ASL	70 1		76	Conj	76 11/11 COL	70	3KIII 76		76	LFT	%	NSBH	R %	PFT	% n/n <mark>S</mark>	IC %	1 (n) 1 (n) d (n) r	n/n SPT	%	n/n lgE	%	
Water-flea (Daphnia)		2	Meister, 1978	3; case	2	2	2/2		2/2		nd	1/2		1/2	2/2	1	1/1		nd		nd	1/1		1		2/2*	1	nd		Workers in the fish food store. *1/1 IC+ and 1/1 SPT+
Lobster (Family Nephropidae)	-	2	Lemière.	reports 3; case report	1	1	1/1		1/1		nd	1/1		1/1	1/1		0/1		1/1		nd	1/1		1	+	1/1*		1/1**		Worker in a fishmonger shop, co-exposed and co-
	-	-	Desjardins et al., 1996			·					nd										10									sensitized to shrimp. "SPT+ also with shrimp and clam; **IgE+ also with shrimp, crab, and crawfish; see also shrimp
•			Patel and Cockcroft, 1992	3; case report	1	1	1/1		nd		nd	1/1		1/1	1/1		1/1		1/1		nd	1/1		1		1/1		nd		Restaurant chef
Prawn (Nephrops norwegicus), Norway lobster	**	22	McSharry, Anderson et al., 1994	2+; case control	26	15 (57.7)	26/26	100	3/26	11.5	3/26 1	1.5 17/26	65. 4	13/26 50	26/26	100	15/26	57.7	nd		nd	nd				nd		15/26	57.7	Seefood-processing factory workers with respiratory symptoms. IgE+ sign. associated with duration of exposure and duration of symptoms
*			Gaddie, Legge et al., 1980	2-; cross- sectional	50	7 (14.0)	18/50	36	11/50	22	9/50	18 17/50	34	6/50 12	18/50	36	12/18	66.7	nd		nd	2/2		1 1		13/50	26	8/50	16	Prawn processors. 7/18 asthmatics SPT+ and IgE+, the other 11 asthmatics were not sensitized
Shrimp (Order Decapoda)	[*]	5	Desjardins, Malo et al., 1995	3+; cross- sectional	57	1 (1.8)	2/57	3.5	3/57	5.3	nd	nd		nd	nd		nd		4/8*		nd	1/3	33.3	3 1		9/57	15.8	8/55		Food company workers including index case, co-exposs to clam. "NSBHR and SIC in sensitized only; 1/2 asthmatics during shrimp-production period was SPT+, IgE+ and SIC+ to shrimp; see also clam
			Lemière, Desjardins et al., 1996	3; case report	1	1	1/1		1/1		nd	1/1		1/1	1/1		0/1		1/1		nd	1/1		1		1/1*		1/1**		Worker in a fishmonger shop, co-exposed and co- sensitized to lobster. *SPT+ also with lobster and clam; **IgE+ also with lobster, crab, and crawfish; see also lobster
	-		Goetz, Whisman et al., 2000	3; case report	1	1	1/1		nd		nd	nd		1/1	1/1		nd		1/1		1/1	1/1		1		1/1		1/1		Restaurant seafood handler. See scallop
", Gammarus			Baur, Huber et al., 2000	3; case report	1	1	1/1		nd		nd	1/1		nd	1/1		1/1		1/1		nd	1/1		1		1/1		1/1		Employee in a fish-food factory. Also IgE+ with Chi t 1-s of C. thummi
Shrimp meal (Penaeus shrimp, brine shrimp Artemia salina)	-		Carino, Elia et al., 1985	3; case report	1	1	1/1		1/1		nd	1/1		nd	1/1		0/1		1/1		nd	1/1			1	1/1		1/1		Technician for experimental aquaculture
Snow crab (Chinoecetes opilis)	**	30	Ortega, Daroowalla et al., 2001	2-; longitudinal study	107	3 (2.8)	28/107	26.2*	nd		nd	nd		nd	nd		4/91*	* 4.4	8/91	8.8*	nd	nd				nd		2- 12/96**	2-12	Crab processing workers over the course of 1 processi season. "Incidence; **end of the season; sign. change i prevalence of the asthma-like symptom complex was observed over the season; 3 asthmatics had IgE+
			Cartier, Malo et al., 1984	2-; cross- sectional	303	27 (8.9)	64/303	21.1	+*		+*	nd		72/303 23.	8 nd		13/29	8 4.4	62/114	4 54.4	12/14**	33/4	6 71.	7 1 2	39	65/298	21.8	nd		Snow crab processors. *55/303 (18.2 %) WR rhinitis and/or conj., "Serial PERR before and after return to work; SIC, PFT, BHR in asthmatics only; 46 had OA, defined as +SIC (n=33) or at least 2 of the following: sign.changes in PERP, PC20 and/or FEV1 on return to work (n=13); 27 of 46 subjects with OA were SPT+
MOLLUSKS (MOLLUSCA)																														
Clam (Class Bivalvia)	-	2	Desjardins, Malo et al., 1995	3+; survey	57	2 (3.5)	2/57	3.5	4/57	7.0	nd	nd		nd	nd		nd		4/8*		nd	2/2*	100) 1	1	4/57	7.0	4/55	7.3	Food company workers including the index case, co- exposed to shrimp. 'BHR and SIC in sensitized subjec only; both asthmatics during clam-production period we SPT+, IgE+ and SIC+ to clam; see also shrimp
Cuttle-fish <i>(Sepia apama)</i>	-	1	Tomaszunas, Węcławik et al., 1988	3+; case series	66	[61 (92.4)]	61/66*	92.4	nd		5/61*	nd		8/61*	66/66	100	nd		nd		nd	nd				nd		nd		Deep-sea fishermen. * Respiratory symptoms were atopic bronchial asthma or spastic bromchitis. Of affected workers, 5 had also conjunctivitis and 8 had sk
			Beltrami, Innocenti et al., 1989	3; case report	1	1	1/1		nd		nd	nd		1/1	1/1		nd		nd		nd	1/1	1		1	1/1		nd		sympotms. Goldsmith. Clinical tests done with cuttle-fish bone dust
Green-lipped mussel (Perna canaliculus)	-	-	Glass, Power et al., 1998	2-; cross- sectional	223	[26 (11.7)]	51/223*	22.9	nd		nd	nd		nd	72/223	32.3	26/22	3 11.7	nd		4/19**	21.1 nd				nd		nd		Mussel openers at 9 processing sites. *WR wheeze; **PFT done in 1 of 9 sites; duration of work sign. associated with WRS; obstructive symptomatic subject not listed
Scallop (Family Pectinidae)	-	1	Goetz, Whisman et al., 2000	3; case report	1	1	1/1		nd		nd	nd		1/1	1/1		nd		1/1		1/1	1/1		1		1/1		1/1		Restaurant seafood handler. Co-exposure to shrimp; significant cross-reactivity between scallop and shrimp

Agents		Total no.	Reference	Level of	Occupa-	Allergic asthma cases											EVIDE	NCE (patholo	gical results)									Remarks
	evidence per agent (three star system	of allergic asthma		evidence per study (revised	tionally exposed subjects	due to				WOR	K-REL/	ATED SY	MPTOM	S				LFT	NSBHR	s	PFT		SIC		SPT	Spe	c.lgE	
	of RCGP)	cases per agent, n		SIGN grading system); study type.		agent, n, prevalence (%). Cases with probable allergic asthma but specific sensitization not confirmed in parantheses [] or not indicated.	Asthr		Rhini n/n Rhin		Conjune n/n Conj		Cough	Ski n/n Skin	in %	To n/n Tot	al %	n/n	n/n NSBHR	n/n) n/n SPT %		~	
Octopus (Order Octopoda)	-	1	Rosado, Tejedor et al., 2009	3; case report	1	1	'1/1	70	1/1		'1/1		/1	nd	70	nd	78	nd	nd	5 PF1	%	n/n SIC 1/1	1) n/n <u>SPT %</u> 1/1*	n/n lgE 1/1	- %	Worker in a canning fish and shellfish factory * SPT+ also for raw squid, raw shrimp and cat dander
SPONGES (PORIFERA)																												
Marine sponge, powdered (<i>Dysidea</i> herbacea)	-	1	Baldo, Krilis et al., 1982	3; case report	1	1	1/1		nd		nd		nd	1/1		1/1		1/1	nd	nd		nd			nd	1/1		Laboratory worker. Also IgE+ with 7 other sponge and soft coral species; HR+ with <i>D. herbacea</i>
CNIDARIA															1									1 1				
Red soft corals (Dendronephthytia nipponica)	[*]	9	Onizuka, Inoue et al., 1990 ABSTRACT	3+; survey with index cases	2 72	2	2/2 7/72	9.0	- 28/72	39 72	- 2/72	100	-	- 72/72	100	2/2 72/72	100	-	-	-		-			2/2	-		2 spiny lobster fishermen with OA 72 spiny lobster fishermen. *Intracutaneous test positi in asthmatics for immediate and late reaction; individu
SPINAL CORDS (CHORDATA), VERTEBRATA																												figures not listed
FISH (PISCES)																												
Atlantic Salmon (Salmo salar)	**	28	Shiryaeva, Aasmoe et al., 2010	3+; cross- sectional	139	2 (2.2)*	10/139	7.2	28/139*	20.1	nd	8/	139 5.7	12/139	8.6	nd		**	nd	nd		nd			nd	2/89		Salmon-processing workers. not indicated but probably asthma symptoms as well a sensitization "*Higher prevalence of reduced LFT (FEV1 < 80% ar FVC < 80%) in salmon-workers than in control. reliable relation between asthma diagnose and occupation in salmon industry but significant higher prevalence of relativary symptoms (wheezing,
ttlantic Salmon (Salmo salar)	-		Douglas, McSharry et al., 1995	2-; cross- sectional	291	15 (5.2)	70/291	24.1	+*		nd		+*	nd		121/291	41.6	nd	nd	24/29	1* 8.2	nd			nd	25/291		shortness of breath, coughing) Employees of a salmon-processing plant. "Prevalenc of indiv, WRS not listed, "serial PEFR over several weeks: 24 subjects showed marked changes in daily mean PEFR levels, of whom 15 were sensitized and asthmatic WRS, the other 9 PFT+ not sensitized to salmon
Seafood (hake, pilchard, rock lobster, squid, mussel, abalone, prawn)			Jeebhay, Lopata et al., 2000	3+; cross- sectional	8532		597/8532 *	7	•		•		nd	6484 /8532*	76	nd		nd	nd	nd		nd			nd			Seafood processers in 38 workplaces. *Of all symptomatics (figures not listed) 7% had asthma, 15 RC and 78% skin symptoms
Fishmeal: pickiling, herring, cod, shell fish, plaice, eel, sardine, tunny-fish, salmon, shrimp, mussel			Droszcz, Kowalski et al., 1981	2-; cross- sectional	51	1 (2.0)	1/51	2.0	nd		nd		nd	2/51	3.9	3/51	5.9	17/51 33.3	nd	nd		2/51**	1		12/51* 23.5	nd		Fish meal factory workers. *IC with a mix of 10 fish species; **nasal Ch induced a 20% decrease in FEV? asthmatic subject
Trout, Rainbow			Sherson, Hansen et al., 1989	2-; cross- sectional	8	5 (62.5)	6/8	75	3/8	37.5	nd	7	7/8 87. 5	. nd		8/8	100	1/8	7/8	4/6*	66.7	nd			nd	8/8**	100	Production workers from trout-processing factory. *Pf at work, PFT was not done in 1 asthmatic with NSBHI **IgE done with trout-contaminated water containing 1 endotoxin/ml
Turbot (Scophthalmus maximus)			Pérez Carral, Martín-Lázaro et al., 2010	3; case reports	3	3	3/3		3/3		3/3		nd	2/3		nd		nd	'3/3	3/3		nd			3/3	3/3		Fish-farm workers
īsh: anchovy, Atlantic pomfret, hake, Ilaice, salmon, sardine, sole, trout, tuna			Rodríguez, Reaño et al., 1997	3; case reports	2	2	2/2		1/2		1/2	1	/2	nd		2/2		nd	1/1	2/2'		2/2	2		2/2	2/2		Fish-processing workers. "Serial PEFR for periods of weeks at work and off-work; subject 1: SPT+ with ra- and cooked places, salmon, hake, tuna; IgE+ with salmon; SIC+ with raw hake, salmon, plaice, tuna; subject 2: SPT+ with raw and cooked anchovy, sardir trout, salmon, sole, Atlantic pomfret; IgE+ with trout, anchovy, salmon; SIC+ with raw salmon
BIRDS (AVES)		I		1	1		1			<u> </u>				1	1	1	1		<u> </u>						<u> </u>	- 1	1	
Budgerigar (<i>Melopsittacus undulatus</i>)	[*]	5	Faux, Wide et a., 1971	3+; survey	118	5 (4.2)	14/118	11.9	nd		nd		nd	nd		75/118*	63.5	nd	nd	nd		3/3**	'100 2	1	8/59*** 13.6	22/59	37.3	Budgerigar fanciers. *Total symptoms of asthma, aller, alveolitis etc.; 3/14 asthmatics underwent SIC, 2/3 wer sensitized, ***SPT and IgE done in 59 symptomatics; tested asthmatics were SPT+ and IgE+ with budgeriga serum

Agents	Strength of	Total no. of	Reference	Level of	Occupa-	Allergic asthma cases										EVIDE	NCE (pa	atholog	ical result	s)								Remarks
	evidence per agent (three	allergic		evidence per study	tionally exposed	due to				WC	RK-RELAT	ED SYMP	roms				LF	т	NSBH	IR sPFT		SIC	;		SF	т	Spec.	lgE
	star system of RCGP)	asthma cases		(revised SIGN grading	subjects	mentioned agent, n,																						
		per		system);	n n	prevalence (%).	Asthr	ma	Rhin	iitis	Conjunct.	Coug	h	Skin	Tot	al							Read	tion				
		agent, n		study		Cases with probable allergic asthma but																						
				type.		specific sensitization																						
						not confirmed in parantheses [] or																						
						not indicated.	n/n Ast	%	n/n Rhin	%	n/n Conj %	n/n Cou		n/n Skin %	n/n Tot	%	n/n LFT	%	n/n	n/n			; (m) 1 (r) d (n)				P/
I			Toorenenbergen	3+; case	154	.*	*	~	*	70	nd	nd		nd	154/154		nd	%	NSBHR nd	% PFT 9	% n/n Sl nd	%	. (1) . (1	i) u (ii)	n/n SPT nd		n/n lgE 28/15/	% 18.2 *154 budgerigar fanciers with asthma and/or rhintis (an
			van, Gerth van	series	134	-					nu	nu		nu	104/104	100	nu		nu	nu	nu				na		20/134	with no signs of hypersensitivity pneumonitis); see also
			Wijk et al., 1985																									canary
Canary (Serinus canaria)			Toorenenbergen	3+; case	98		*				nd	nd		nd	98/98		nd		nd	nd	nd				nd		25/98	25.5 *98 canary fanciers with asthma and /or rhinitis (and wit
)	-		van, Gerth van	series																								no signs of hypersensitivity pneumonitis); see also
			Wijk et al., 1985																									budgerigar
Various hirds: hen duck goose parrot		17	Krakowiak,	3+; cross-	68	1 (1.5)	1/68	1.5	5/68	7.4	6/68 8.8	8 nd		nd	nd				nd	nd	nd				15/68**	22.1	5/15***	33.3 Zoo workers, co-exposure and co-sensitization to anima
Various birds: hen, duck, goose, parrot	[*]	17	Palczynski et al.,	sectional	00	1 (1.5)	1/00	1.5	5/08	7.4	0/00 0.0	, nu		nu	nu				nu	nu	nu				15/08	22.1	3/13	fur. *Individual results not listed; **SPT with feather
			2002																									extract; ***lgE in SPT+
	-		Linear and	2	04	40 (40 0)	40/04	40.5							20/04	40.0	40/20*	50	-		20/04	44.5	5 07		40/00*	44.5		Did faction II FT and CDT water does in 20 CIC .
Various birds: pigeon, budgerigar,parrot, finches and others			Hargreave and Pepys, 1972	3+; case series	81	10 (19.8)	10/61	12.5	nd		nd	nd		nd	39/81	40.2	10/30	50	nd	nd	30/61	44.5	5 21	4	16/36*	44.5	nd	Bird fanciers. *LFT and SPT were done in 36 SIC+ subjects; 8/9 subjects with immediate reaction to SIC
																												were SPT+, 7/27 subjects with late reaction to SIC were
																												SPT+
Various birds: budgerigar, parrot, canary	1		Tauer-Reich,	3+; case	5	5	5/5		2/5		1/5	nd		nd	5/5		2/5	1	5/5	nd	nd				nd		5/5*	Bird fanciers. *IgE with sera and feathers; SDS-PAGE:
			Fruhmann et al.,	series																								cross-reactivity between serum and feather allergen of
			1994																									diff. bird species
Various birds: pigeon, chicken	-		Hoffman and	3; case report	1	1	1/1	-	1/1		1/1	nd		nd	1/1		nd		nd	nd	nd				1/1*		1/1**	Worker raising chicken, pheasants, quails and doves.
vanous birds. pigeon, chicken			Guenther, 1988	5, 0836 Tepon			1/1					na		na	17.1		110		110	i iu	na						17.1	*SPT+ with egg and feathers; **IgE+ with pigeon and
																												chicken serum, with chicken meat and yolk
Various birds: parrot, pigeon, canary and	1		Świderska-	3; survey	200	[7 (4.2)]	7/200	4.2	33/200	16.5	27/200 13.	5 20/200	10 12	2/200 12	nd		nd		nd	nd	nd				nd		nd	Zoo bird keepers; only questionnaire survey.
others			Kielbik,																									Co-exposure to various birds, latex and disinfectants. The
			Krakowiak et al., 2009																									latter were not associated with work-related symptoms. More work-related symptoms in contact with parrots
			2003																									(67%).
Poultry	F*1	18																										
	[*]																											
Poultry	-		Radon, Danuser	3+; survey	214	[13 (12.4)]	13/104	12.4	21/104	20.0	nd	25/104	24	nd	nd		nd		nd	nd	nd				nd		nd	Questionnaire survey of 7,496 animal farmers, 214
			et al., 2001			1.0(poultry farmers were included, 104 had work-related
																												respiratory symptoms. *
-	-			-																								not confirmed by allergy test results
Poultry			Kimbell-Dunn, Bradshaw et al.,	3+; survey	23	-	4/23	17.4	nd		nd	nd	8	8/23 34.8	nd		nd		nd	nd	nd				nd		nd	Questionnaire survey of 1,706 farmers; 23 poultry farmers were inclued. *17.4 % suffered from asthma, n
			1999																									allergy tests were made
Poultry allergens	1		Bar-Sela,	3+ case	16	13 (81.25)	14/16	87.5	15/16	93.75	nd	nd		nd	16/16	100	10/14	71.4	nd	nd	1/1*	100	1		13/16**	81.25	10/16**	62.5 Symptomatic poultry workers. *SIC done with northern
chicken droppings	-		Teichtahl et al., 1984	series																					2/16 3/16	12.5	9/12	75 fowl mite; **with at least one poultry allergen; 13/14 37.5 asthmatics sensitized to at least one poultry allergen;
chicken feathers chicken serum	1		1304																						3/16			18.75 none of the asymptomatic exposed controls was
Northern fowl mite]																								9/16	56.25	10/16	62.5 sensitized
poultry feed	-		D. C. W. O. Frank						0/4		3/4			- 4						4/4*					6/16 4/4**	37,5	7/12	
Chicken and turkey			Perfetti, Cartier et al., 1997	3; case reports	4	4	4/4		3/4		3/4	nd		nd	4/4		nd		nd	4/4*	nd				4/4**	100	nd	Poultry-slaughterhouse workers. **SPT with feathers; *FEV1 at work and off-work
			,																									
Chicken and turkey			Schwartz, 1994	3; case report	t 1	1	1/1		1/1		1/1	1/1		nd	1/1		0/1		nd	nd	nd				1/1*		nd	Food processing. *SPT+ with raw chicken and raw turke
AMPHIBIANS (AMPHIBIA)												•														· · ·		
		r .		1	· · · · ·																-							
Bull frog (Rana catesbieana)	-	2	Nakazawa, Inazawa et al	3; case report	t 1	1	1/1		nd		1/1	1/1		1/1	1/1		0/1		nd	nd	nd		1		nd		1/1	Laboratory technician handling frog brains
	-		1983																									
Frog (Rana esculenta)	+		Armentia, Martin-	3. case report	1	1	1/1		1/1		nd	nd	-	nd	1/1		nd		nd	nd	nd			+	1/1*		1/1*	Frog catcher with prev. diagn. of seasonal asthma.
rog (nana escalenta)			Santos et al.,	5, 0836 Tepon			1/1				nu	na		na	17.1		110		110	i iu	na							*Clinical tests with venom extract
			1988																									
MAMMALS (MAMMALIA)	-				1			1		1	I	1			I		I	I	I		1		1	1				
WANIVIALS (WANIVIALIA)																												
Black bat (Tandarida (chaerenhon) moior)		٩	FI-Ansary	3+: case	7	7	7/7	, ,	6/7	-	nd	nd	<u> </u>	nd	7/7		nd		nd	nd	nd	1	1	1 1	7/7*	100	7/7*	100 6 employees and 1 housewife exposed to bat dropping
Black bat (Tandarida [chaerephon] major)	(*)	3	Gordon et al.,	series		'			0/7		nu	nu		114			nu		nu	nu	nd		1			100		from cracked ceiling in Sudan. *Clinical tests with bat
	()		1987																				1					guano/droppings
	4		0														0/4		0/4					+				
			Senti, Lundberg	case report	t 1	1	1/1	1	1/1	1	1/1	1/1		nd	1/1		0/1	1	0/1	nd	nd	1		1	1/1		1/1	Zoologist. Clinical test with bat guano; co-exposure and
Bat			et al., 2000	· ·		1		1 1											1 1	1 1				1 1			1	co-sensitization to Tenebrio molitor (bat feed)

Agents	Strength of evidence per	Total no. of	Reference	Level of evidence per	Occupa- tionally	Allergic										EVIDE	ENCE (p	athologic	al result:	ts)							Remarks
	agent (three star system	of allergic asthma		evidence per study (revised	exposed subjects	asthma cases due to mentioned				wo	ORK-RELA	TED SYMI	томя	1			LI	FT	NSBH	łR	sPFT		SI	SPT	Spe	ec. IgE	
	of RCGP)	cases per agent, n		SIGN grading system); study type.	studied,	agent, n, prevalence (%). Cases with probable allergic asthma but specific sensitization not confirmed in parantheses [] or not indicated.	Asthr	ma	Rhin		Conjunc	t. Con		Skin n/n Skin %	n/n Tot	al %	n/n		n/n		/n			Reaction			
Bat (Chiroptera)			Spiewak, Johansson et al., 1996	3; case report	1	1	1/1	70	nd	76	Conj nd	nd		nd	1/1	76	1/1	%	NSBHR nd		d	n/n SIC	* *	i (n) I (n) d (n) n/n SPT 1/1	% n/n lgi 1/1	E %	Bat scientist. Clinical tests with bat hair
Cow (Bos primigenius taurus)	*[*]	84	Walusiak, Krawczyk- Adamus et al., 2004	2+; case- control	100	[10 (10)]*	38/100	38	41/100	41	38/100 3	83/10	0 83	nd	100/100		nd		nd	n	d	11/100*	•	7/41***	4/41**	*	Farmers. Sign. risk factor of 38 OA cases was SPT+ to storage mites and cereals. *10 asthma cases indacted as be due to cow, individual sensitization not listed. "SIC+ or nasal challenge + with cow, *"SPT+ an IgE+ with animal allergens in symptomatics.
 Farming (Cow dander, storage mites, fodder yeast, grains) 			Terho, Vohlonen et al., 1987	3+; survey	208		+*		+*		0/208	0/208	5	0/208	136/208	65.4	nd		nd	n	d	nd		+**	nd		*Selected 136 symptomatic (asthma and/or rhinitis) and 72 asymptomatic dairy farmers. **SPT done in 121 symptomatics and 64 asymptomatics, mean weal areas for cow dander and fodder yeast (<i>C. utilis</i>) were sign. larger in symptomatic farmers
Cow (Bos primigenius taurus)			Terho, Husman el al., 1985	3+; survey	106	.•	*		*86/106	81.1	nd	nd		nd	86/106	81.1	nd		nd	n	d	**		nd	nd		106 non-smoking dainy farmers. *86/106 had rhinitis or rhinitis together with asthma, individual symptoms not listed. **8/63 nasal Ch+ to storage mites and 10/70 nas: Ch+ to cow dander, all nasal challenge positive subjects were symptomatic
a			Hinze and Bergmann, 1995	3+; case series	67	31 (83.8)	67/67	100	39/64	60.9	39/64 6	0.9 46/64	9	22/64 34.	4 67/67	100	X*		32/35	91.4 n	d	31/37*	83.8	59/61*** 9	5.7 33/40**	** 82.5	Retrospective analysis of 67 asthmatics sensitized with cow hair: 64 farmers and 3 veterinarians. *Mean FEV1/FVC 57.4%; "type of reaction not listed; ***IgE and IC done with cow dander
*			Ylönen, Mäntyjärv et al., 1992	i 3+; case serie	49	49 (100)	49/49	100	nd		nd	nd		nd	49/49	100	nd		nd	n	d	49/49*	100	x**	x**		Dairy farmers with diagnosed bovine asthma. "Type of reaction not listed; "+49/49 either IgE+ or SPT+; 30/51 IgE+ with BEA (bovine epithelical allergen), 26/51 IgE+ with BUA (bovine urinary antigen); sign. higher anti-BEA IgE
Bovine animals (Cow etc.)	-		Virtanen, Vilhunen et al., 1988	3+; case series	41	4 (10)	4/33	12.1	9/33	27.3	nd	nd		nd	nd		nd		nd	n	d	nd		nd	+*		Dairy farmers from 18 family farms. *IgE+ with bovine epithelial and urinary antigens
Deer: Whitetail deer (<i>Odocoidleus</i> virginianus) and mule deer (<i>Odocoidleus</i> hemionus)	-	1	Gillespie, Dahlberg et al., 1985	3+; case series	13				*		•			•	13/13		nd		nd	n	d	nd		13/13**	11/13*	*	Deer/elk exposed symptomatic subjects, including at least 1 professional hunting guide; *individual symptoms not listed; **SPT and IgE done with deer hair/dander; se also elk
Deer (Cervus elaphus, Capreolus capreolus)	-		Nahm, Park et al. 1996	3; case report	1	1	1/1		1/1		nd	1/1		nd	1/1		nd		1/1	n	d	1/1		1 1/1*	1/1		Farmer raising red deer. *SPT+ with dander from deer, goat, sheep, camel, cow, deer
Roe deer (Capreolus capreolus)	-	2	Carballada, Sanchez et al., 2006	3; case reports	2	2	1/2*		2/2		2/2	nd		nd	nd		nd		nd	n	d	nd		2/2	1/2**		Workers in an animal recovery center. Co-exposure to other animals. Cross-reactions to other animal allergens (mainy cow). Probable asthma with work-related symptoms of dyspnea, wheezing, cough, hinicoconjunctivitis and eye- edema. ** Patient with probable asthma had no Spe. IgE to roe deer but to mites with a history of mite allergy. Conjunctival provocation tests were positive to roe deer.
Elk (Cervus canadensis)	-		Gillespie, Dahlberg et al., 1985	3+; case series	13	•	+*		+*		+*	+*		+*	13/13		nd		nd	n	d	nd		13/13**	5/13**	•	Deer/elk exposed symptomatic subjects, including at least 1 professional hunting guide; "individual symptoms not listed; "SPT and IgE done with elk hair/dander; see also deer
Gerbil (Meriones unguiculatus)	-		de las Heras, Cuesta-Herranz et al., 2010	3; case report	1	1	1/1		1/1		1/1	nd		nd	nd		0/1		0/1	n	d	nd		1/1*	1/1*		Biologist working with gerbils; co-exposure to guinea pigs. *SPT+ and Spec.IgE+ for guinea pig.
Guinea pig (Cavia porcellus)	-	3	Hanada, Shima et al., 1995	3+; case series	5	3 (60)	3/5	60	5/5	100	0/5	0 0/5	0	0/5 0	5/5	100	nd		nd	n	d	nd		5/5* 1	00 5/5*	100	Laboratory workers. *SPT and IgE-test done with urine, saliva and pelt allergens; 5/5 nasal Ch+ with urine
Horse (Equus ferus)	-	-	Tutluoglu, Atis et al., 2002	3+; cross- sectional	125	[18]		14.4		42.4	44/125 3			41/125 32. **			30/125	24	nd		d	nd			2.8 nd		Grooms. *total asthma cases, 12 of 18 work-aggravate asthma, **not clear whether WRS; ***mean FEV1, FEV1/FVC and FVC sign. decreased in exposed; sensitized asthmatics not listed but sign. relation betwee asthma and sensitization to horse hair.
Mink (<i>Mustela vison</i>)	-	1	Jimenez Gomez, Anton et al., 1996	3; case report	1	1	1/1		1/1		1/1	1/1		nd	1/1		1/1		1/1	n	d	1/1*		1 1/1*	0/1*		Worker at a mink farm. *Clinical tests with mink urine
Monkey (Cotton top tamarin)	-	2	Petry, Voss et al., 1985	3; case reports	2	2	2/2		1/2		nd	nd		nd	2/2		nd		nd	n	d	nd		2/2*	2/2*		Research psychology professor and his assistant. *Clinical tests with monkey dander

Agents	Strength of	Total no.	Reference	Level of	Occupa-	Allergic									E	VIDEN	CE (path	nological resu	ılts)										Remarks
	evidence per agent (three	of allergic		evidence per study	tionally exposed	asthma cases due to mentioned				W	ORK-RELAT	ED SYMP	OMS				LFT	NSE	BHR	sPFT		SI	с		SPT		Spec.	lgE	
	star system of RCGP)	asthma cases		(revised SIGN grading	subjects studied,	agent, n,	Asthr	na	Rhin	nitis	Conjunct.	Coud	ih Sł	sin	Total						_		Read	tion					
		per agent, n		system); study	n	prevalence (%). Cases with probable allergic asthma but																							
				type.		specific sensitization																							
						not confirmed in parantheses [] or not indicated.					n/n		n/n				n/n	n/n		v/n									
							n/n <mark>Ast</mark>	%	n/n <mark>Rhin</mark>		Conj %					%	LFT	% NSBHR	% P	FT %			i (n) I (r	n) d (n) n/n			/n <mark>IgE</mark>	%	
Mouse (Mus musculus)	[*]	8	Schumacher, Tai et al., 1981	3+; cross- sectional	121	4 (3.3)	5/121	4.1	29/121	24.0	14/121 11.	6 nd	16/12	1 13.2 39	9/121 :	32.2	nd	nd		nd	nd			25	6/121 2	20.7 2	6/121	21.5	Workers in a biological research institute. Immunologica test done with urinary proteins. 4/5 asthmatics SPT+
•			Newman Taylor, Longbottom et al. 1977	3; case , reports	4	4	4/4		4/4		4/4	nd	4/4		4/4		nd	nd		nd	4/4	•	3	1 4	1/4*		4/4*		Laboratory workers co-exposed and co-sensitized to rats. *Clinical tests with urine; see also rats
																					4/4	l I	3	1 3	3/4 4/4		3/4 nd		mouse serum mouse hair
			Muñoz, Gómez- Ollés et al., 2007	3; case report	1	[1]	1/1		1/1		1/1	nd	nd		nd		0/1	1/1	C)/1	1/1				nd		0/1		Laboratory worker co-exposed and co-sensitized to collagenase in a laboratory. Rhinitis and conjunctivitis were found attributable to exposure to powdered collagenase (SIC+ and Spec. IgE+ to collagenase) and asthma due to the contact with mouse allergens (SIC+).
Pig farming			Radon, Schottky	3+; case	100	[44]	44/100*	44	nd		nd	76/100	76 nd	10	0/100	100	••	nd		**	nd				nd	37	/99***	37	100 pig farmers claiming compensation for occupational airway disease. *Wheezing, 69/100 shortness of breath;
D. pteronyssinus D. farinae	-		et al., 2000	series																	_	_				1	4/99	14	**sign. LFT decrease during the feeding period in the
Lepidoglyphus destructor Pig epithelium	_																				_					1	2/99 2/99	12	morning, not in the afternoon.***37/99 IgE+ to at least 1 allergen; 15/99 IgE+ to at least 1 animal allergen; 18/99
r ig optionant																											2,000	-	IgE+ to at least 1 mite allergen
Pig (Order Sus)	_		Labrecque, Coté et al., 2004	3; case reports	2	2	2/2		2/2		2/2	2/2	nd		2/2		0/2	1/2		nd	2/2	•	2	2	2/2*		nd		Pork processing workers. *With pork extract
•			Dosman, Lawson et al., 2004/2006	3+; case series	7	[7*]	7**		nd		nd	7***	nd		nd	1	0/6**	2/5		nd	nd			(0/7		nd		Workers in swine confinement facilities. The diagnose of occupational asthma is based on reference to the guidelines of American College of Chest Physicians, not confirmed by allergy tests. "Asthma described as onset of wheezing and cough. "*First 4 cases had normal FEV1, FVC and FEV1/FVC, in the last 2 only FEV1 was indicated.
×			Harries and Cromwell, 1982	3; case report	1	1	1/1		nd		nd	nd	1/1		1/1		nd	nd		nd	1/1		1	1	1/1*		1/1**		Agricultural sciences student. *SPT+ with pork extract and with urine, IgE+ with urine
×			Brennan, 1985	3; case report	1	1	1/1		nd		nd	1/1	nd		1/1		1/1	nd	1	/1*	nd				nd		1/1**		Butcher. *Serial PEFR off-work for 1 week and at work for 1 week; **lgE+ with pig urine and pig skin
Reindeer (Rangifer tarandus)	-	1	Reijula, Halmepuro et al., 1991	3+; cross- sectional	216	1 (0.5)	1/211	0.5	nd		nd	nd	nd		nd		nd	nd		nd	nd			1/2	216*	0.5 1	0/104	9.6	Reindeer herders. *SPT+ in one with pos. case history
Rat (Rattus norvegicus)	**	89	Cullinan, Cook et al., 1999	2++; nested case-control	342	17 (5.0)**	36/342	10.5*	84/342	24.6*	nd	nd	59/342	2 17.3 10 **	3/342 3	0.1**	nd	nd	1	nd	nd			54/	/342* 15	5.8**	nd		Laboratory animal workers. Cohort study of 7 years and case-referent analysis within the cohort; "with urine (46 of asthmatics SPT+, sign, exposure-response relationship with sensitisation and chest-symptoms within the first 2 years of exposure; **incidence in 3 years
и	_		Nieuwenhuijsen, Putcha et al., 2003	2+; cohort study	342	17 (5.0)	36/342	10.5	71/342	20.8*	+*	nd	47/342	2 13.7 10	1/342	29.5	nd	nd		nd	nd			46	3/342 1	13.5	nd		Laboratory animal workers, same cohort like above. 17 asthmatics sensitized; strong accociation between intensity of exposure and WR respiratory symptoms
8	_		Hollander, Heederik et al.,	2-; cross- sectional	398									78	/398	19.6	nd	nd		nd	nd			69)/398 1	17.3 4	4/398		among sensitized. Rat workers from 8 facilities. *Individual WRS not listed; 53/398 had rat allergy (WRS and sensitization to rat
			1997																										urinary protein and/or fur): sensitization, WRS and rat allergy sign. accociated with the time-multiplied rat urinary allergen exposure in workers with less than 4 yr e exposure
Rat (<i>Rattus norvegicus</i>)	1		Cullinan, Lowson et al., 1994	2-; cross- sectional	323	10 (4.2)	32/323	9.9	71/323	22	71/323 22	0/323	48/323	3 14.9 98	3/323	30.3	nd	nd		nd	nd								Cohort of laboratory animal workers in an initial cross- sectional phase of a longitudinal study
							17/238*	7.1	32/238*	13.5	32/238 13. *	5 0/238	25/238	3 10.5 50	/238* :	21.0	nd	nd		nd	nd			21/	238**	8.8	nd		*New WRS in subjects without previous exposure; **SP done with rat urinary allergen; 10/17 asthmatics were SPT+
*			Hollander, Heederik et al., 1998	3+; cross- sectional	398	12 (5.7)	14/208	6.7	+		+	+	+	78	3/398	19.6	x*	nd	,	e**	nd			×	~~~		X***		Laboratory workers working with living rats only (part of cross-sectional study above). "Individual results not listed; "only 208 underwent PFT on work-days: PEFR sign. declined in asthmatics: "V70/389 (17.6%) sensitized to rat allergens, of whom 12 were asthmatics
	-		Platts-Mills, Longbottom et al. 1987	3+; cross- , sectional	179	13 (7.3)	18/179	10.1	30/179	16.8	nd	nd	nd	30)/179	16.8	nd	nd		nd	nd			22	/179 1	12.3 1	7/179	9.5	Laboratory workers. SPT and IgE done with rat urinary protein. 13/18 asthmatics SPT+

Agents	Strength of	Total no.	Reference		Occupa-	Allergic asthma cases								EVIDE	ENCE (pa	atholog	gical result	s)										Remarks
	evidence per agent (three star system	of allergic asthma		evidence per study (revised	tionally exposed subjects	due to mentioned			wo	ORK-REI	LATED SYMPTOMS	6			LF	FT	NSBH	IR sF	PFT		SIC			SPT	r	Spec	c. IgE	
	of RCGP)	cases		SIGN grading system);		agent, n, prevalence (%).	Asthr	na Rhi	nitis	Conju	nct. Cough	Skin	Tot	al								Reac	tion					-
		agent, n		study		Cases with probable allergic asthma but																						
				type.		specific sensitization not confirmed in parantheses [] or																						
						not indicated.	n/n Ast	% n/n Rhi	n %	n/n Coni	% n/n Cou %	n/n Skin	% n/n Tot	%	n/n		n/n	n/n										
,			Lieutier-Colas,	3+; cross-	113	1 (0.9)		4.4 38/113				nd	% n/n 10t 44/113		LFT nd	%	NSBHR nd	% PFT nd	%	n/n SIC nd	%	(n) I (n) d (n) n/n r	nd SPT		n/n lgE 9/73*		Rat workers in 12 laboratories. *2/5 of asthmatics
			Meyer et al., 2002	sectional																								underwent IgE testing, 1/2 tested asthmatics IgE+
*			Davies, Thompson et al.,	3+; case series	32	12 (37.5)	13/32	21/32		16/32	nd	11/32	24/32		3/29		nd	nd		nd			20)/32*		17/32*		Laboratory animal workers who previously reported allergic symptoms. *With urine; 12/13 asthmatics were
	_		1983 Newman Taylor,	3; case	5	5	5/5	5/5		5/5	nd	5/5	5/5		nd		nd	nd		5/5*		2	2 3	3/5*		5/5*		SPT+ and IgE+ Laboratory workers. Co-exposure and co-sensitization to
			Longbottom et al. 1977	reports	5	5	5/5	5/5		5/5	nu	5/5	3/3		nu		nu	nu		2/5		1 1		3/5		2/5		mice: *with urine: see mice Rat serum
			-		005	[00]	00/005*				57/005		101/005							0/2			4	4/5		nd		Rat hair
Sheep (Ovis aries)	-	-	Radon and Winter, 2003	3+; cross- sectional	325	[68]	68/325*	nd		nd	57/325	nd	124/325	38.2	nd		nd	nd		nd			r	nd		nd		Sheep breeders. '12 months prevalence and sign. increased WR respiratory symptoms (asthma and/or cough), work intensitiy and use of chemical footbath being the most important risk factors
ANIMAL PRODUCTS																												
Beef, raw	-	1	San-Juan, Lezaur et al., 2005	3; case report	1	1	1/1	0/1		0/1	0/1	1/1	1/1		nd		nd	nd		1/1		1	1.	I/1*		1/1**		Cook. *SPT+ also with dog dander; **IgE done with dog dander: SDS-PAGE: cross-reactivity of dog dander with bovine serum albumin
Bovine serum albumin (BSA) powder	-	-	Joliat and Weber, 1991	3; case report	1	[1]	1/1	1/1		1/1	nd	nd	1/1		0/1		nd	nd		1/1**		1	0.	0/1*		nd		Laboratory technician co-exposed and co-sensitized to lab animals. *IC+ with BSA; **SIC+ with aqueous BSA
Clam's liver	-	1	Karlin, 1979	3; case report	1	1	1/1	1/1		nd	1/1	nd	1/1		nd		nd	nd		1/1*			1/	/1**		nd		Drug research employee. *Reaction type not listed; **IC
Endocrine glands (ovaries, testes, pancreas, adrenal glands) of bovine origine	-	1	Breton, Leneutre et al., 1989	3; case report	1	1	1/1	1/1		nd	nd	nd	1/1		1/1		nd	nd		1/1*		1	1	1/1		nd		Pharmacist. *SIC done with powdered bovine testes and adrenal glands
Honey	-	1	Johnson, Dittrick et al., 1999	3; case report	1	1	1/1	nd		nd	1/1	1/1	1/1		0/1		1/1	1/1		1/1			1 1	1/1		1/1		Worker in a breakfast cereal-producing company
Ivory (Loxadonta africana)	-	-	Armstrong, Neill et al., 1988	3; case report	1	[1]	1/1	nd		nd	nd	nd	1/1		nd		nd	1/1*		1/1		1	C	0/1		nd		Worker in an ivory carving shop. *Serial FEV1 at work and off-work for 2 weeks
Shark cartilage	-	1	Ortega, Kreiss et al; 2002	3; case report	1	[1]	1/1	nd		nd	1/1	nd	1/1		nd		nd	nd		nd			r	nd		nd		Industrial mill worker with physician diagnosed and autopsy confirmed asthma
Milk proteins												· · · · ·						L.			1 1		11					1
Milk powder	-	4	Sripaiboonkij, Phanprasit et al., 2008	2-; cross- sectional	167	[2 (1.2)]	2/167*	1.2 59/167	35.3	55/167 **	32.9 31/167 18. ** 6	42/167	25.1 nd		x***		nd	nd		nd			r	nd		nd		Milk powder factory workers. *Physician diagnosed asthma within past 12 mo.; **symptoms within past 12 mo.; ***sign. decreased FEV1 in exposed
Alpha-lactalbumin	=		Bernaola, Echechipía et al., 1994	3; case report	1	1	1/1	1/1		1/1	1/1	nd	1/1		0/1		1/1	nd		1/1		1	1	1/1		1/1		Chocolate candy maker. Conj Ch+
Casein (main milk protein)	_		Olaguibel, Hernandez et al., 1990	3; case report	1	1	1/1	1/1		nd	1/1	nd	1/1		nd		1/1	nd		1/1		1	1	1/1		1/1		Tannery worker
Milk proteins	_		Rossi, Corsico et al., 1994	3; case report	1	1	1/1	1/1		1/1	1/1	nd	1/1		0/1		0/1	nd		1/1*		1	1/	/1**		1/1**		Delicatessen factory worker. *SIC+ with sodium caseinate, **SPT+ and IgE+ with lactoalbumin and case
Milk proteins (casein, lactoglobulin)			Vargiu, Vargiu et al., 1994	3; case report	1	1	1/1	1/1		nd	nd	nd	1/1		nd		nd	nd		nd			1	1/1		1/1		Cattle farmer
Egg proteins																												
Egg white, lysozyme, ovalburnin, ovomucoid, egg yolk	**	36	Smith, Bernstein et al., 1990	2-; cross- sectional	188	14 (7.4)	58/188	30.9 nd		nd	nd	nd	58/188	30.9	nd		nd	19/86	22	nd			29	9/86	33.7	25/86	29	Employees of egg products production plant. 44/58 symptomatics and 44 asymptomatics underwent SPT, IgE, PFT; asthma cases defined by dual concordance between the physician diagnosis of asthma, WRS and SPT+ with ≥ 2 egg proteins
Egg protein			Smith, Bernstein et al., 1987	2-; follow-up/ cross- sectional ?	94	5 (5.3)	9/25*	nd		nd	nd	nd	23/94	24.5	3/25		nd	5/25*		nd			8/	8/21		4/19		25 egg workers from initial survey (n=94) were studied in detail. *Physician diagnosed asthma; **all 5 PFT+ were SPT+; 5 additional possible asthma cases among non- participants in the follow-up
Egg proteins Conalburnin	-		Bernstein, Smith et al., 1987	2-; survey	25	5 (20)	6/25	24 0/25		0/25	0/25	0/25	6/25	24.0	nd	-	nd	6/25	24	nd			8/	/25	32.0	4/19	21.1	Workers in an egg-processing factory. 5 subjects had WR asthma, PFT+ and SPT+ to at least 1 egg allergen

Agents	Strength of	Total no.	Reference		Occupa-	Allergic								EVIDE	ENCE (pa	tholog	ical results)										Remarks
	evidence per agent (three	of allergic		evidence per study	tionally exposed	asthma cases due to				WORK-R	ELATED SYMPTON	IS			LF	т	NSBHR	sPF	т		SIC			SPT	S	ipec. IgE	
	star system of RCGP)	asthma cases		(revised SIGN grading	subjects studied,	mentioned agent, n,	Asthr	na	Rhinitis	Con	unct. Cough	Skin	То	tal				-			R	eaction					_
		per agent, n		system); study	n	prevalence (%). Cases with probable allergic asthma but																					
				type.		specific sensitization	1																				
						not confirmed in parantheses [] or not indicated.				n/n		n/n			n/n		n/n	n/n									
							n/n <mark>Ast</mark>	% n/ı	Rhin 🤊	6 Conj	% n/n Cou %	Skin	% n/n Tot	%	LFT	%		% PFT	% 1	n/n <mark>SIC</mark>	% i (n)	l (n) d (r					
Egg white Egg yolk																							1/25	0	0/1	19 0	
Lysozyme Ovalbumin	-																						4/25		1/1	19 5. 19 21	
Ovomucoid Whole egg	-																						4/25	16	4/1	19 21 19 2	.1
igg proteins: egg white and yolk	_		Edwards, McConnochie et al., 1983	3+; survey	13	[5 (38.5)]	5/13	38.5	/13 7.	7 nd	7/13 53	. nd	8/13	61.5	1/13	7.7	nd	nd		nd			2/13		4 4/13		8 Bakery workers. Sensitized asthmatics not listed; *SP with egg white, egg yolk and chicken serum; 1 with SF was symptomatic. **IgE with ovalbumin, 2 were symtomatic. Sensitized asthmatics not listed
gg proteins: lysozyme, egg white and olk	_		Leser, Hartmann et al., 2001 ABSTRACT	3+; case series	6	4 (66.6)	4/6	66.6	6/6 10	0 6/6	100 nd	nd	6/6	100	+		+	2/6	33.3	nd			2/6	33.3	3 6/6	6 10	4 bakery and 2 confectionary workers. 3/6 IgE+ to eg white, 4/6 IgE+ to egg yolk, 4/6 IgE+ to lysozyme; 3/6 had allergic symptoms after egg eating
gg proteins	_		Escudero, Quirce	3; case	4	4	4/4		4/4	nd	nd	1/4	4/4		1/4		4/4	nd									Bakery workers, all sensitized to wheat, rye and barle
Egg white Egg yolk	-		et al., 2003	reports			-							-			+ - +						4/4 2/4		4/4		
Lysozyme (Gal d 4) Ovalbumin (Gal d 2)	-																			4/4 2/2	4		4/4 2/4		2/4	4	_
Ovomucoid (Gal d 1)	-		Voloro Livebat	3; case	2	1 (50)	1/2	50	2/2 10	00 nd		2/2	100 2/2	100	nd		nd	nd		1/1	1		1/4		2/4	4	0 Confectionary workers #SPT: and InF : with a first
gg white			Valero, Lluch et al., 1996	3; case reports	2	1 (50)	1/2	50	2/2 10	JU na	nd	2/2	100 2/2	100	na		na	na		nd			2/2	100) 2/2	2" 10	0 Confectionary workers. *SPT+ and IgE+ with various of proteins; 2/2 nasal Ch+ with egg white and wheat
			Blanco Carmona, Juste Picón et al., 1992	3; case report	t 1	1	1/1		nd	nd	nd	nd	1/1		nd		nd	nd		1/1	1		1/1		1/*	1	Confectionary worker
gg lysozyme			Bernstein, Kraut et al., 1993	3; case report	t 1	1	1/1		nd	nd	nd	nd	1/1		nd		1/1	1/1*		1/1	1		1/1		1/	1	Lysozyme production worker. *PEFR for 2 weeks at work. Also SPT+ and IgE+ to conalburnin, ovomucoid ovoalburnin
	_		Anibarro Bausela and Fontela, 1996	3; case report	t 1	1	1/1		1/1	1/1	1/1	nd	1/1		0/1		1/1	1/1*		1/1	1		1/1		1/	1	Cheese factory worker, co-exposure and co-sensitiza to pepsin. *PEFR for 5 days off-work and 1 day at wo
PLANTS (PLANTAE) Family Amaranthaceae		1			1	1		<u> </u>			J I I	<u> </u>			11												
razil ginseng root (Pfaffia paniculata)	-	1	Subiza, Subiza et al., 1991	3; case report	t 1	1	1/1		1/1	1/1	1/1	nd	1/1		nd		1/1	nd		1/1	1		1/1		1/	1	Laboratory worker
Family Apiacea=Umbelliferae		1				1		1 1			<u> </u>	1											1		1		
ishop's weed (<i>Ammi maju</i> s), Queen nne's lace	-	1	Kiistala, Mäkinen- Kiljunen et al., 1999	3; case report	t 1	1	1/1		1/1	1/1	nd	1/1	1/1		0/1		0/1	nd		nd			1/1		1/*	1	Florist. Nasal Ch+
arrot (Daucus carota)	-	3	Quirce, Blanco et al., 1997	3; case reports	2	1 (50)	1/2	50	2/2 10	0 1/2	50 1/2 50	2/2	100 2/2	100	nd		0/1 0	% nd		1/1	100 1		2/2	100) 2/2	2 10	Housewives handling raw carrots. 2/2 HR+; 1/1 conj C also 2/2 SPT+ with celery and the Apiaceae spices
carrot			Moreno-Ancillo, Gil-Adrados et al., 2005	3; case report	t 1	1	1/1		1/1	nd	1/1	1/1	1/1		nd		nd	nd		1/1			1/1*		1/*	1	Cook. *SPT+ to carrot, cellery, aniseed and fennel
Coriander (Coriandrum sativum)	-	1	Sastre, Olmo et al., 1996	3; case report	t 1	1	1/1		1/1	nd	nd	nd	1/1		nd		1/1	nd		1/1	1		1/1		1/*	1	Butcher co-exposed to mace and paprika. See mace and paprika
ennel seed (Foeniculum vulgare)	-	1	Schwartz, Jones et al., 1997	3; case report	t 1	1	1/1		1/1	nd	1/1	nd	1/1		1/1		nd	nd		nd			1/1		1/*	1	Sausage processing worker
Family Araceae		1	1	1	1	1								1	1 1	1		1									
anha (Pinellia ternata)	-	1	Park, Kim et al., 1994	3; case report	t 1	1	1/1		1/1	nd	1/1	nd	1/1		nd		0/1	nd		1/1		1	1/1		0/'	1	Employee at herbal medicine pharmacy. Co-exposure and co-sensitization to Sanyak; see Sanyak
Canari palm pollen (Phoenix canariensis,	-	1	Blanco, Carrillo et al., 1995	3; case report	t 1	1	1/1		1/1	1/1	1/1	1/1	1/1		0/1		1/1	nd		1/1	1		1/1		1/*	1	Gardener. Sign.cross-reactivity btw. P. c. pollen and d palm (P. dactylifera) pollen

Agents	Strength of	Total no.	Reference		Occupa-	Allergic										EVID	ENCE (pa	thologi	ical result	s)							Remarks
	evidence per agent (three	of allergic		evidence per study	exposed	asthma cases due to				WC	ORK-RELA	TED SYMP	PTOMS	1			LF	т	NSBH	IR sPFT		SIC			SPT	Spe	c. IgE
	star system of RCGP)	asthma cases		(revised SIGN grading		mentioned agent, n,	Asth	ma	Rhini	itie	Conjunc	t. Cou	uab	Skin	Tot	al							Reactio	n			
		per agent, n		system); study	n	prevalence (%). Cases with probable			, and		conjuno		.g.,	Unit								_	nouou				
		•		type.		allergic asthma but specific sensitization not confirmed in																					
						parantheses [] or not indicated.					n/n			n/n			n/n		n/n	n/n							
						not maloated.	n/n Ast	%	n/n <mark>Rhin</mark>	%		% n/n <mark>Co</mark>	<mark>u</mark> %	Skin %	n/n Tot	%	LFT	%	NSBHR	% PFT %	6 n/n <mark>SIC</mark>	% i	n) I (n) o	i (n) n/n <mark>S</mark>	PT 9	6 n/n lgE	%
Family Araliaceae																											
Jmbrella tree (Schefflera)	_	1	Grob, Wüthrich et	3; case report	t 1	1	1/1		1/1		1/1	nd		nd	1/1		nd		nd	nd	nd			1/		1/1	Indoor gardener. Co-exposure and co-sensitization to
	-		al., 1998																								Ficus benjamina
Family Asclepiadaceae																											
Madagascar jasmine (Stephanotis floribunda)	[*]	4	Zee van der, de Jager et al., 1999	3+; cross- sectional	34	4 (11.8)	4/34	11.8	nd		nd	nd		+**	9/34**	26.5	0/3		1/3	2/2	1/1			1 4/8	3	9/34***	26.5 Greenhouse employees from 5 nurseries including 4 index cases. **5 subjects with "airway and skin
ionsunda j	1 1		ougor or un, rooo	oootionai																							symptoms" and 4 index cases with asthma; ***only
																											symptomatics were IgE+
Family Bombacaceae																											
																	1										
Kapok (Ceiba pentandra Gaertner)	-	-	Kern und Kohn, 1994	3; case report with follow-up	1	[1]	1/1		nd	1	nd	1/1		nd	1/1		1/1		nd	nd*	1/1			1 0/*		0/1	Sewer. *0/9 PFT+ co-workers
Family Brassicaceae (Cruciferae)																	1										
Arabidopsis thaliana		1	Yates, De Soyza	3; case report	t 1	1	1/1		nd		nd	1/1		nd	nd	-	0/1*		1/1	1/1	1/1			1/*		nd	Research student working with A. thaliana. *LF
	-		et al., 2008							1																	showed a mild airway obstruction (about 16 % decrea in FEV1)/(FVC)
Cabbage		1	Quirce, Madero et	3; case report	t 1	1	1/1		1/1		1/1	1/1		1/1	1/1		0/1		0/1	nd	nd			1/*	1	1/1	Kitchen supervisor co-exposed and co-sensitized to
	-		al., 2005																								cauliflower. See cauliflower
Cauliflower (<i>Brassica oleracea</i> var. Botrytis)	-	1	Quirce, Madero et al., 2005	3; case report	t 1	1	1/1		1/1		1/1	1/1		1/1	1/1		0/1		0/1	nd	1/1			1 1/		1/1	Kitchen supervisor co-exposed and co-sensitized to cabbage. See cabbage
Cauliflower (Brassica oleracea var.			Hermanides.	3+: cross-	54	(0 (0 7))	2/24	8.3	23/24	96	18/24	7/04	29	40/24	24/54	44	nd		nd		-			22/2	41 0	6 14/24*	
Botrytis) and Broccoli (B. oleracea	-		Lahey- de	sectional	54	[2 (3.7)]	2/24	0.3	23/24	90	10/24	75 7/24	29	10/24	24/54	44	na		na	nd	nd			22/2	4* 9	0 14/24	*SPT and RAST for the 24 workers with WRS. Sensiti
italica/cymosa)			Boer et al., 2006																								asthmatics not listed.
Oilseed rape flour		3	Alvarez, Estrada	3; case	3	2 (66.6)	3/3	100	3/3	100	3/3 1	00 0/3	0	0/3 0	3/3	100	0/3	0	3/3	100 nd	2/3	66.6	2	3/3	3 10	0 3/3	100 Farmers handling animal fodder
	-		et al., 2001	reports																							
Oilseed rape (Brassica napus spp., oleifera)			Suh, Park et al., 1998	3; case report	t 1	1	1/1		nd		nd	1/1		nd	1/1		nd		0/1	nd	1/1		1	1/*	I	1/1	Employee in the animal feed industry.
White wall rocket pollen (Diplotaxis		1	Brito, Mur et al.,	3; case	2	1 (50)	1/2		2/2		2/2	1/2		nd	2/2		nd		1/1	1/1	1/1			2/2	2	2/2	Vinyard farmers
erucoides)	-		2001	reports		. ,																					
			Garcia-Ortega, Bartolome et al.,	3; case reports	3	0	0/3		3/3		3/3	nd		nd	3/3		nd		nd	nd	nd			3/3	3	3/3	3 occupationally exposed (vineyard workers) out of 41 allergic patients who unterwent SPT with D. e. 14/410
			2001	Topono																							allergic patients were SPT+ to <i>D. e.</i> . 9/12 SPT+ subje were nasal Ch+
White mustard (Sinapis alba)		-	Anguita, Palacios	3+; cross-	12	[11 (91.6)]	11/12	91.6	12/12	100	nd	nd		nd	nd		nd		nd	nd	nd			12/	12 10	0 12/12	100 Olive farmers. No pulmonological assessment except
	-		et al.,2007	sectional																							nasal chalange test (NCT). NCT+ in all farmers.
Family Cactacea																											
Carnation (Dianthus caryophyllus)	-	1	Paulsen, Stahl Skov et al., 1997	3+; case series	5	1 (20)	1/5	10	3/5	60	2/5	10 nd		5/5 100	0 5/5	100	nd		nd	nd	nd			5/	5 10	00 5/5	100 SPT and IgE+ with at least 1 cultivar of cactus
Family Cannabaceae					1 1					1	I I							· · · ·	1 1								
Hops (Humulus lupulus)		1	Newmark, 1978	3: case report	1 1	1	1/1	1 1	1/1		1/1	nd	1 1	1/1	1/1	1	nd	 1	nd	nd	nd	1		1/1		nd	Brewery worker. *Scratch test+ with hops flowers
	-	'		2, 0000 100011								nd								10	10					IN	Sionery nonce. Control test with tops howers
Family Caryophyllaceae																											
Baby's breath (Gypsophila paniculata)	_	3	Antépara,	3; case report	t 1	1	1/1		1/1		1/1	1/1		nd	1/1		0/1		nd	nd	1/1			1/		1/1	Florist
	-		Jáuregui et al., 1994							1																	
	1		Schroeckenstein,	3; case report	t 1	1	1/1		1/1		1/1	1/1		nd	1/1		0/1		nd	nd	1/1			1/*		1/1	Florist
			Meier-Davis et al., 1990							1																	
	-		Twiggs,	3; case report	1	1	1/1		1/1		1/1	nd	+	nd	1/1		nd		nd	nd	1/1	+ +		1/*		1/1	Florist
			Yunginger et al., 1982							1																	
	+		Vidal and Polo,	3; case report	1	0	0/1		1/1	-	1/1	nd		1/1	1/1		0/1		0/1	nd	nd		+	1/'		1/1	Flower supplier co-exposed and co-sensitized to
			1998	,						1					1	1	1				1						Dianthus caryophillus and Lilium longiforum; see also

Agents	Strength of	Total no.	Reference	Level of	Occupa-	Allergic										EVIDE	NCE (patho	logical results	5)										Remarks
	evidence per agent (three star system	of allergic asthma		evidence per study (revised	tionally exposed subjects	asthma cases due to mentioned			WORK	-RELA	TED SYM	PTOM	8				LFT	NSBH	R	sPFT		SIC			SP	т	Spec	c. IgE	
	of RCGP)	cases per agent, n		SIGN grading system); study	studied,	agent, n, prevalence (%). Cases with probable allergic asthma but	Asthma	Rh	initis (Conjunct	. Co	ugh	Ski	n	То	otal							React	ion					
				type.		specific sensitization not confirmed in parantheses [] or not indicated.	n/n Ast %	n/n Phi		/n	% n/n Co	9/	n/n Skin	%	n/n Tot	%	n/n LFT 9	n/n % NSBHR		n/n			(n) (n)	d (p)(
Carnation (Dianthus caryophyllus)	(*)	15	Sanchez- Guerrero, Escudero et al., 1999	3+; case series	16	13 (81.25)	15/16 93.			nd .	nd		1/16							PFT % 3/14* 92.5		<u>c %</u> i					n/n lgE 11/14	78.6	Employees in indoor carnation cultivation. *Serial PEFR for 2 weeks at work and 2 weeks off-work
				3; case report	: 1	1	1/1	nd	r	nd	1/1		nd		1/1		0/1	1/1		nd	1/1		1		1/1		1/1		Flower cultivator co-exposed and co-sensitized to Tetranychus urticae .
•			Sáncher- Fernández, González- Gutiérrez et al., 2004	3; case report	1	1	1/1	1/1	1	/1	nd		nd		1/1		nd	1/1		nd	1/1			1	1/1		1/1		Flowershop worker.
•			Vidal and Polo, 1998	3; case report	1	0	0/1	1/1	1	/1	nd		1/1		1/1		0/1	0/1		nd	nd				1/1		1/1		Flower supplier co-exposed and co-sensitized to Gypsophila paniculata and Lilium longiforum; see also Gypsophila paniculata and Lilium longiforum
Family Chenopodiaceae													1															<u> </u>	
Swiss chard (Beta vulgaris L. cycla)	-	2	Parra, Lázaro et al., 1993	3; case report	1	1	1/1	1/1	1	/1	1/1		nd		1/1		0/1	1/1		nd	1/1			1	1/1		1/1		Housewife inhaling vapors of boiling Swiss chard
*			Hoz de la, Fernandez-Rivas et al., 1991	3; case report	1	1	1/1	1/1	1	/1	nd		nd		1/1		0/1	1/1		nd	1/1		1		1/1		1/1		Housewife. HR+; oral Ch-
Family Compositae=Asteraceae														1															
Artichoke, globe (Cynara scolymus)	-	3	Miralles, Garcia- Sellés et al., 2003	3; case reports	2	2	2/2	2/2	C	/2	0/2		1/2		2/2		0/2	nd		1/1	nd				2/2		2/2		Vegetable warehouse workers. 2/2 nasal Ch+
и	_		Quirce, Tabar et al., 1996	3; case report	1	1	1/1	1/1	1	/1	1/1		1/1		1/1		0/1	0/1		nd	0/1				1/1		1/1		Worker in a vegetable-processing plant
Camomile (Matricaria charnomilla)	-	1	Rudzki, Rapiejko et al., 2003	3; case report	1	1	1/1	1/1	1	/1	nd		1/1		1/1		nd	nd		nd	nd				1/1		nd		Cosmetician co-exposed and co-sensitized to lime flower. *Nasal Ch+
Chicory (Cichorium intybus)	-	4	Cadot, Kochuyt et al., 1996	3; case report	1	1	1/1	1/1	1	/1	nd		1/1		1/1		nd	nd		nd	nd				1/1		1/1		Vegetable wholesaler
			Nemery and Demedts, 1989	3; case report (letter)	1	1	1/1	1/1		/1	1/1		1/1		1/1		1/1	1/1		1/1*	nd			1	/1**		nd		Chicory grower. *Serial PEF for 4 weeks; **patch (delayed reaction)
•			Escudero, Bartolomé et al., 1999	3; case report	1	1	1/1	1/1	ſ	nd	nd		1/1		1/1		0/1	1/1		1/1*	nd				1/1		1/1		Grocery store worker, co-exposed and co-sensitized to lettuce. *PEFR for 2 weeks; see lettuce
			Pirson, Detry et al., 2009	3; case report	: 1	1	1/1	1/1	1	/1	nd		nd		nd		0/1	1/1		nd	1/1		1		/1*		1/1*		Worker in a factory producing inulin from chicory. He developed an oral allergy syndrome to raw fruits and vegetables. SPT+ for birch pollen, raw carrot,
Chrysanthemum (Chrysanthemum)	[*]	9	Groenewoud, Jong et al., 2002	3+; cross- sectional	104	8 (7.7)	8/104 7.	7 50/10	4 48.1 27/	104 2	26 nd		15/104	14.4	59/104	56.7	nd	nd		nd	nd			21	/104	20.2	11/104	10.6	Greenhouse employees. Cross-reaction between C. and mugwort.
	-		Piirilä, Keskinen et al., 1994	3; case report	1	1	1/1	nd	1	nd	nd		1/1		1/1		1/1	1/1		1/1*	1/1		1		1/1		nd		Florist. *Serial PEFR or FEV1 at home and at work
Flowers (Aster chinensis, Chrysanthemum koreanum, Dahlia cultorum, Solidago virgaurea, and Chrysanthemum leucanthemum)	*	6	Akpinar-Elci, Elci et al., 2004	2-; cross- sectional	128	5 (3.9)	18/128 14	.1 17/12	8 13.3 18	128 14	4.1 10/12	8 7.8	29/128	22.7	'nd		0/128	nd		nd	nd			11	/128*	8.6	nd	1	Florists in 54 floral shops. *SPT with flower mix; 5/18 asthmatics SPT+: asthmatics were sign. more likely to have SPT+; risks for asthma were high work intensity and long work duration
Flowers (dandelion, blazing star, golden rod, yarrow, Aster spp, chrysanthemums, margerite)	1		Uter, Nöhle et al., 2001 ABSTRACT	3; case report	: 1	1	1/1*	1/1	1	/1	-		1/1		1/1		-	-		-	1/1**			1	/1**		1/1**		Florist. *Late asthma; **SIC+, SPT+ and IgE+ to various members of the plant family Compositae
Lettuce (Lactuca sativa)	-	1	Escudero, Bartolomé et al., 1999	3; case report	1	1	1/1	1/1		nd	nd		1/1		1/1		0/1	1/1		1/1*	nd				1/1		1/1		Grocery store worker, co-exposed and co-sensitized to chicory. *PEFR for 2 weeks; see chicory
Marigold flour (Tagetes erecta, Calendula officinalis)	-	1	Lluch-Perez, Garcia-Rodriguez et al., 2009	3; case report	1	1	1/1	1/1	1	nd	nd		nd		nd		nd	nd		nd	nd				1/1		1/1		Porter in an animal fodder factory. Nasal challenge test was positive

Agents	Strength of	Total no.	. Reference	Level of	Occupa-	Allergic asthma cases									EVIDE		thological resul										Remarks
	evidence per agent (three			evidence per study	tionally exposed	due to				wo	ORK-RELAT	ED SYMPT	OMS			LF	T NSBI	HR	sPFT		SIC	:		SPT	Spe	ec. IgE	
	star system of RCGP)	asthma cases		(revised SIGN grading	subjects studied,	mentioned agent, n,	Asthr		Dhini	itio	Conjunct.	Cours	h Skin	Те	tal							Reac	tion				-
		per agent, n		system); study		prevalence (%). Cases with probable	ASUII	na	NIIIII	ius.	conjunct.	Coug	n Skin	10	Lei							Neau	uon				
		-3,		type.		allergic asthma but specific sensitization																					
						not confirmed in parantheses [] or																					
						not indicated.	n/n Ast	%	n/n <mark>Rhin</mark>	%	n/n Conj %	n/n Cou	n/n % <mark>Skin</mark>	% n/n Tot	%	n/n LFT	n/n % NSBHR	n/ % PF		n/n SIC	%	i (n) l (n) d (n) n/n <mark>S</mark>	т %	n/n lgi	E %	
Milk thistle (Silybum marianum)	-	1	Bircher and Wütrich, 1992	3; case report	1	1	1/1		1/1		1/1	nd	nd	1/1	ĺ	nd	nd	n	ł	nd			1/1	Ì	1/1	Ì	Pharmacy employee
Safflower (Carthamus tinctorius)	-	1	Compes, Bartelomé et al., 2006	3; case report	t 1	1	1/1		1/1		nd	nd	1/1	1/1		0/1	1/1	n	ł	1/1		1	1/1		1/1		Instructor of personell making dried flower arrangements See also yarrow
Sunflower pollen (<i>Helianthus annuus</i>)	*	3	Atis, Tutluoglu et al., 2002	2-; cross- sectional	102	[17 (16.6)]	17/102	16.6	*			nd		nd			nd	n	t	nd			24/10	2 23.	5 nd		Sunflower processing factory. *Allergic symptoms (rhinitis, conj., skin) 29/102 (28.4%); ** LFT parameters significant lower in high exposed workers than in unexposed group; sensitized asthmatics not listed
			Jiménez, Moreno et al., 1994	3+; case series	5	2 (40)	2/5	40	5/5	100	5/5 100) nd	2/5	40 5/5	100	nd	nd	n	ł	2/2	100	1	1 5/5	100	4/5	80	5 occupationally exposed workers handling sunflower pollen and 32 non-occupationally exposed
,	_		Bousquet, Dhivert et al., 1985	3; case report	1	1	1/1		1/1		1/1	nd	nd	1/1		nd	0/1	n	ł	1/1		1	1/1		1/1		Employee in the agricultural department
Sunflower seeds	-	1	Vandenplas, Van der Borght et al., 1998	3; case report	1	1	1/1		1/1		1/1	nd	nd	1/1		1/1	1/1	n	ł	1/1		1	1/1		1/1		Baker. Also SPT+ with alpha-amylase and SIC+ with flou
Yarrow (Achillea millefolium)	-	1	Compes, Bartelomé et al., 2006	3; case report	t 1	1	1/1		1/1		nd	nd	1/1	1/1		0/1	1/1	n	ł	1/1		1	1/1		1/1		Instructor of personell making dried flower arrangements See also safflower
Family Cucurbitaceae					11							-			I					-			<u> </u>		_	_	ļ
Courgette (Cucurbita pepo)	-	1	Miralles, Negro et al., 2000	3; case report	t 1	1	1/1		1/1		1/1	nd	nd	1/1		nd	nd	n	ł	nd			1/1		1/1		Worker in the fruit and vegetable warehouse. Nasal Ch+
Family Euphorbiaceae					1 1			1 1				1							-	1	1 1					-	
Castor beans (<i>Ricinus communis</i>)	[*]	16	Topping, Henderson et al., 1982	3+; cross- sectional	70	7 (10)	7/70	10	12/70	17.1	12/70 17.	1 nd	nd	12/70	17.1	nd	nd	no	ł	nd			12/20	* 60	15/23	* 65.2	Workers of felt (mixture of waste natural fibers) manufacturing plant. "SPT and IgE done with castor bear and felt in 23/26 subjects with suspected WRS; all symptomatics sensitized to castor bean and felt
1			Patussi, De Zotti et al., 1990 ABSTRACT	3+; case series	16	.•			•		-	•	-	16/16		nd	nd	n	3	nd			15/10	3	15/15	;	"Workers with asthma or rhinitis handling green coffee beans in sacks which were contaminated with castor beans
			Panzani, Johansson et al., 1986	3+; case series	15	2	13/15*		•		nd	nd	nd	15/15		nd	nd	n	ł	nd			2/15		2/15		6 groups studied, 1 occupationally exposed: 15 SPT- symptomatic farmers handling castor bean fertilizer. *Asthma or allegic rhinitis
	_		Davison, Britton et al., 1983	3+; case series	5	5	5/5		nd		nd	nd	nd	5/5		0/3	nd	n	ł	2/3		2	nd		5/5		3 mechant seamen and 2 laboratory workers
	_		Baur, Chen et al., 1998	3; case report	1	1	1/1		1/1		1/1	nd	nd	1/1		1/1	nd	n	ł	nd			1/1		1/1		Trader of agricultural goods (castor bean fertilizer)
			Merget, Heger et al., 1994			1	1/1		1/1		nd	nd	nd	1/1		0/1	1/1	n	ŧ	1/1*		1	1/1		1/1		Agricultural products merchant. *SIC done with extract of castor bean fertilizer
Copperleaf (Acalypha wilkesiana)	-	1	Perez, Blanco et al., 2006	3; case report	t 1	1	1/1		1/1		1/1	nd	nd	nd		0/1	nd	n	ł	1/1		1	1/1		1/1		Gardener
.atex (Hevea brasiliensis)	**	136	Bousquet, Flahault et al., 2006	2+; systematic review of cross- sectional studies	9056	-		OR: 1.55		OR: 2.73				DR: 46	4.32									7.1	9	6.37	Health care workers. Sensitization sign. assoc. with asthma (OR 3.95) but exposure to latex was not associated with a sign.increased risk of positive SPT (OI 1.47)
,			Archambault, Malo et al., 2001	2+; prospective cohort study	122	5 (4.5)***	1/7*		2/7*		2/7*	nd	6/7*	nd		x**	5/110***	4.5 no	t	nd			7/110	6.4	nd		Apprentices in dental hygiene starting a programm. "Symptoms listed for SPT+ subjects only," "07 in SPT+ subjects only measured at entry," "18 J st Mih BHR+ wer SPT+, cumulative incidence of probable OA (SPT+ and BHR+ 4.5% at 22 months after start of exposure, incidence density 5/282 person-years (1.8%); "***cumulative incidence 6.4%, incidence density 7/282 person-years (2.5%)

Agents	Strength of evidence per	Total no. of	Reference	Level of evidence per	Occupa- tionally	Allergic asthma cases										EVID		hological result										Remarks	
	agent (three star system			study (revised	exposed subjects	due to				WORK-	RELATE	D SYMP1	OMS				LFT	NSBH	HR	sPFT		S	IC		SPT		Spec.	lgE	
	of RCGP)	cases per agent, n		SIGN grading system); study type.		agent, n, prevalence (%). Cases with probable allergic asthma but specific sensitization not confirmed in	Asthr	ma	Rhinit	is Co	njunct.	Coug	h	Skin	Тс	tal							Read	ction					
						parantheses [] or not indicated.	n/n Ast	%	n/n Rhin	n/r % Cor	i %	n/n Cou	n/ı % <mark>Ski</mark>	n %	n/n Tot	%	n/n	n/n % NSBHR		n/n PFT 9	% n/n S	IC %	i (n) l (i	n) d (n) n/n	SPT	%	n/n laE	a/.	
			Liss, Sussman et al., 1997	2-; cross- sectional	1351	23 (1.7)				8.8 205/ 51				-	_		nd	nd		nd	nd				132	12.1	nd	Hospital workers. 23 asthmatics SPT+; sig associations between SPT+ and WRS	sign.
			Chaiear, Sadhra et al., 2001	3+; cross- sectional	814		186/814	22.9	200/814	24.6 323/4	31 39.7	200/81 4	24. 183/ 6 4		5 nd		nd	nd		nd	nd			12/	795	1.5	nd	500 latex glove factory workers and 314 la *Sensitized asthmatics not listed but work respiratory and dermatological symptoms were not related to the presence of positiv latex SPT.	ork-related ns itive
			Grzybowski, Ownby et al., 1996	2-; cross- sectional	741	[27 (3.6)]	27/741	3.6	99/741	13.4 96/7	13.0	nd	423/ 1	74 57.	1 448/74	1 60.5	nd	nd		nd	nd			n	d		65/741	 Registered nurses. 56 symptomatics IgE+ asthmatics not listed; WRS sign. associate 	E+; sensiti iated with I
			Carrillo, Blanco et al., 1995	sectional	418	•	*		*	nd		nd	23/4		75/418		nd	nd		nd	nd			21/-				3.8 Agricultural workers. *20/418 nasal and/or complaints; sign. association between ser symptomatics and duration of exposure	sensitized
			Hunt, Fransway et al., 1995	3; case series	342	43 (12.6)	43/104*	41.4	72/104*	69.2 66/1	04 63.5	nd	81/1	04 77.	9 342/342	2 100.0	0 nd	nd		nd	nd			104	342 :	30.4	36/58**	Health care workers with symptoms sugger allergy. *Individual WRS listed in SPT+ on SPT+	gestive of only; **IgE
	_		Vandenplas, Delwiche et al., 1995	3+; Cross- sectional	273	7 (2.6)	5/273	1.8	25/273	9.2 25/2	73 9.2	nd	19/2	73 7	nd		1/12*	12/12*		nd	7/12		4	3 13/	273	4.8	nd	Hospital employees. *Only sensitized subj clinical tests; in addition to 5 asthmatics 2 were SIC+, NSBHR+ and SPT+	ibjects und 2 other su
			Tarlo, Sussman et al., 1997	2-; cross- sectional	203	6 (3.0)	10/203	4.9	24/203*	11.8 +*		nd	34/2	03 17	48/203	23.6	ind	nd		nd	nd			13/1	31**	10.0	nd	Dental students and staff. *Rhinitis or conj astmatics SPT+, 1 astmatic not tested; Sf associated with asthma (WRS)	unj.; **6/9 SPT+ sigr
			Baur, Chen et al., 1995	2-; cross- sectional	111	3 (2.7)	4/111	3.6	12/111	10.8 10/1	11 9	nd	26/1	11 23.	4 32/111	28.8	nd	nd		nd	nd			n	d		17/111	15.3 Hospital staff. WRS sign. associated with asthmatics sensitized	th IgE+; 3
			Tarlo, Wong et al., 1990	3+cross- sectional with index case	81	3 (3.7)	42/69	60.9	52/69	75.4 nd		nd	7/6	9 10.	2 53/69	76.8	1/1	6/12		6/51	nd			8/	65 ·	10.9	nd	Employees in a surgical glove manufactur Results include 1 index case; 3 subjects h WRS, SPT+, BHR+, and PFT+; not all ast underwent clinical tests	s had asth
			Zuskin, Mustajbegovic et al., 1998	2-; cross- sectional	17	1 (5.9)	8/17	47.1	nd	13/1	7 76.5	10/17	58. no 8	I	nd			nd		nd	nd			1/	17	5.9	nd	Employees of a latex glove manufacturing *Sign. lower FVC, FEV1, FEF50, and FEF had symptoms of OA (asthma and LFT+)	EF75; 1 s
	_		Vandenplas, Binard-van-Cangh et al., 2001	3+; case series	45	31 (68.8)	36/45	80	43/45	95.5 nd		nd	40/4	15 88.	8 45/45	100	nd	44/45	97.7	nd	6/14	* 68.8		42	45 9	93.3	nd	45 latex exposured subjects. All SIC+ we	<i>i</i> ere also
			Baur, Jäger et al., 1992	3+; case series	56	6 (10.7)	24/56	42.9	12/56*	21.4 +*		nd	56/	i6	56/56	100	nd	nd		nd	6/23	** 26.1		56	56	100	50/56	89.3 SPT+ hospital personnel. *Rhinitis or conj. asthmatics, reaction type not listed	nj.; **SIC
			Jäger, Kleinhans et al., 1992	3+; case series	70	5 (7.1)	22/70	31.4	36/70	51.4 31/7	0 44.2	nd	70/	0 10	0 70/70	100	nd	nd		nd	5/18	3* 27.8		38/	45	84.4	43/70	'61.4 Hospital personnel. *SIC in IgE+ symptom	matics
	_		Orfan, Reed et al., 1994	3+; survey with index case	22	2 (9)	2/22	9	2/22	9 2/2	2 9	nd	no		2/22	9	nd	nd		nd	1/1		1	2/2	22	9	nd	Workers of a latex doll manufacturing plan include index case	ant. Resu
	_		Anibarro, Seoane et al., 2010	3; case report	1	1	1/1		1/1	1/1		nd	no		nd		0/1	1/1		nd	nd			0)	'1		1/1	Butcher. Had no direcht contact with latex, the coworkers latex gloves.	ex, source
enetia volubilis seeds	-		Bueso, Rodriguez-Perez et al., 2010	3; case report	1	1	1/1		1/1	1/1		1/1	no		nd		0/1	nd		nd	1/1		1	1/	1		1/1	Worker in a cosmetic company	
Family Iridaceae															•	•													
esia (Freesia hybride)	-	1	Toorenenbergen van and Dieges, 1984	3; case report	1	1	1/1		nd	nd		nd	no		1/1		nd	nd		nd	nd			1/	1		1/1	Greenhouse worker. Clinical tests done wi stem	with flowe
			et al., 1994	3; case report	1	[1]	1/1		nd	1/1		nd	no		1/1		0/1	1/1		1/1*	0/1			0)			nd	Gardener. *PEFR or FEV1 at home and a	
ron pollen (Crocus sativus)	-	1	Feo, Martinez et al., 1997	3+; Cross- sectional	50	1 (2)	3/50	6	8/50	16 2/5) 4	nd	4/5	0 8	nd		nd	1/1*		nd	1/1		1	3/	50	6	3/50	6 Saffron workers. *NSBHR and SIC in sens ; 2/2 conj Ch+	ensitized a

Agents		Total no.	Reference		Occupa-	Allergic										EVIDENC	E (patho	ologica	al results)									Remarks
	evidence per agent (three	of allergic		evidence per study	tionally exposed	asthma cases due to mentioned				WORK-	RELATE	D SYMPTO	MS				LFT		NSBHR	sPFT		SIC			SPT		Spec. Ig	E
	star system of RCGP)	asthma cases		(revised SIGN grading		agent, n,	Asthr	na	Rhinitis	s Co	njunct.	Cough	Sk	in	Tot	al							Reaction	1		_		
		per agent, n		system); study type.	n	prevalence (%). Cases with probable allergic asthma but specific sensitization not confirmed in parantheses [] or																						
						not indicated.	n/n Ast	% n/n	Rhin	n/r % Cor	n ni %	n/n Cou	n/n % Skin	%	n/n Tot		n/n		n/n	n/n PFT %	n/n <mark>SIC</mark>	% i(n) I (n) d	(n) n/n 9	от с		n IgE	e/
Bells of Ireland, pollen of (<i>Molucella laevis</i>)	-	1	Miesen, van der Heide et al., 2003	3; case report	1	1	1/1	1,		1/1		1/1	nd	~	1/1		0/1	10	1/1	1/1*	1/1	70 1		1 1/			1/1	Greenhouse employee. 18% decline of FEV1 during seasonal exposure; *serial PEFR for 1 week
Family Leguminosae			•	1				1 1		1	1					ı .				· · · · ·				1				
Carob bean flour (Ceratonia siliqua)	-	3	Brempt van der, Ledent et al., 1992	3; case report	1	1	1/1	1.	/1	1/1		1/1	nd		1/1		1/1		nd	1/1	1/1			1 no			1/1	Employee in a jam factory co-exposed and co-sensitized to guar gum
8			Scoditti, Peluso et	3; case report	1	1	1/1	n	nd	nd	1	1/1	nd		1/1		0/1		1/1	nd	1/1	1		1/	1		1/1	Ice cream maker
Carob bean tree-St. John's bread seed	-		al., 1996 Bircher and Wütrich, 1992	3; case report	1	1	1/1	1.	/1	1/1		nd	nd		1/1		nd		nd	nd	nd			1/1			1/1	Ice cream production worker, co-exposed and co- sensitized to Tragacanth gum. *Scratch test; see Tragacanth gum
Chick pea (Cicer arietinum)	-	1	Martin, Compaired et al., 1992	3; case report	1	1	1/1	1.	/1	nd		1/1	nd		1/1		D/1		1/1	nd	1/1	1		1/			1/1	Houseman, co-exposed and co-sensitized to lentil. HR+, see lentil
Chickling vetch (Lathyrus sativus)	-	1	Valdivieso, Quirce et al., 1988	3; case report	1	1	1/1	1.	/1	nd		nd	nd		1/1		D/1		1/1	nd	1/1	1		1/	I		1/1	A 10-year-old child in the family store
Green bean (Phaseolus multiflorus)	-	2	Igea, Fernandez et al., 1994	3; case report	1	1	1/1	1.	/1	1/1	1	nd	1/1		1/1		0/1		1/1	nd	1/1	1		1/	1		1/1	Homemaker exposed to vapor of boiling green beans. SPT- with cooked green beans
8	-		Parra, Lázaro et al., 1993	3; case report	1	1	1/1	1.	/1	1/1		1/1	nd		1/1		0/1		1/1	nd	1/1			1 1/	1		1/1	Housewife inhaling vapors of boiling GB, co-exposed and co-sensitized to Swiss chard.
Guar gum (Cypamopsis tetragonolobus)	*	6	Malo, Cartier et al., 1990	2-; cross- sectional	162	3 (1.9)	37/162	22.8 59/	162	36.4 nd		nd	17/162	10.5	5 nd	3	\$/40 7	7.5 1	1/40* 27.5	0/5**	2/4***	50 2		8/1	62 4	.9 11	/133	 8.3 Employees of a carpet manufact. plant. *NSBHR in symptomatics or sensitized only; **Serial PEFR for 2 weeks at work in SPT- and NSBHR+ subjects; **SIC
н	-		Lagier, Cartier et al., 1990	3; case reports	3	3	3/3	3	/3	1/3	3	nd	nd		3/3		1/3		3/3	1/1	3/3	2	:	1 3/3	3	:	3/3	not in asthmatics_SPT+ and NSRHR+ 1 pharmaceutical worker and 2 carpet-manufacturing workers.
Gum arabic (Acacia senegal)	(*)		Bohner, Sheldon et al., 1941	3+; case series	10	10	10/10	n	nd	nd		nd	nd		10/10		nd		nd	nd	nd			10/	10		nd	Printers
n	-		Sander, Raulf- Heimsoth et al., 2006	3; case report	1	1	1/1	1.	/1	1/1		nd	nd		1/1		0/1		0/1	nd	1/1	1		1/			1/1	Pharmaceutical industry worker
Lathyrus sativus flour	-		León, Martín Calderín et al., 2001	3; case report	1	1	1/1	1.	/1	nd		1/1	nd		nd		nd		1/1	1/1	1/1	1		1/			1/1	Worker in parquet processing.
Lathyrus sativus flour	-		Gironés, de la Hoz Caballer et al., 2005	3; case report	1	1	1/1	1.	/1	nd		nd	nd		nd		0/1		1/1*	nd	1/1	1		1/	1		1/1	Carpanter. *NSBHR was absent 24h before and presen 72h after SIC.
Lupine (<i>Lupinus albus</i>)	-		Campbell, Jackson et al., 2007	2-; cross- sectional	53	2 (3.8)	3/53	5.7 10	/53	18.9 2/5	3 3.8	2/53 3	.8 1/53	1.9	16/53	30.2 2	2/53 3	3.8	2/4	nd	1/1			1 11/	53 20	0.8	nd	Workers in a food processing company. 7/11 sensitize workers had WRS. Out of 3 asthmatics, 2 had SPT+, 1 suffered from work-aggravated asthma.
Lupine seed flour (Lupinus albus)	-		Crespo, Rodríguez et al., 2001	3+; cross- sectional	7	1 (14.3)	1/7	14.3 2	/7 :	28.6 3/7	42.9		4. nd 3		3/7	42.9	nd		1/1	nd	1/7	14.3 1		3/	42	2.9	2/7 2	28.6 Employees at legume laboratories.
Acacia (Gum arabic)			2001 Fowler, 1952	cross-	31	[6 (19.4)]	6/31	19.4		_	+	+	_				nd		nd	nd	nd			na		+	nd	12 additional printers had early symptoms of sensitisatio
	-			sectional symptomatic subjects	32	[26 (81.3)]	26/32	81.3	+		+	+			32/32		nd		nd	nd	nd	+		1/			nd	2 additional printers had early symptoms of asthma.
Henna, black (Indigofera argentea)	-	1	Scibilia, Galdi et al., 1997	3; case report	1	1	1/1	1.	/1	1/1		1/1	nd		1/1		1/1	\uparrow	1/1	1/1	nd			1/			1/1	Herbal shop worker.
Lentil (<i>Lens culinaris</i>)	-		Martin, Compaired et al., 1992	3; case report	1	1	1/1	1.	/1	nd		1/1	nd		1/1		0/1	+	1/1	nd	1/1			1/			1/1	Houseman, co-exposed and co-sensitized to chick pea. HR+; see chick pea
Liquorice roots, licorice (<i>Glycyrrhiza</i> glabra)	-	1	Cartier, Malo et al., 2002	3; case report	1	1	1/1	1.	/1	1/1		nd	nd	+	1/1		1/1	+	1/1	1/1	1/1	1		1/			nd	Herbalist co-exposed and co-sensitized to echinacea, nettle, hop, thistle
Mimosa (Acacia floribunda)	-	4	Ariano, Panzani et al., 1991	t 3+; survey	106	4 (11.5)*	4/106	11.5* 29/	106 7	78.5* 29/1	06 78.5	nd	1/106		33/106*	31	nd	+	nd	nd	nd		+	33/10	16**	33/	106**	Floriculturists. *Incidence in 9 years; **Results listed only for symptomatics

Agents	Strength of evidence per	Total no. of	Reference	Level of evidence per	Occupa- tionally	Allergic asthma cases											EVIDEN		-												Remarks
	agent (three star system	allergic		study	exposed subjects	due to mentioned				WOR	K-RELA	ATED S	YMPTOM	8				LFI	r	NSB	HR	sPFT		SIC			s	PT	Spec	c. IgE	
	of RCGP)	cases per agent, n		SIGN grading system); study type.		agent, n, prevalence (%). Cases with probable allergic asthma but specific sensitization not confirmed in parantheses [] or	Asthr	na	Rhin	itis	Conjund	ct.	Cough	Ski	n	Tot	al								Reac	tion					
						not indicated.	n/n Ast	%	n/n Rhin		n/n Conj	% n/r	Cou %	n/n Skin	%	n/n Tot		n/n LFT	%	n/n NSBHR		n/n PFT %	n/n <mark>SIC</mark>	% i	(n) I (n	n) d (n)	n/n <mark>SPT</mark>	%	n/n lgE	%	
Pea, perennial (<i>Lathyrus odoratus</i>), sweetpea	-	2	Jansen, Vermeulen et al., 1995	3; case report	1	1	1/1		1/1		1/1		nd	nd		1/1		nd	Ĩ	1/1		1/1*	nd		Ì		1/1**		1/1***		Greenhouse worker. *Serial PEFR at work and off-work for 4 weeks; **SPT+ with whole plant; IgE+ with pollen
Pea flour			Bhagat, Swystun at al.,1995	3; case report	1	1	1/1		nd		nd		1/1	nd		1/1		0/1		1/1		nd	nd				1/1		nd		Flour mill worker processing peas
Senna and Ispaghula husks	*	6	Marks, Salome et al., 1991	2-; cross- secional	125	4 (3.2)	10/125	8.0	+*		+*		nd	+*		nd		4/119	3.4	9/112**	8	nd	nd				21/118**	17.8	nd		Pharmaceutical workers. *21/115 WR nose, eye, and skin symptoms; "NSBHR in LFT; "*SPT+ with ispaghula and/or senna: 911 BST+ with ispaghula, 18/118 SPT+ with senna: 4 OA, defined as at least one WR respiratory symptom, SPT+ to at least one occupational allergen, and either NSBHR+ or BD+ or physician diagnosed asthma
Senna (Cassia angustifolia, Cassia acutifolia or Cassia senna)	-		Helin and Mäkinen-Kiljunen, 1996	3; case report	1	1	1/1		1/1		1/1		nd	nd		1/1		0/1		1/1		nd	1/1			1	1/1		1/1		Worker in a company manufaturing hair dyes
			Baur and Luderschmidt, 1983	3; case report	1	1	1/1		1/1		nd		nd	nd		1/1		0/1		nd		nd	1/1			1	1/1		1/1		Pharmaceutical worker
Vetch (<i>Vicia sativa</i>)	-	1	Picón, Carmona et al., 1991	3; case report	1	1	1/1		nd		nd		1/1	nd		1/1		nd		1/1		nd	1/1		1		1/1		1/1*		Farmer. *PK
Family Liliaceae																															
Amaryllis (Amaryllis hippeastrum), hybrid cultivate of hippeastrum	-	1	Jansen, Visser et al., 1996	3; case report	1	1	1/1		1/1		nd		nd	nd		1/1		1/1		1/1		1/1*	1/1**		1		1/1***		1/1***		Greenhouse worker. *PEFR during work days and off- work; **SIC+ with pollen; ***SPT+ and IgE+ with pollen, stem, petal
Asparagus (A <i>sparagus officinalis</i>)	(*)	10	Tabar, Alvarez- Puebla et al., 2004	3+; case series	27	8 (29.6)	8/27	29.6	10/27	37	nd		nd	10/27	37	27/27	100	x*		nd		nd	8/10	80	5	3	20/27	74.1	19/27	70.4	Asparagus processing workers etc *Baseline FEV1 >70% of predicted in asthmatics
	-		Eng, Yman et al., 1996	3; case reports	2	1 (50)	1/2*	50	1/2	50	2/2	:	2/2	nd		2/2		nd		nd		nd	nd				2/2**		2/2		Housewives. **WR tightness in the throat and hoarseness" in 1/2 subjects; **prick-to-prick test with ra- green and white asparagus
a	-		Lopez-Rubio, Rodriguez et al., 1998	3; case report	1	1	1/1		1/1		1/1		1/1	nd		1/1		0/1		1/1		nd	1/1		1		1/1		1/1		Harvesting worker. Clinical tests with raw green asparagus; oral Ch-
Daffodil (<i>Narcissus pseudonarcissus</i>), Trumpet narcissus	-	1	Gonçalo, Freitas et al., 1987	3; case report	1	1	1/1		1/1		1/1		nd	1/1		1/1		nd		nd		nd	nd				0/1*		nd		Flower grower. *SPT with $N. p.$ juice; patch test+ with flower and leaf of $N. p.$
Easter Lily (Lilium longiflorum)	-	2	Piirilä, Kanerva et al., 1999	3; case report with follow-up	1	1	1/1		1/1		1/1		1/1	1/1		1/1		0/1		1/1		1/1	1/1			1	1/1		1/1		Floral shop worker. Also IgE+ and SPT+ with tulip
			Lahti, 1986	3; case report		1	1/1		1/1		0/1		0/1	1/1		1/1		nd		nd		nd	nd				1/1		nd		Florist co-exposed and co-sensitized to tulips. See tulip
•			Vidal and Polo, 1998	3; case report	1	0	0/1		1/1		1/1		nd	1/1		1/1		0/1		0/1		nd	nd				1/1		0/1		Flower supplier co-exposed and co-sensitized to Dianthus caryophillus and Gypsophila paniculata; see also Dianthus caryophillus and Gypsophila paniculata
Garlic dust (<i>Allium sativum</i>)	(*)	10	Añíbarro, Fontela et al., 1997	3+; case series	12	6 (50)	12/12	100	12/12	100 1	2/12 1	100	nd	nd		12/12	100	x*		×.		nd	7/12	58.3	5	2	7/12	58.3	5/12	41.6	Gartic workers. 6/7 SIC+ also SPT+; "baseline LFT > 80% predicted; **individual results not listed; 1/2 oral Cl induced a 35% decline in FEV1; cross-reactivity with onion
,	-		Seuri, Taivanen et al., 1993	3; case reports	3	2 (66.6)	3/3	100	3/3	100	3/3 1	100	nd	1/3	33.3	3/3	100	0/3	0	0/1	0	1/1* 100	2/2	100		2	3/3	100	3/3	100	Sausage makers and cook. *Serial PEFR for 1 week o work and 2 weeks at work; 1/1 nasal Ch+ with garlic ar with flour
			Lybarger, Gallagher et al., 1982	3; case report	1	1	1/1		nd		nd		1/1	nd		1/1		nd		1/1		nd	1/1		1		1/1		1/1		Electrician at a spice processing plant. Oral Ch + with garlic induced a 21% decline in FEV1
			Falleroni, Zeiss et al., 1981	3; case report	1	1	1/1		1/1		nd		nd	1/1		1/1		1/1		nd		nd	1/1		1		1/1		1/1		Employee with work-aggravated asthma in a firm packaging spices, similar but milder WRS also by onion IgE+ with onion
Hyacinth (Hyacinthus orientalis)	-	-	Piirilä, Hannu et al., 1998	3; case report	1	[1]	1/1		1/1		1/1		1/1	1/1		1/1		0/1		0/1		1/1*	1/1		1		0/1		nd		Gardener. *Serial PEFR at work and off-work
Onion (<i>Allium cepa</i>)	-	2	Valdivieso, Subiza et al., 1994	3; case reports	4	1 (25)	1/4	25	4/4	100	4/4 1	100	1/4 25	1/4	25	4/4	100	nd		1/2	50	nd	1/2	50	1		4/4	100	3/4	75	3 homemakers and 1 cook.

Agents	Strength of	Total no.	Reference	Level of	Occupa-	Allergic									EVIDE	NCE (pa	thologie	cal results	s)									Remarks
	evidence per agent (three star system	of allergic asthma		evidence per study (revised	exposed	asthma cases due to mentioned				WC	ORK-RELATE	D SYMPTO	MS			LF	г	NSBH	R sPF	т		SIC			SPT	Sp.	bec. IgE	
	of RCGP)	cases		SIGN grading		agent, n, prevalence (%).	Asth	ma	Rhin	itis	Conjunct.	Cough	Skin	То	tal							R	eactio	n				-
		per agent, n		system); study	n	Cases with probable allergic asthma but																						
				type.		specific sensitization not confirmed in																						
						parantheses [] or not indicated.					n/n		n/n			n/n		n/n	n/n									
S. (n/n Ast	%	n/n Rhin	%	Conj %	+		% n/n Tot	%	LFT	%	NSBHR	% PFT			% i(n)					gE %	
Dnion seeds, red (Allium cepa)			Navarro, del Pozo et al., 1995	3; case report	1	1	1/1		1/1		1/1	nd	nd	1/1		0/1		nd	nd	1	/1	1			1/1	1/1		Worker packing red onion seeds. SPT+ with italian, wh and violet onion seed; IgE- with onion
arsaparilla root dust	-	1	Vandenplas, Depelchin et al., 1996	3; case report	1	1	1/1		1/1		nd	nd	nd	1/1		1/1		1/1	nd	1	/1	1			1/1	1/1		Herbal tea worker
ulip (<i>Tulipa</i>)	-	4	Piirilä, Keskinen et al., 1994	3; case reports	2	2	2/2		2/2		1/2	1/2	2/2	2/2		1/2		1/1	1/2*	1	/1	1			1/2	1/1		Gardener and florist. *Serial PEFR or FEV1 at work an at home
			Krüsmann and Hausen, 1987	3; case report	1	1	1/1		1/1		1/1	nd	nd	1/1		nd		1/1	1/1	1	/1	1			1/1	1/1		Florist. Nasal Ch+
			Lahti, 1986	3; case report	1	1	1/1		1/1		0/1	0/1	1/1	1/1		nd		nd	nd		nd				1/1	nd		Florist co-exposed and co-sensitized to Easter Lily. Se
Sanyak (Dioscorea batatas)	-	1	Park, Kim et al., 1994	3; case report	1	1	1/1		1/1		nd	1/1	nd	1/1		nd		0/1	nd	1	/1			1	1/1	1/1		Easter Lily Employee at herbal medicine pharmacy co-exposed at co-sensitized to Banha. See Banha
Spice dust Garlic (Allium sativum) Onion (Allium cepa)	-	2	van der Walt, Lopata et al., 2010	3; case reports	3	2 (66.6)*	3/3	100	3/3	100	nd	nd	nd	nd		0/3**	0	1/3	33.3 2/3	66.6	nd				nd	2/3	66.6	Spice mill workers. exposure to chili peppers, cayenne, soya, grain fOur du and other. Spec. IgE in the 2/3 workers for many other spices. I Worker was not sensitized to garlic or onion o to another spice constituent. "The sensitized workers had only mild airway obstruction
Family Lythraceae			ļ	l				-			II	<u> </u>		 		II			Į							ļ	_	
lenna (roots of Lawsonia inermis L.)	-	4	Starr, Yunginger et al., 1982	3; case reports	2	1 (50)	2/2		2/2		nd	1/2	nd	2/2		0/2		nd	nd	1	/2	1			2/2	2/2	!	Beauticians
			Frosch and Hausen, 1986	3; case report	1	1	1/1		1/1		1/1	nd	1/1	1/1		nd		nd	nd		nd				1/1	nd		Hairdresser
			Pepys, Hutchcroft et al., 1976	3; case report	1	1	1/1		1/1		1/1	nd	nd	1/1		0/1		nd	nd	1	/1	1			1/1	nd		Hairdresser, co-exposed to persulphates. SIC+ with persulfate salts (late asthma response)
			Majoie, Bruynzeel et al., 1996 ABSTRACT	3; case report	1	1	1/1		1/1		nd	nd	1/1	1/1		nd		nd	nd		nd				1/1	nd		Hairdresser
Family Moraceae																												
Veeping fig (Ficus benjamina)	*	10	Axelsson, Johansson et al., 1987	3+; cross- sectional	84	6 (7.1)	6/84	7.1	17/84	20.2	14/84 16.7	'nd	13/84	5.5 18/84	21.4	nd		6/9	nd	6	/6*	00 4		2 1	8/84	21.4 18/8	4 21.4	Plant keepers, greenhouse workers. *SIC in sensitized asthmatics; 9/9 rhinoconj. Ch+
	-		Axelsson, Skedinger et al.,	3; case reports	2	2	2/2		2/2		2/2	1/2	nd	2/2		nd		nd	nd		nd				2/2	2/2	2	Plant keepers
			1985																									
			Grob, Wüthrich et al., 1998	3; case report	1	1	1/1		1/1		1/1	nd	nd	1/1		nd		nd	nd		nd				1/1	1/1		Indoor gardener. See umbrella tree
			Diez-Gomez, Quirce et al., 1998	3; case report	1	1	1/1		1/1		1/1	nd	1/1	1/1		nd		1/1	nd	1	/1			1	1/1	1/1		Plant keeper. SPT+ also to fig, kiwi, papain
Family Myristicaceae		1	Sastre, Olmo et	3; case report	1	1	1/1		1/1		nd	nd	nd	1/1		nd		1/1	nd	1	/1	1			1/1	1/1		Butcher co-exposed to paprika and coriander. See als paprika and coriander
	-		al., 1996			1				1					1				I									1
	-		al., 1996																									
Mace (<i>Myristicia fragans</i>), nutmeg Family Myrsinaceae	-	1	al., 1996 Bolhaar and van Ginkel, 2000	3; case reports	2	1	1/2		2/2		2/2	nd	nd	2/2		nd		nd	nd		nd				2/2	2/2		Floriculturists
Mace (<i>Myristicia fragans</i>), nutmeg	-	1	Bolhaar and van		2	1	1/2		2/2		2/2	nd	nd	2/2		nd		nd	nd		nd				2/2	2/2		Floriculturists
Mace (<i>Myristicia fragans</i>), nutmeg Family Myrsinaceae Cyclamen pollen	•	1	Bolhaar and van			1	1/2		2/2		2/2 nd	nd	nd	2/2 nd		nd 0/1		nd 1/1	nd		nd d*				2/2	2/2		Floriculturists Worker in an olive-oil mill. "Nasal challenge test was positive

Agents	Strength of		Reference		Occupa-	Allergic										EVID	ENCE (p	atholo	ogical resu	ults)										1	Remarks
	evidence per agent (three	of allergic		evidence per study	exposed	asthma cases due to				wo	RK-RE	LATED SYMPT	OMS				L	FT	NSE	BHR	sPFT			SIC		:	SPT	S	oec. IgE	E	
	star system of RCGP)	asthma cases		(revised SIGN grading		agent, n,	Asthr	ma	Rhiniti	is	Conju	unct. Coug	h	Skin	To	tal								Re	action						
		per agent, n		system); study type.	n	prevalence (%). Cases with probable allergic asthma but specific sensitization not confirmed in parantheses [] or not indicated.			/n Rhin		n/n	% n/n Cou		√n kin %		%	n/n		n/n		n/n										
Poppy (Papaver somniferum)	*	6	Moneo, Alday et al., 1993	3+; cross- sectional	28	6 (21.4)	n/n Ast 6/28		nd	76	Conj nd	nd		nd 74	6/28	21.4	nd	%	nd	8 %	nd	% n/n 4/4		4	(n) a (i	n) n/n SP 6/28				:	Workers of pharmaceutical factory. 6/6 asthmatics sensitized; *SIC done only in 4 asthmatics; see also opiate
Family Passifloraceae					1										-				-					-	-	-	-				
Passion flower <i>leaves (Passiflora alata),</i> naracuja	-	1	Giavina-Bianchi, Castro et al., 1997	3; case report	1	1	1/1		1/1		1/1	1/1		nd	1/1		0/1		1/1		nd	1/*			1	1/1		1/'		1	Pharmacy worker co-exposed and co-sensitized to Rhamnus purshiana bark
Family Pedaliaceae																	_											-			
Sesame seeds (Sesame indicum)	-	1	Alday, Curiel et al., 1996	3; case report	1	1	1/1		1/1		1/1	nd	1	/1	1/1		nd		nd		1/1	1/*			1	1/1		1/'		1	Baker with prev. diagnosis of wheat allergy. SPT+ with wheat, rye
	-		Keskinen, Östman et al., 1991	3; case report	1	1	1/1		1/1		nd	1/1	1	/1	1/1		0/1		0/1		nd	1/*		1		1/1		1/		I	Baker
Family Plantaginaceae			1			<u> </u>	I									1	1	1	1	1	I					1					
Senna and Ispaghula husks	*	4	Marks, Salome et al., 1991	2-; cross- secional?	125	4 (3.2)	10/125	8.0	+*		+*	nd		+*	nd		4/119	3.4	9/112**	8	nd	no				21/118	** 17.	8 nc			Pharmaceutical workers. "21/115 WR nose, eye, and skin symptoms; "NSBHR n LFT; ""SPT+ with isogahula and/or soma: 3/118 SPT+ with spaghula, 18/118 SPT+ with sema; 4 OA, defined as at least on WR respiratory symptom, SPT+ to at least one occupational allergen, and either NSBHR+ or BD+ or physician diagnosed asthma
Psyllium (Plantago ovata, Plantago psyllium or Plantago indica)	**	31	Malo, Cartier et al., 1990a	2-; cross- sectional	197	8 (4.1)	24/197	12.2 6	65/197	33	nd	nd	9/	193 4.3	7 nd		2/10*	20	20/70*	28.6	nd	8/10	** 80	3	5	10/191	1 5.3	2 24/1	66 14	4.5 I	Health personnel of 4 hospitals. 4 preceeding cases o OA intrigated in cross-secional study of 193 subjects; "LFT and BHR only in symptomatics or sensitized; individual LFT parameter given only in 10 individuals; "SIC in symptomatic, sensitized, and BHR+
	-		Bardy, Malo et al., 1987	2-; cross- sectional	130	5 (3.9)	39/130	30 3	39/108	36	25/108	23.2 nd	1	nd	nd		3/125	2.4	12/35*		3/33**	5/18		5		23/120	0 19.	2 31/1	18 26	4	Workers of a pharmaceutical company surveyed befor and during production period. 'NSBHR in asthmatics only: 'PEFR for 2 weeks in asthmatics only: ''SIC ir SPT+, NSBHR+ and PFT+; sign. association between asthmatic symptoms and SPT+; all 5 SIC+ also SPT+
,	-		McConnochie, Edwards et al., 1990	2-; cross- sectional	92	4 (4.3)**	18/92	19.6	27/92	29.3	24/92	26.1 nd	1	/92 1.1	1 48/92	52.2	nd		nd		nd	no				5/92*	5.4	4 9/9:	2* 9		Workers of a pharmaceutical factory. *11/92 sensitize **4/18 asthmatics SPT+, 4/18 asthmatics IgE+, integr not given
	-		Kirby, Bardy et al., 1986	3+; cross- sectional	188		*		•		•	nd	1	nd	*66/188	35.1	nd		nd		nd	no				39/188	8 20.	7 22/1	88 11		Workers in 2 plants producing psyllium hydrophillic mucilloid. *66 had asthma or rhinoconjunctivitis, indivic figures not given. (32/66 symptomatics were sensitize
,	-		Göransson and Michaelson, 1979	3+; cross- sectional	64	[6 (9.4)]	6/64	9.4	26/64	40.6	14/64	21.9 nd	1	nd	27/64	42.2	nd		nd		nd					28/64*	** 43.	8 nc		:	Employees at a pharmaceutical factory. ***IC, *18/27 symptomatics were sensitized, sensitized asthmatics listed. **18/35 either conj., nasal or inhalation Ch+;
	-		Nelson, 1987	3+; survey	743	[25 (3.5)]	25/717	3.5 6	67/723	9.3	+	nd	6/	665 0.9	9 136/743	18.3	nd		nd		nd	nc				nd		nc	1	1	Health care workers
	-		Machado, Olsson et al., 1983	3+; case series	15	5 (33.3)	5/15	33.3	15/15	100	nd	nd	15	5/15 10	0 15/15	100	nd		nd		nd	5/1	5 33.	3 5		15/15	10	0 15/	15 1	100	Symptomatic sensitized nurses and pharmaceutical workers
			Cartier, Malo et al., 1987	3; case series	5	5	5/5		5/5		5/5	nd		nd	5/5		1/5		4/5		nd	5/:	5	2	3	4/4		5/	5	1	Nurses. 4/5 SIC+ and 1/5 had to be intubated, FEV1 could not be measured
			Busse and Schoenwetter, 1975	3; case reports	3	2 (66,6)	3/3		2/3	66.6	1/3	33.3 1/3	33. I 3	nd	3/3	100	nd		nd		nd	2/3	66.	62		3/3*	10	0 nc			Workers of pharmaceutical firm. *3/3 IC+ with plantain and with psyllium husk
	-		Vaswani, Hamilton et al., 1996	3; case report	1	1	1/1		1/1		nd	nd		nd	1/1		nd		nd		nd	no				1/1		1/*		i	Nurse with an episode of anaphylaxis after Psyllium ingestion
			Gauss, Alarie et al., 1985	3; case report	1	1	1/1		nd		1/1	nd	1	/1	1/1		nd		nd		nd	no			+	nd	1	1/*			Pharmaceutical worker
Family Plumbaginaceae			ļ	1	+	ı	+	ı — I	I						-1	1	1	-1	-1		I					-1					
Statice (<i>Limonium tataricum</i>), sea avender	-	1	Ueda, Tochigi et al., 1992	3; case reports	3	0	0/3		3/3		3/3	nd		nd	3/3		nd		nd		nd	nc				3/3*		3/3	3	1	Greenhouse workers. * I.C.; 3/3 + nasal Ch; 3/3+ conj Ch

Agents		Total no	. Reference	Level of	Occupa-	Allergic asthma cases									EVIDE	ENCE (pa	thological resu	ults)										Remarks
	evidence per agent (three star system	allergic asthma		evidence per study (revised	exposed subjects	due to mentioned			wo	RK-RELAT	ED SYMP	TOMS				LF	T NSE	BHR	sPFT		S	SIC		S	PT	Spe	c. IgE	
	of RCGP)	cases per agent, n		SIGN grading system); study type.	i studied, n	agent, n, prevalence (%). Cases with probable allergic asthma but specific sensitization not confirmed in parantheses [] or not indicated.	Asthma	Rhir	nitis	Conjunct.	Cou	gh n	Skin	To	tal				n/n			Rea	ction					
							n/n Ast %		%	Conj %		1 % <mark>S</mark>	din %	n/n Tot	%	LFT	n/n % NSBHR	۶ %	PFT	% n/n \$		i (n) I (n) d (n)		%	n/n lgE	%	
			Quirce, García- Figueroa et al., 1993	3; case report	1	1	1/1	1/1		1/1	1/1	1	/1	1/1		0/1	1/1		1/1*	1/*	I	1		1/1		1/1		Floral industry worker. *Serial PEFR at work and at hor for 4 weeks
Family Poaceae=Gramineae									1			1 1			1			-11					II					
Esparto grass (<i>Stipa tenacissima</i>)	-	1	Ruiz-Hornillos, De Barrio Fernández et al., 2007 ABSTRACT	3; case report	1	1	1/1	nd		nd	nd		ıd	nd		nd	nd		1/1	no	1			1/1		1/1		Building industry worker.
Grass juice (Lolium perenne)	-	1	Subiza, Subiza et al., 1995	3; case report	1	1	1/1	1/1		nd	1/1	r	d	1/1		0/1	1/1		nd	1/*			1	1/1		1/1		Gardener
Rice (Oryza sativa)	-	3	Kim, Choi et al., 2010	3; case reports	3	3*	3/3	nd		nd	nd	r	d	nd		nd	3/3			3/3	3		3	3/3		3/3		Rice millers or farmer SPT+ for common allergens and rice extract in 2/3. On case had SPT+ only to rice extract
Family Rosacea			1	ļ	1				1 1		-			1			Į	1 1		-	-	- 1 1			1	1	1	
Peach (Prunus persica)	-	2	Moya, Hernández et al., 2002	3; case report	1	1	1/1	1/1		nd	1/1	r	d	1/1		nd	×		nd	1/*		1		1/1		1/1		Fruit factory worker. WRS also with apricot; SPT+ and IgE+ with apricot
			García, Lombardero et al., 2004	3; case report	1	1	1/1	1/1		1/1	1/1	r	d	1/1		0/1	1/1		nd	1/*	1		1	1/1		1/1		Fruit grower. Clinical tests with peach leaves
Raspberry (Rubus idaeus)	-	1	Sherson, Andersen et al., 2003	3; case report	1	1	1/1	1/1		1/1	nd	r	d	1/1		0/1	0/1		1/1*	no	1			1/1		1/1		Chewing gum factory worker. *PEFR for 8 weeks at work; HR-
Rose (<i>Rosa rugosa</i>)	*	20	Demir, Karakaya et al., 2002	2-; cross- sectional	290	18 (6.2)	69/290° 23.	8 38/290*	13.1	25/290 8. *	6 23/290 *	7.9 26/	290 9.0) nd		nd	nd		nd	no	1			12/70	17.1	8/41	19.5	Rose cultivators. *New-onset and exacerbated symptoms, 18/290 (6.2%) new-onset asthma
Rose hips (<i>Rosa rugosa</i>)			Kwaselow, Rowe et al., 1990	3+; case series	13	2 (15.4)	9/13 69.	2 5/13	38.5	nd	nd	2	/9 22.:	2 13/13	100	nd	nd		nd	2/4	* 50	2		7/13	53.8	7/13	53.8	13 symptomatic employees of vitamin manufact. plant, with work-exacerbated asthma. "SIC in sensitized asthmatics
Rose (Rosa domescena)	-	-	Akkaya, Örnek et al., 2004	3+, cross- sectional	52	[1 (1.9)]	1/52 1.9	2/52	3.8	1/52 1.3	9 2/52	3.8 r	d	nd		•	42/52	80.7	nd	nc	I			28/52	53.8	nd		Workers in a rose extracting plant and 30 controls. * significant differences in FEV1, FVC, and FEV1/FVC between controls and workers. Not indicated if asthma case is sensitized.
Strawberry (Fragaria ananassa)	-	1	Patiwael, Vullings et al., 2010	3+,survey	75	1 (1.3)	4.2	2	30.7	23	3	nd	nd	1 29/75	38.7	0/3*	0/3*		nd	no	I			3/3*		2/3**		Strawberry greenhouse workers, response rate to questionnaire: 50.3%. workers with work-related symptoms were investigated detail. 1 with asthma and thinoconjunstivitis, the others with thinoconjunctivitis and skin symptoms. LFT and NSHFR were not indicated in detail but adjudged as normal. Nasal provocation test was positive in 2/3 **Spec.IgE was not present in the worker with asthma **
Family Rubiaceae			1								_					1				_	_							
Coffee, raw (<i>Coffea arabica</i>)	*[*]	51	Jones, Hughes et al., 1982	2-; cross- sectional	372	7 (1.9)	7/372* 1.5	9 nd		nd	nd	r	d	nd		**	nd		***	nc			į	93/362** **	25.7	39/331	11.8	Green coffee processing plant workers. "New-onset asthma; ""sign. association between length of exposure and FEV1 decline as compared to those with roasted coffee exposure, also IgE+ subjets had sign, declines c FEV1, FEV1/FVC and FEF25-75; ""Pre-and postshift PFT: The mean change in FEV1 for all 66 tested subjects was -0.024 L; """SPT with collector dust
Coffee, raw			Thomas, Trigg et	2-; cross-	150		•	nd		nd		r	d	19/150	12.7	nd	45/150	30	nd	nc						28/150	18.6	Coffee workers. *WRS (wheeze, cough, or dyspnoea)
Green coffee Castor beans (<i>Ricinus communi</i>)			al., 1991	sectional		9 (6.0)																		22/150 nd	14.7	21/150 22/150	14 14.7	sign. associated with IgE+ (castor bean) and duration o employment; 9/19 symptomatics IgE+ with castor bean
Coffee. raw (Coffea arabica) Green coffee Castor beans (<i>Ricinus communis</i>)	-		Romano, Sulotto et al., 1995	3+; cross- sectional	211	[34]	34/211 16.	1 55/211	26.1	55/211 26	.1 nd	r	d	56/211	26.5	nd	nd		nd	no				32/211 47/211	15.2 22.3	nd		Coffee workers. Sensitized asthmatics not listed
Green coffee beans Castor beans (Ricinus communis)			????	3+; cross- sectional	129		19/129 14.	7 40/129	31	31/129 24	1 nd	21/	129 16.	3 56/129	43.4	nd	nd		nd	no		+		24/129 22/129	18.6		-	Coffee workers. 28/129 (21.7%) were sensitized to occupational allergens; sensitized asthmatics not listed

Agents	Strength of evidence per	Total no. of	Reference	Level of evidence per	Occupa- tionally	Allergic asthma cases										EVIDE			gical resu											Remarks
	agent (three	allergic		study	exposed	due to mentioned				WOF	RK-REL	ATED SYMPT	OMS				LF	т	NSE	BHR	sPFT		SIC			SI	РТ	Spe	c. IgE	
	star system of RCGP)	asthma cases		(revised SIGN grading	subjects studied,	agent, n,	Asthr	na	Rhiniti	is	Coniun	ct. Cough	s	kin	Tot	tal								Read	tion					
		per agent, n		system); study	n	prevalence (%). Cases with probable											1						_							
				type.		allergic asthma but specific sensitization																								
						not confirmed in parantheses [] or not indicated.					n/n		n/n																	
						not indicated.	n/n Ast	% n/	/n Rhin	%		% n/n Cou		%	n/n Tot	%	n/n LFT	%	n/n NSBHR	%	n/n PFT %	n/n <mark>SIC</mark>	% i	(n) I (n	n) d (n)	n/n <mark>SPT</mark>	%	n/n lgE	%	
Coffee, raw (Coffea arabica)			Larese, Fiorito et al., 1998	2-; cross- sectional	31	1 (3.2)	2/31	6.5	4/31	12.9	2/31	6.5 nd	nd		6/31	19.4	•		nd		nd	nd				8/31	25.8	3/8**		31 green coffee workers. *No sign. difference in LFT between exposed and non-exposed; "*IgE done in symptomatic or SPT+; 1/2 asthmatics SPT+ and IgE+
					37	1 (2.7)	1/37	2.7	nd		nd	nd	nd		1/31	2.7			nd		nd	nd				1/37	2.7	1/1**		37 roasted coffee workers
Coffee, raw (Coffea arabica) Green coffee	-		Žuškin, Valić et al., 1981	2-; cross- sectional	45	2 (4.4)	4/45	8.9	+*		+*	nd	nd		nd		nd		nd		x**	nd				5/45***	12	nd		Coffee workers. *17/45 rhinitis or conj.; **sign. mean decrease in maximum expiratory flow (MEF) rate at 50
Roasted coffee			uii, 1001	ooolondi																						4/45***	8.9			and 25% of vital capacity; ***IC; 2/4 asthmatics had
Coffee bag dust Green coffee beans	-			3+; case	25		12/25		20/25		18/25	5/25	4/25	;	25/25		nd		nd		nd	nd				18/45*** 18/25	45	12/25		SPT+ Symptomatic coffee workers. (20/25 were sensitized to
Castor beans (Ricinus communis) Roasted coffee	-			series																								18/25 7/25		occupational allergens); sensitized asthmatics not liste
Coffee, raw (Coffea arabica)	-		Zuskin, Valic et al., 1979	3+; survey	72	2 (2.7)	34/72	47.2	45/72	62.5	28/72	38.9 30/72	41. nd 7		nd		+*		nd		+**	nd				nd		nd		72 roasted coffee processors. *2 subjects with asthma had LFT+ and PFT+; **sign. mean acute reductions in FEF50
					31	1 (3.2)	13/31	41.9	3/31	9.7	8/31	25.8 12/31	38. nd		nd		+*		nd		+**	nd				nd		nd		31 green coffee processors. *1 subject with asthma ha
						(- <i>)</i>							7																	LFT+ and PFT+; **sign. mean acute reductions in FEF
			Osterman, Johansson et al., 1985	3+; case series	22	8 (36.4)	11/22	50 3	20/22	90.9	5/22	22.7 nd	3/22	13.6	22/22	100	nd		14/22	63.6	X*	8/22**	36.4	6 2		18/22	81.8	11/22	50%	Coffee roastery workers. *Serial PEFR at work and off work for 1 week: PEFR in subjects with SPT+ sign.declined; **SIC done with green coffee beans, all & SIC+ were sensitized asthmatics
H	_		Zuskin, Kanceljak		9	4 (44.4)	6/9	66.6	9/9	100	9/9	100 9/9	100 nd		9/9	100	4/9	44.4	nd		nd	4/9	44.4	4			66.6	nd		Coffee workers. *IC; all 4 SIC+ were SPT+
Roasted coffee			et al., 1985	series																						1/9				
•			Karr, Lehrer et al., 1978	3+; case series	8	6 (75)	6/8	75	6/8	75	6/8	75 nd	6/8	75	6/8	75	3/8	37.5	nd		nd	2/2	100	2		6/8*	75	6/8	'75	Coffee workers. *IC; both SIC+ asthmatics were sensitized
Coffee green			Karr 1979	3+; case series	8	6 (75)	6/8	75	6/8	75	6/8	75 nd	6/8	75	6/8	75	nd		nd		nd	2/2	100	2		6/8	75	6/8	'75	8 symptomatic coffee workers unterwent bronchoprovocative studies; "IC; both SIC+ subjects were sensitized
Coffee (raw)	-		Wallenstein and Schöneich, 1983	3; case reports	2	1 (50)	2/2		2/2		0/2	0/2	0/2		2/2		0/2		1/2		nd	1/1		1		2/2		2/2		Coffee workers. 1/1 nasal Ch+
Roasted coffee	-		Lemiere, Malo et al., 1996	3; case report	1	1	1/1		1/1		1/1	nd	nd		1/1		1/1		nd		1/1*	1/1		1		1/1 1/1		1/1 1/1		Coffee production worker. *Serial PEFR at work and o work
	-		Müsken, Bergmann et al.,	3; case report	1	1	1/1		nd		nd	nd	nd		1/1		1/1		1/1		nd	1/1		1		1/1		1/1		Coffee factory worker
	-		Herrmann, Hausen et al., 1991 ABSTRACT	3; case report	1	1	1/1		nd		nd	nd	1/1		1/1		nd		nd		nd	1/1		1		1/1		1/1		Locksmith in a coffee processing plant
pecacuanha (Cephaelis ipecacuanha and/or Cephaelis acuminata)	-		Luczynska, Marshall et al., 1984	3+; cross- sectional	42		*		*		*	nd	nd		20/42*	47.6	nd		nd		nd	nd				13/39	33.3	14/32*	43.8	Workers packing Ipecacuanha tabletts. *WR-allergic symptoms (rhin., conj. and chest tightness), not individually listed; 12/18 IgE+ and 10/19 SPT+ subjects had WRS
Family Solanaceae		Į			I		1	I I I						-1				1	1	-11	I	1			-1 1				-	<u> </u>
Eggplant pollen (Solanum melongena)	-	1	Gil, Hogendjik et al., 2002	3; case report	1	1	1/1		1/1		1/1	1/1	nd		1/1		1/1		nd		nd	nd				1/1		nd		Agricultural worker. Conj. Ch+ with pollen
Paprika (Capsicum annuum)	*[*]	55	Patiwael, Jong et al., 2009	2-; cross sectional with follow-up	322	10 (3.1)*	19/231*	9 2	27/143	19	nd	nd	nd		nd		nd		nd			nd				16/184	9	nd		Greenhouse employees. Follow-up study of the cross- sectional study of Groenewoud, de Jong et al., 2002. Indicated are new cases during 8-year follow-up. *Of the 19 new asthma cases, 10 were newley sensitized.
			Groenewoud, de Jong et al., 2002	2-; cross- sectional	472	42 (8.9)	63/472	13.3 2	33/472	49.4 1	143/47 2	30.3 nd	42/47	2 8.9	254/472	53.8	nd		nd		X*	nd				167/472	35.4	88/472	18.6	Greenhouse employees. Clinical test with pollen, stam juice, leaf and/or stem; *PEFR 2/day for 2 weeks in 43 subjects showed sign. Iower PEFMEAN in those with asthmatic symptoms; 42/472 sensitized asthmatics
,	1		Toorenenbergen van and Dieges, 1984	3; case report	1	1	1/1		1/1		1/1	nd	nd		1/1		nd		nd		nd	nd				1/1		1/1		Greenhouse worker. Clinical tests with flower, leaf and stem
	1		Sastre, Olmo et	3: case report	1	1	1/1	+	1/1		nd	nd	nd	-	1/1	+	nd	+	1/1	+	nd	1/1	+ +		-	1/1	1	1/1	1	Butcher co-exposed to mace and coriander. See mace

Agents	Strength of evidence per	Total no. of	Reference	Level of evidence per	Occupa- tionally	Allergic asthma cases											EVI	DENCE (patholog										Remarks
	agent (three	allergic		study	exposed	due to				WOF	RK-REL	ATED S	YMPTO	NS				LFT	NSBHR	sPF	т		SIC		SI	РТ	Spec. Igi	E
	star system of RCGP)	asthma cases		(revised SIGN grading	subjects studied,	mentioned agent, n,	Asthr		Rhini	410	Coniun		Courth	61	kin		otal							Reaction				
	-	per agent, n		system); study	n	prevalence (%). Cases with probable	ASUII	IId	KIIIII	15	Conjun	<i>с</i> .	Cough	3	<u></u>		ULAI							Neaction	-			
		agent, n		type.		allergic asthma but specific sensitization																						
						not confirmed in parantheses [] or																						
						not indicated.					n/n			n/n				n/n	n/n	n/n								
			Taaraanharaan	2	4	4	n/n Ast	%	n/n Rhin	%			n Cou %		%		nt %	LT 1 70	NSBHR %	PFT	%		% i(r	i) I (n) d (n	n/n SPT	%	n/n lgE °	6 Frankriger in the price forster:
Paprika (Capsicum tetragonum)			Toorenenbergen van and Dieges, 1985	3; case report	1	1	1/1		1/1		nd		nd	nd		1/1		nd	nd	nd		nd			1/1		1/1	Employee in the spice factory.
Potato (Solanum tuberosum)	-	2	Zock, Doekes et al., 1996	3+; cross- sectional	131	[5 (3.8)]	5/131	3.8	nd		nd	9	/131 6.	9 nd		21/13	1 16.	0 nd	nd	nd		nd			nd		0/117	Workers of 4 potato processing plants. IgG 111/117 (95%)
			Quirce, Gómez et al., 1989	3; case reports	2	2	2/2		2/2		2/2		1/2	1/2		2/2		0/2	2/2	nd		2/2	2		2/2		2/2	Housewives
Tobacco leaf dust (<i>Nicotiana tabacum</i>)	*[*]		Mustajbegovic, Zuskin et al., 2003	2-; cross- sectional	121	[6 (5)]*	6/121	5	nd		nd	35	i/121 2	ə nd		nd			nd	***		nd			nd		nd	Tobacco workers. 81% response rate. ** sensitization indicated, OA diagnosed by physical examination and spirometric measurements during exposure to dust at or following work. **FEV1, FEF50 and FEF25 were significantly decrease 3% had FEV1<70% of predicted values. ***Significant decrease in FEV1, FEF50 and FEF25 in workerse tudied.
Tobacco leaf dust (<i>Nicotiana tabacum</i>)			Valic, Beritic et al., 1976	2-; cross- sectional	318	[32 (10.1)]	32/318	10.1	nd		nd		nd	nd		nd		•	nd			nd			nd		nd	Finale tobacco workers in 3 cigarette factories. *No sign. impairment of FEV1 and FVC; **sign. acute decrease in FEV1 and FVC during work-shift in expose (117 tested); sign. higher prevalence of chronic asthm. symptoms among exposed
•			Viegi, Paggiaro et al., 1986	3+; cross- sectional	223	[10 (4.5)]	10/223	4.5	20/223	9.0	nd		nd	nd		nd			nd	nd		nd			14/182**	7.7	nd	Workers at a cigar and cigarette factory. *All LFTs in older women, EE75-85 in younger women and in me lower than reference; *ISPT in men and younger wom only; sensitized asthmatics not listed.
•			Mukhtar, Rao et al., 1991	3+; survey	195	-	nd		nd		nd		nd	nd		nd			nd	nd		nd			nd		nd	Workers of a tabacco factory. *Sign. decrease in all parameters of ventilatory capacity in exposed as compared to unexposed controls
Tobacco (raw)			Uitti, Nordman et al., 1998	2-; cross- sectional	106		•				•		•	nd		5/106	6 4.7	7 16/106	nd	nd		nd			0/106		nd	Cigar factory workers. *No sign. difference in WRS between exposed and controls, individual data not liste **sign. decreased FEV1, FVC and MEF25 in exposed
Tobacco			Kjaergaard, Pedersen et al., 1989	2-; cross- sectional	75	[1 (1.3)]	1/75*	1.3	nd		nd		nd	nd		nd			12/71** 17			nd			18/75**		nd	Cheroot factory workers. *Physician diagnosed asthma or hayfever, not clear whether WR; **Not sign. differen exposed
•			Lander and Gravesen, 1988	2-; cross- sectional	16	[8 (50)]	11/16	68.8	nd		1/1		1/1	nd		nd		x**	nd	8/16*		nd			nd		nd	Workers of tobacco plant. *PEF before and after work for at least 1 week: sign. greater diurnal change; **sign lower FVC and FEV1
и			Gleich, Welsh et al., 1980	3; case report	1	1	1/1		1/1		nd		1/1	nd		1/1		nd	nd	nd		1/1	1		1/1		1/1	Tobacco manufacturer
a			Baur, 1993	3; case report	1	1	1/1		1/1		1/1		nd	nd		1/1		1/1	nd	nd		nd			1/1		1/1	Worker in a tabacco plant. Nasal Ch+
Family Sterculiaceae		1	Perfetti, Lehrer et	2: and report	1	1	1/1		1/1	1	nd		1/1	nd		1/1	1	0/1	1/1	1/1*		1/1**	1		1/1		1/1	Confectionery worker. *Serial PEFR and FEV1; **SIC
	-		al., 1997	5, case report	1		171		1/1		nu			nu		1/1		0/1	1/1	1/1		1/1	'		1/1		1/1	with cocoa powder
Family Theaceae																												
Tea dust (Camomile, dog-rose, gruzyan	*[*]	8	Zuskin and	2-; cross-	100	[3 (3]	45/100*	45		3	32/100	32 48	/100 4	3 nd		nd		x	nd	57/100*	57	nd			nd		nd	Employees processing different types of tea. *Acute
ea, Indian tea, sage) Camomile	*[*]		Skuric, 1984	sectional	26	1 (3.9)	13/26	50	11/26	42.3	12/26	46.2 1	2/26 5) nd	_	_		2/26 8.0	-			-			-		-	WRS; **sign. mean acute decline in FEF50 and FEF7 across-shift; ***"acute reductions* in maximal expirato
Dog-rose					10	1 (10)	4/10	40	4/10	42.3	4/10	40.2 1.	/10 4) nd				1/10 10		X X**								flow rate (MEF) across-shift, not clear whether signific
Gruzyan Indan	-				28 16	1 (3.6)	14/28 5/16	50	12/28	42.9 6.3	13/28	46.4 1	4/28 5	0 nd 5 nd	_	_		3/28 11 0/16 0	_	x** x**		_			-			3 employees had WR asthma and PFT+
Sage	1				20		9/20	45	10/20	50	0/20	0 1	3/20 6					1/20 5		X**		=			1			<u> </u>
ea dust (Camomile, dog-rose, gruzyan ea, Indian tea, sage)			Zuskin, Kanceljak et al., 1985	2-; cross- sectional	26	3 (11.5)	10/26	38.5	8/26	30.8	3/26	11.5	nd	nd		nd		X*	nd	x**		4/6	4		15/26		nd	26 volunteers from the previous cross-sectional study above. *Sign. lower pre-shift FEF50 and FEF75; **sig across-shift decline in FEF50 and FEF75; 1 SIC+ and
Dog rose	1					1 (3.9)	1															1/6	1			10		SPT+ with dog rose, 1 SIC+ and SPT- with gruzyan te
Gruzyan Mentha	-					1 (3.9)				-				+	_		_	+	+ +	+	<u> </u>	1/6	1	+ $+$	10/26 9/26		\vdash	2 SIC+ and SPT- with sage; 1 asthmatic was SPT+ with sage and gruvan
Sage	1					1 (3.9)	1							+		+		+ +	+ $+$	1		2/6	2			35 45		sage and gruyan
Tea dust (Camillia sinensis)	1		Jayawardana and Udupihille, 1997	2-; cross- sectional	53	[1 (1.9)]	1/53	1.9	3/53	5.7	nd		nd	nd		nd		+*	nd	nd		nd			nd		nd	Tea workers. *Sign. decreased FEV1, FEF25-75
•	-		Hill and Waldron, 1996	3+; cross- sectional	249	0	+*		+*		nd		+*	nd		+*		nd	nd	+**		nd			nd		nd	Group of subjects in a tea packaging plant. "Higher prevalence of rhinitis, cough and chest tightness in exposed; "Mean PEF was higher at the non-working days, measured for 12 days. No evidence that tea fluff contains materials which may induce asthma.

Agents	Strength of	Total no.	Reference	Level of	Occupa-	Allergic									E	/IDENCE (patholog	gical results)									Remarks
	evidence per agent (three	of allergic		evidence per study	tionally exposed	asthma cases due to				WOR	(-RELA	TED SYMPTO	MS			L	LFT	NSBHR	sPFT		SIC		S	PT	Spe	lgE	
	star system	asthma		(revised	subjects	mentioned																					
	of RCGP)	cases per		SIGN grading system);	studied, n	agent, n, prevalence (%).	Asthr	na	Rhinit	is	Conjunct	. Cough	Ski	in	Total						F	leaction					
		agent, n		study		Cases with probable allergic asthma but																					
				type.		specific sensitization																					
						not confirmed in parantheses [] or																					
						not indicated.	n/n Ast	% r	v/n Rhin		n/n onj %	6 n/n Cou	n/n Skin	%	n/n Tot	n/n % LFT		n/n NSBHR %	n/n PFT %	n/n SIC	× i (n) I (n) d (r		. %		9/	
			Uragoda, 1980	3+; survey	125	[3 (2.4)]	3/125	2.4	nd		nd	nd	nd		nd*	nd		nd	nd	nd	/0 . (nd	70	nd	Tea workers. *31 ha	d chronic bronchitis, 8 had asthma,
			-																							3/8 had WR asthma	
	_		Cartier and Malo,	3; case	3	[3]	3/3		2/3		nd	3/3	nd		3/3	0/3		3/3	2/3*	2/3 66	5.7	2	0/3		0/2	Teapackers, *Serial	PEF at work and off-work for 3
			1990	reports	-	[-]																				weeks	
", green	_		Shirai, Sato et al.	3; case	3	3	3/3		3/3		nd	3/3	nd		3/3	nd		3/3	nd	3/3	3		3/3*		3/3**	Employees in green	tea factories. *IC; IC and SIC with
			1994	reports																						epigallocatechin gall	ate; 3/3 IC+ and 1/1 SIC+ with a; 1/3 oral Ch+; **PK
-																										-	
			Lewis and Morgan, 1989	3; case report	t 1	[1]	1/1		nd		nd	nd	nd		1/1	1/1		1/1	nd	1/1		1	nd		nd	Worker at a compar	ny processing tea
						1						-														T	
			Senff, Hausen et al., 1989	3; case report	t 1	1	1/1		1/1		nd	nd	nd		1/1	nd		nd	nd	nd			1/1*		1/1	Tee trader. *Rub tes	it
	_		Uragoda, 1970	3; case report	1	1	1/1		1/1		nd	nd	nd		1/1	nd		nd	nd	1/1	1		1/1		nd	Too maker Clinical	test done with tea fluff containing
			Ulayoua, 1970	3, case report		'	1/1		1/1		lu	nu	nu		1/1	nu		na	nu	1/1			1/1		nu	Aspergillus, Penicilli	inum and Chromobacteria
8	-		Roberts and	3; case report	1	[1]	1/1	+	1/1		nd	1/1	nd	-	1/1	0/1		nd	1/1*	1/1	_	1	0/1	+	nd		PEFR 5 days at work and 9 days o
			Thomson, 1988	5, 0836 report		19			.,.		~		nd			5/1							0/1		10	work	o dayo at work and 9 days 0
Other Plant Families		1				1	!	· ·	!		!			1	· · · · ·			· · · ·	I I	+		↓ ↓	+		I	I	
			The second second second			10 (07 7)	40/7 :	00-	7/5	10.0		107-1						1		1			00/77			har a	10-16-16-16-16-16-16-16-16-16-16-16-16-16-
Dried fruits and teas	-	-	Zuskin, Kanceljak et al., 1996	3+; survey	54	[18 (33.3)]	18/54	33.3	7/54	12.9	nd	18/54 3	3. nd 8		nd	+*		nd	+**	nd			39/50**	78	nd	Workers processing FEF25 sign, lower th	dried fruit and teas. *Mean preshift an predicted; **sign. across-shift
Apple	_																						2/50	4		reductions of ventilat	tory capacitiy; ***SPT+ with at least
Lemon Orange	-																-						5/50 7/50	10 14		one occupational alle	ergen; sensitized asthmatics not
Pineapple																							9/50			listed	
Peach																				_			3/50	6			
Chamomile Dog rose	-											_	_										2/50	4 20			
Sage	-																						30/50	60			
Flowers	F#3	10	Jong de,	3+; cross-	14	10 (71.4)	10/14	71.4	14/14	100 14	4/14 10	00 nd	5/14	35.7	14/14 1	00 nd		nd	nd	nd						Flower industry work	ers
Ageratum	[*]		Vermeulen et al.,	sectional											7/14	50							7/14				
Alstroemeria Asclepias			1998												6/14 4 4/14 2	2.9	_						6/14	42.9 28.6			
Aster	_														5/14 3	5.7							2/14	14.3			
Chrysanthemum															12/14 8	5.7									10/11	90.9	
Dianthus	_											_	_		2/14 1								5/14	35.7			
Euphorbia Eustoma	-												_		5/14 3 7/14	5.7							7/14	46.1 50			
Freesia															5/14 3								6/14	42.9			
Gerbera															7/14	50							4/13	30.8			
Helianthus	_														5/14 3	5.7	_						6/13	46.2			
Limonium Matricaria	-														1/14 12/14 8	57							0/13	0 78.6			
Narcissus															5/14 3	5.7							3/13	23.1			
Pelargonium															4/14 2					_				23.1			
Saintpaulia	_														2/14 1 12/14 8									35.7	11/11		
Solidago Flowers	1		Goldberg, Confine	- 3+; cross-	75		•	+	•		•	nd	nd		35/75 4	5.3 nd	-	nd	nd	nd			39/75	52	nd	Rural flower growers	s. * Individual symptoms not listed, 2
Asteraceae			Cohen et al.,	sectional	1																		36/39	92		of the 35 symptoma	tics had asthma and/or rhinitis. SP1
Gentianaceae Liliaceae	-1		1998	1	1			+					_	1	⊢		_	+		+		\vdash	7/39	18 18	I	results for individual	flowers in sensitized only. 11/29 a and/or rhinitis were SPT+.
Ranunculacea	-																						5/39			growers with astnma	a and/or minitis were SP1+.
Scrophulariaceae																							9/39				
Herbal tea (containing chaparral, red		-	Blanc, Trainor et	3; case report	t 1	[1]	1/1		nd		/1	1/1	nd		1/1	1/1		nd	nd	1/1	1		nd		nd	Worker processing I	nerbal tea
clover, mint etc.)	-		al., 1986																								
Herbal tea		-	Castellan,	2-; survey	206	[1 (0.5)]	21/206	10	nd		nd	nd	nd		nd	+*		nd	+**	nd			nd		nd		tea processing plant. *Mean
	-		Boehlecke et al.,																								re >80% for all exposure categorie
			1981																							no sign. changes i	n FEV1 between exposure groups; oms of OA, he was also PFT+ and
														1									1	1		LFT+	
Herbs, aromatic (thyme, rosemary, bay		1	Lemière, Cartier	3: case report	1	1	1/1		1/1		nd	1/1	nd	1	1/1	0/1	-	1/1	1/1	1/1	1	$\left - \right $	1/1	+	1/1	Butcher SIC+ and S	PT+ with garlic, rosemary, thyme,
leaf, garlic)	-		et al., 1996	5, 0000 report			., .						nu -	1		0/1					1			1		bayleaf. IgE+ with ga	arlic, bay leaf
Lime flower	1	1	Rudzki, Rapiejko	3; case report	1	1	1/1	+	1/1	-	/1	nd	1/1	1	1/1	nd	-	nd	nd	nd			1/1	1	nd		osed and co-sensitized to camomile
	-		et al., 2003											1										1		*Nasal Ch+	
	1	4	Muittari,	3: case series	136	4 (2.9)	45/83*		+		nd	nd	nd	1	136/136 1	00 nd		41/101 40.6	nd	20/108** 18	3.5		4/104	+	nd	Textile workers with	suspected allergy for fiber. *WRS in
Natural fibers								1		1.1							1		1						1		,
Natural fibers	-		Veneskoski et al.	,																							ion not listed; 4/20 SIC+ were SPT-
Cotton fiber	-			,																7/20						also 16/79 SIC+ with	non not listed; 4/20 SIC+ were SP1- n synthetic fibers, of whom 4/16 SIC
Cotton fiber Cotton flock	-		Veneskoski et al.	,																5/25							
Cotton fiber			Veneskoski et al.																							also 16/79 SIC+ with	

	Strength of evidence per	Total no. of	Reference	Level of evidence per	Occupa- tionally	Allergic asthma cases										E	VIDENCI		-	results)										Remarks
	agent (three star system	allergic asthma		study	exposed subjects	due to mentioned				WORK	(-RELAT	ED SYM	PTOMS					LFT		NSBHR	sPFT		SIC	5		SF	PT	Spec	c. IgE	
	of RCGP)	cases per agent, n		SIGN grading system); study type.	studied,	agent, n, prevalence (%). Cases with probable allergic asthma but specific sensitization not confirmed in parantheses [] or not indicated.	Asthn	na	Rhiniti	is C	Conjunct.	Co	ugh	Skin n/n		Total		n/n	n	n/n	n/n			React	tion					
Pectin (carbohydrate of plant cells)		2	Cohen, Forse et	3: case report	1	1	n/n Ast 1/1		n Rhin 1/1		onj %	n/n Co 1/1	u %	Skin nd	%	n/n Tot 1/1		FT 9		BHR %	PFT %	n/n S		i (n) l (n) d (n) _i	/n <mark>SPT</mark> 1/1	%	n/n lgE nd		Worker manufacturing jam. *Serial PEF at work and at
·,	-		al., 1993				-										-													home for 5 weeks
			Kraut, Peng et al., 1992	3; case report	1	1	1/1		1/1	1	/1	nd		nd		1/1	1	/1	1	1/1	nd	1/1		1		1/1		0/1		Candymaker. Positiv pectin specific IgG.
Sisal	-		Zuskin, Kanceljak et al., 1994	2-; cross- sectional	50	[2 (4.0)]	2/50		nd	r	nd	nd		nd		nd	r	nd	3	x*	x**	nd				nd		nd		Sisal workers. *Individual results not listed; **sign. acros shift reduction of FVC and FEV1, reduction larger at
				Follow-up study	20	2 (10)	7/20	35 -	4/20	20 12	/20 60	0 12/20	0 60	nd		nd	r	nd	:	x*	x**	nd				2/20***	10	nd		follow-up; ***both SPT+ asthmatics
Spices: Coriander (<i>Coriandrum sativum</i>) and other spices: mace (<i>Myristica</i> <i>fragrans</i>), ginger (<i>Zingiber officinale</i>), paprika (<i>Capsicum tetragonum</i>), curry.	-		Toorenenbergen van and Dieges, 1985	3; case report	1	1	1/1		1/1	r	nd	nd		nd		1/1	r	nd	r	nd	nd	nd				1/1		1/1		Employee in the spice factory. SPT+ with curry, coriander, mace. IgE+ with curry, coriander, mace, ginger, paprika; no cross-reaction between spices detected
Tragacanth gum	-		Bircher and Wütrich, 1992	3; case report	1	1	1/1		1/1	1	/1	nd		nd		1/1	r	nd	r	nd	nd	nd				1/1*		0/1		Ice cream production worker, co-exposed and co- sensitized to St. John's bread seed. "Scratch test; see St. John's bread seed
Voacanga africana seed dust, APOCYNACEAE family	-	1	Hinojosa, Moneo et al., 1987	3; case report	1	1	1/1		1/1	1	/1	1/1		nd		1/1	C)/1	r	nd	nd	1/1		1		1/1		1/1		Housewife indirect exposed through her husbands clothing, a chemist in a pharmaceut. plant
Natural thickening products Cassia spp., Leguminosae family Guar (Cyamopsis tetragonoloba); Tamarind tree (Tamarindus indica) Storage mites (A. siro, T. putrescenita, L. destructor)	-		Steger, Radon et al., 2000	2-; survey	62	3 (4.8)	6/62	9.7	+*		+*	8/62	12.	+*		34/62	54.8 x	<i>.</i>	r	nd	nd	nd				7/62 0/62 0/62 6/62	11.3 9.7	3/62 0/62 0/62 0/62		Staff of a plant producing natural thickeners. "Individual results not listed; "FVC sign. decreased in highly exposed workers; 10/62 (.975) sensitized to at least 1 WR allergen, 3/10 were asthmatics
Wood dust																														
Maple (hardwood) and pine (softwood)	-	-	Whitehead, Ashikaga et al., 1981 ABSTRACT	3+; survey	1157													+*												Woodworkers. *Odds ratio for reduced pulmonary function (FEV1/FVC) in high exposed was 3.12 for map and 2.61 for pine
East African teak trees (Chlorophora excelsa), mahogary (Khaya nyasiga), blod wood (Procarpus angolensis), East African camphor (Doctee usamberensis), East African Atzelia Burt (Afzelia quanzonsis), "manga" (Albizia spp.) African penci cedar (Luniperus procera), African blackwood (Dulbergia melanoxylon), "kawlia" (Grevilea melanoxylon), "kawlia" (Grevilea melanoxylon), "kawlia" (Grevilea melanoxylon), "kawlia" (Grevilea melanoxylon), "kawlia" (Grevilea Melano (Franci atternita), pine (Prinus patulia)	-	-	Rongo, Besselink et al., 2002	3+; cross- sectional	546	[106 (19.4)]	106/546*	19.4 50	//546*	9.2 17/	/546 3. *	1 151/5	4 27. 3	3/546*	0.5	nd	ſ	nd	1	nd	nd	nd				nd		nd		Workers in small-scale wood industries. "Sign. increase in exposed subjects
Wood dust	-		Paggiaro, Vellutini et al., 1986 ABSTRACT		239		•		nd	r	nd	•		nd		•			r	nd	nd	nd				nd		nd		Furniture plant workers. "Sign, higher prevalence of cough and wheeze in smokers than in non smokers and in non smoker exposed than in the control group. "Sign lower valus is mokers; after adjusting for age and smoking lower FEV1 in subjects with more working year
Wood (Eucalypt, radiata pine, meranti, sugar pine, tasmanian oak, american oak, jarrah, tasmanian blackwood, wester red cedar)	-	-	Mandryk, Alwis et al., 1999	2-, cross- sectional	197	[21 (10.8)]	21/195	10.8 8	3/195	42.6 r	nd	119/1 5	9 61. 0	nd		nd	•/*	168	r	nd	**/168	nd				nd		nd		Woodworkers. *Pos. correlation with number of yrs. of exposition, individual data not listed; **sign. cross-shift decrease in exposed
Various Woods (Abies, Chestnut, Douglas, Framire, Mansonia, Oak, Obeche, Walnut, White poplar)	*	9	Carosso, Ruffino et al., 1987	2-; cross- sectional	90	9 (10)	20/90	22.2	nd	r	nd	nd		nd		20/90	22.2	•			nd	nd				12/90	13.3	1/90		Wood workers. *Sign. neg. correlation between FEV1, FEF50, TLco, Kco and duration of exposure; **all 20 asthmatics NSBHR+; sign. higher prevalence of SPT+ ii asthmatics, 9 asthmatics SPT+
Wood dust (not specified)	-		Holness, Sass- Kortsak et al., 1985	2-; cross- sectional	50	[9 (18)]	9/50	18 1	6/50	32 10	/50 20	0 19/50) 38	5/50	10	nd		•	r	nd		nd				nd		nd		Cabinet makers. *Sign. inverse correlation between FEV1, FEF75, and exposure index; **sign. decline in FEV1 and FVC cross-workshift in 48 exposed
/arious woods (not specified)	-		Aguwa, Okeke et al., 2007	3+; cross- sectional	591	[56 (6.3)*]	56/591	6.3 40	1/591	78 r	nd	nd		nd		nd	r	nd	r	nd	251/591 42.	.5 nd				nd		nd		Woodworkers. *No allergy test was done. Asthma was confirmed by presence of wheezing and breathlessness The ratio of observed PEFR and predicted PEFR (%) <75% was considerated as abnormal.
/arious woods Ash	-		Kersten and von Wahl, 1994	3; case series	157	•	157/157		nd	r	nd	nd		nd		157/157	r	nd	r	nd	nd		0 6.7				3.4 6.1	nd		157 wood-workers claiming for compensation due to O/ Number of subjects per species exposed not listed; *positive SPTs were found with 33 different wood specie

1		Total no. of	Reference		Occupa- tionally	Allergic asthma cases								EVID	ENCE (pa	atholog	lical result	ts)										Remarks
a	evidence per agent (three	allergic asthma			exposed subjects	due to mentioned			v	ORK-RE	LATED SYMPTON	IS			LF	т	NSB	HR	sPFT			SIC			SPT	Sp	ec. IgE	
, ,	star system of RCGP)	cases		SIGN grading	studied,	agent, n,	Asthr	na R	hinitis	Conj	unct. Cough	Skir	n To	tal								R	eaction	1			_	-
		per agent, n		system); study	n	prevalence (%). Cases with probable allergic asthma but																						
				type.		specific sensitization																						
						not confirmed in parantheses [] or not indicated.				n/n		n/n			n/n		n/n		n/n									
							n/n <mark>Ast</mark>	% n/n R	hin %		% n/n Cou %	Skin	% n/n Tot	%		%	NSBHR	%	PFT %	6 n/n	SIC 9	% i (n)	l (n) d ((n) n/n <mark>SP</mark>			E %	
Gaboon Fir																				4/	90 4.	.4		14/26	4 <u>5.3</u> 1 4.6			out of 45 species tested
Kambala Limba																				7/	90 7. 90 2.	.8		14/26	4 5.3 2.7			-
Mahagony, american																								21/26	3 8.0			-
Makore Mansonia																				4/	/90 15 90 4.	.4		10/26	3 11.4 3 3.8			-
Meranti Oak																				6/	90 6.	.7		6/261	2.3 4 9.1			-
Obeche																				20	/90 22	2.2		31/26	3 11.8 4 5.3			-
Pine Sapeli																				2/	90 5. 90 2.	.2		4/267	1.5			-
Spruce Walnut									_											2/	90 2. 90 2.	.2		22/26	2 8.4 3 1.9	-		-
	(*)	11	Oertmann and Bergmann, 1993	3+; case series	55	11 (20)	55/55	100 +*	_	+*		+*	+*		17/55	30.9	40/55	72.7	nd	18	/55 32	2.7		29/55	** 52.7			55 wood-workers claiming for compensation due to OA. *Individual symptoms and number of subjects per
Beech	()		Borgmaill, 1993	301103																1	/2			8/55	14.5			species exposed not listed; **IC; 11 SIC+ were also IC+
Limba Mahagony								<u> </u>	_					-						2	/3 /4		\vdash	9/55 9/55	16.4			+
Makore										-										4	/5			15/55	27.3			1
Oak Obeche																				6	/3 /8			11/55				1
Red Cedar Teak											\vdash						\square				/1 /2		\vdash	0/55				+
Various woods (obece, lanan, mahogany, samba, mansonia, ramin)	-	-	Fasani, Pisati et al., 1982 ABSTRACT	3+; case series	55		-	-		-	-	-	-		-		-		-	1)	1.			10/55	* 18.2			Woodworkers. *SIC+ to mansonia and ramin; **SPT+ to at least one wood dust
Exotic woods			Colas,	3+; case	10		10/10	-			-	-	10/10		-				-		-					-	-	10 woodworkers with OA due to exotic woods
	-		Grosclaude et al., 1985 ABSTRACT	series																								
Rimu (Dacrydium cupressium) and other wood dust (Kauri (Agathis australis), Tawa (Beilschmedia tawa) etc.)	-	-	Norrish, Beasley et al., 1992	2-; cross- sectional	50	[5 (10)]	11/44	25 32/4	4 72.7	32/44	72.7 14/44 31 8	. nd	nd		nd		nd		5/41* 12	.2 r	d			nd		nd		Wood workers. *Serial PEF for 10 days
HARDWOOD																												
Family Bignoniaceae																												
Ipe, Brazilian walnut (Tabebuia spp.)		2	Algranti,	3; case report	1	1	1/1	nd		nd	nd	nd	1/1	1	1/1	1	nd		nd	1	/1	-	1	1/1	1	0/1		Woodworker
pe, brazinan wannu (rabebula spp.)	-	2	Mendonca et al., 2005	3, case report		I	1/1	10		nu	10	na	1/1		1/1		na		nu		/1			1/1		0/1		Woodworker
Bethabara wood, Tabebuia			Yacoub, Lemière et al., 2005	3; case report	1	[1]	1/1	0/1		0/1	1/1	0/1	1/1		0/1		1/1		nd	1	/1		1	nd		nd		Railway platform fitter
Family Ebenaceae														1					1	-								
Ebony wood (Diospyros crassiflora)	-	-	Maestrelli, Marcer et al., 1987	3; case report	1	[1]	1/1	nd		nd	1/1	nd	1/1		0/1		1/1		nd	1	/1		1	0/1*		nd		Carpenter. *IC
*			Kopferschmitt-	3; case report	1	[1]	1/1		_	-		-			-		-	\vdash	-	1	/1			1 -		-		Violin and stringed instrument maker
			Kubler, Bachez et al., 1992 ABSTRACT																									
Family Fagaceae		[1	1	I					1		1		1	1	1			I							1		1
Beech (Fagus silvatica)	-	-	Spiewak, Bozek et al., 1994	3; case report	1	[1]	1/1	1/1		1/1	0/1	0/1	1/1		0/1		nd		nd	1	/1	1*	1'	•• 0/1		nd		Carpenter co-exposed to ash, oak and pine. *Wood dust **aqueous extract
Cabreuva (Myrocarpus frondosus)	-	1	Pala, Pignatti et al., 2010	3; case report	1	1	1/1	1/1		1/1	1/1	nd	nd		0/1		1/1		nd	1/	ʻ1•	1		0/1		nd*		Parquet floor layer. * Increase in CD4 lymphocytes after SIC. Occupational rhinitis was also diagnosed.
Oak (Quercus robur)	-	-	Malo, Cartier et al., 1995	3; case reports	3	[3]	3/3	1/3	;	nd	3/3	nd	3/3		1/1		3/3		1/1	3	/3	1	2	2 0/3		nd		Carpenters
1			Sosman, Schlueter et al., 1969	3; case report	1	[1]	1/1	1/1		nd	1/1	nd	1/1		0/1		nd		nd	1	/1	1		0/1		nd		Lumber-mill worker. See also cedar and mahogany
Oak (Quercus sp.)			Spiewak, Bozek et al., 1994	3; case report	1	[1]	1/1	1/1		1/1	0/1	0/1	1/1		0/1		nd		nd	1	/1	1*	1'	•• 0/1		nd		Carpenter co-exposed to ash, beech and pine. *Wood dust; **aqueous extract
			1		1			1 1	1	1		1		1	1	1	1	1 1		1	1	1 1	1 1	1	1	1	1	1

Agents		Total no.	Reference		Occupa-	Allergic								EVID	ENCE (pa	thologic	al results)								Remarks
	evidence per agent (three	of allergic		evidence per study	tionally exposed	asthma cases due to			wo	ORK-REL	ATED SYMPTON	S			LF	r	NSBHR	sPFT		SIC		s	PT	Spec. IgE	1
	star system of RCGP)	asthma cases		(revised SIGN grading	subjects studied,	mentioned agent, n,	Asthr	na Rhi	nitis	Coniun	ct. Cough	Skin	Т	otal						F	eaction	-			_
		per agent, n		system); study	n	prevalence (%). Cases with probable																			
		-		type.		allergic asthma but specific sensitization not confirmed in																			
						parantheses [] or not indicated.				n/n		n/n			n/n		n/n	n/n							
							n/n <mark>Ast</mark>	% n/n Rhi	n %	-	% n/n Cou %	Skin	% n/n To	%	LFT	%	NSBHR %	PFT %		% i (n) I (n) d (n) n/n <mark>SP1</mark>		/n lgE 🤋	6
Central American walnut (Juglans olanchana)	-	-	Bush and Clayton, 1983	3; case report	1	[1]	1/1	1/1		nd	1/1	nd	1/1		nd		1/1	nd	1/1	1		0/1*		0/1	Woodworker. *IC
Family Lauraceae												1		_				1 1							
Imbuia (<i>Phoebe porosa</i>), Brazilian Walnut	-	1	Jeebhay, Prescott et al., 1996	3; case report	1	[1]	1/1	1/1		nd	1/1	nd	1/1		1/1		nd	X*	1/1	1		nd		0/1	Joinery worker. *Serial PEFR for 2 weeks showed substantial variability, but no specific work-related patter
Family Leguminosae																									
African Zebrawood (Microberlinia)	-	1	Bush, Yunginger et al., 1978	3; case report	1	1	1/1	nd		nd	1/1	nd	1/1		0/1		nd	nd	1/1		1	1/1*		1/1	Woodshop worker. * IC
Angelim pedra (Hymenolobium petraeum)	-	1	Alday, Gómez et al., 2005	3; case report	1	1	1/1	1/1		1/1	1/1	nd	1/1		nd		1/1	nd	1/1	1		1/1		1/1	Carpenter
Blackwood (Acacia melanoxylon)	-	-	Wood-Baker and Markos, 1997	3; case reports	3	[3]	3/3	1/3		nd	3/3	1/3	3/3		2/3		3/3	3/3	3/3		2 1	nd		nd	Cabinet-maker, furniture-makers
Cabrueva (Myrocarpus fastigiatus Fr. All.)	-	-	Innocenti, Romeo et al., 1991	3; case report	1	[1]	1/1	nd		nd	1/1	nd	1/1		0/1		0/1	nd	1/1		1	nd		nd	Parquet floor layer
Cedorana (Cedrelinga catenaeformis)	-	1	Alvarez Eire, Pineda et al., 2006	3; case report	1	1	1/1	1/1		1/1	1/1	nd	nd		nd		0/1	nd	1/1	1		1/1		1/1	Carpenter. Co-exposure to other woods.
Cocabolla (Dalbergia retusa)	-	1	Eaton, 1973	3; case reports	3	1	2/3	3/3		nd	2/3	1/3	3/3		2/3		nd	nd	nd			2/3		nd	Billiard cue manufacture workers
Fernambouc (Caesalpina echinata or Guilandia echinata)	-	1	Hausen and Herrmann, 1990	3+; survey	36	1 (2.8)	9/36	25 6/36	16.7	4/36 1	11.1 9/36 25	nd	12/36	33.3	nd		1/1	nd	1/1*	1		1/12*	8.3	0/12	Music-instruments-makers. *SPT and SIC in symptomatics
Jatoba wood (Hymenaea courbaril)	-	-	Quirce, Parra et al., 2004	3; case report (letter)	1	[1]	1/1	1/1		0/1	0/1	0/1	1/1		0/1		1/1	1/1	1/1	1		0/1		0/1	Carpenter co-exposed and co-sensitized to tali; see tali
Kejaat (Pterocarpus angolensis)	-	1	Ordman, 1949	3; case report	1	1	1/1	nd		nd	1/1	nd	1/1		nd		nd	nd	nd			1/1*		nd	Wood-machinist. Improvement of asthmatic symptoms after desensitization with an extract of Kejaat; * IC
Locust wood (Robinia pseudoacacia L.)	-	2	Kespohl, Merget et al., 2006	3; case reports	2	2	2/2	1/2		1/2	nd	nd	2/2		1/2		1/1	nd	1/1	1		1/1		2/2	Mechanic with 1 high-exposure incident to Locust wood and 1 carpenter.
Palisander, Brazilian rosewood (Dalbergia nigra)	-	1	Godnic-Cvar and Gomzi, 1990	3; case report	1	1	1/1	1/1		1/1	1/1	1/1	1/1		0/1		0/1	nd	1/1		1	1/1*		nd	Joiner. *IC
Tali wood (Erythrophleum suaveolens), elondo, missanda, muave	-	-	Quirce, Parra et al., 2004	3; case reports (letter)	2	[2]	2/2	2/2		1/2	1/2	0/2	2/2		0/2		2/2	2/2	2/2		1 1	0/2		0/2	Carpenters. 1/2 co-exposed and co-sensitized to jatoba see jatoba
Family Meliaceae												1 1													
Mahogany	-	-	Sosman, Schlueter et al., 1969	3; case report	1	[1]	1/1	nd		nd	1/1	nd	1/1		1/1		nd	nd	1/1		1	0/1		nd	Patternmaker. See also cedar and oak
Sapele wood	-	1	Alvarez-Cuesta, Ortiz et al., 2004	3; case report	1	1	1/1	1/1		1/1	nd	1/1	1/1		nd		nd	nd	nd			0/1		1/1	Carpenter
Family Moraceae			I	I	I		I	II	-	L		+		-				+		<u> </u>	⊢		-		
Antiaris (Antiaris africana or Antiaris toxicana)	-	1	Higuero, Zabala et al., 2001	3; case report	1	1	1/1	1/1		1/1	1/1	nd	1/1		0/1		1/1	nd	1/1		1	1/1		1/1	Woodworker
roko (Cholophora excelsa)	(*)	5	Ricciardi, Fedele et al., 2003	3+; case reports	9	4 (44.4)	9/9	nd		nd	9/9	nd	9/9		nd		9/9	9/9	9/9		9	4/9*		0/9	9 woodworkers with clinically proven OA to iroko were compared to 10 asymptomatic woodworkers and to 10 astmatic woodworkers. 'I.C.; all controlls were SPT-, IgE-, PFT- and SIC- to iroko
н	1		Azofra and Olaguibel, 1989	3; case report	1	[1]	1/1	1/1		1/1	1/1	nd	1/1		0/1		1/1	nd	1/1		1	0/1		nd	Carpenter
*			Pickering, Batten et al., 1972	3; case report	1	1	1/1	nd		nd	nd	nd	1/1		0/1		nd	nd	1/1	1*	1**	1/1		nd	Carpenter. *Aqueous extract; ** wood dust
Family Oleaceae					· I					· · I															
Ash (Fraxinus americana)	-	1	Malo and Cartier, 1989	3; case report	1	[1]	1/1	1/1		nd	nd	nd	1/1		0/1		1/1	1/1	1/1	1		nd		0/1	Furniture maker

Agents	Strength of evidence per	Total no. of	Reference	Level of evidence per	Occupa- tionally	Allergic asthma cases								EVID			gical results								Remarks
	agent (three star system	of allergic asthma		study (revised	exposed subjects	due to mentioned			wo	ORK-RE	LATED SYMPTOM	s			LF	FT	NSBH	R sPFT		SIC			SPT	Spec	lgE
	of RCGP)	cases		SIGN grading system);	studied,	agent, n, prevalence (%).	Asthr	na Rhi	initis	Conju	inct. Cough	Skin	т	otal							Reacti	on			
		agent, n		study	n	Cases with probable allergic asthma but																			
				type.		specific sensitization not confirmed in																			
						parantheses [] or not indicated.				n/n		n/n			n/n		n/n	n/n							
							n/n Ast	% n/n Rhi	n %	Conj	% n/n Cou %	Skin	% n/n To	t %	LFT	%	NSBHR	% PFT	% n/n <mark>SI</mark>			d (n) n/n			
sh (Fraxinus excelsior)			Fernández-Rivas, Pérez-Carral et al., 1997	, 3; case report	1	1	1/1	1/1		1/1	nd	nd	1/1		0/1		1/1	1/1*	1/1			1 1/1		1/1	Furniture factory worker. *Serial PEFR at work and o work for 2 weeks; **SPT-, IC+
h (Fraxinus excelsior)	-		Spiewak, Bozek et al., 1994	3; case report	1	[1]	1/1	1/1		1/1	0/1	0/1	1/1		0/1		nd	nd	1/1		1*	1** 0/	1	nd	Carpenter co-exposed to oak, beech and pine. *Aquextract; **wood dust
Family Rhamnaceae					1 1		l	1 1						-1	-	-	1 1								
ascara sagrada bark (Rhamnus		1	Giavina-Bianchi,	3; case report	t 1	1	1/1	1/1		1/1	1/1	nd	1/1		0/1		1/1	nd	1/1			1 1/	1	1/1	Pharmacy worker co-exposed and co-sensitized to
rshiana)	-		Castro et al., 1997																						Passiflora alata
Family Rosacea					11			I I						-	-	1	I I								
papbark (Quillaja saponaria)		1	Raghuprasad,	3; case report	t 1	1	1/1	1/1		1/1	1/1	nd	1/1		0/1	1	1/1	nd	1/1		1	n	3	1/1	Saponin-production worker. RAST: cross-reactivity
	-		Brooks et al., 1980																						gum acacia and gum tragacanth
Family Rutaceae			1		1 1				1		<u> </u>			-	1	1	1 1	I		_ _		1		1	
au marfin (Balfourodendron edelianum)	-	1	Basomba, Burches et al., 1991	3; case report	1	1	1/1	1/1		nd	nd	nd	1/1		1/1		nd	nd	1/1		1	1/	1*	1/1	Carpenter. *IC
Family Sabotaceae			oral., 1331																						
piruana		2	Booth, LeFoldt et	3; case	2	2	2/2	1/2		nd	2/2	nd	2/2		nd		nd	nd	2/2*		1	1 2/2		nd	Workers in a furniture factory. *SIC with aqueous e
	-	2	al., 1976	reports	2	2	272	1/2		na	202	na	202		110		110	nu	2/2			1 2/2		na	**1/1 IC+, 1/1 scratch test+
akore, African cherry wood ïeghemella heckeli)	-	-	Obata, Dittrick et al., 2000	3; case report	t 1	[1]	1/1	nd		nd	1/1	nd	1/1		0/1		1/1	nd	1/1		1*	1** 0/	1	nd	Carpenter. *SIC with wood dust; **SIC with aqueou extract
anganyika aningré	-	2	Paggiaro, Cantalupi et al.,	3; case reports	3	2 (66.6)	3/3	100 2/3	66.6	1/3	33.3 2/3 66. 6	nd	3/3	100	1/3	33.3	2/2	100 nd	2/3	66.6	2	3/3	3* 1	00 0/3	0% Woodworkers. *IC
			1981																						
Family Sterculiaceae																									
rican Maple (Triplochiton scleroxylon), hitewood, Samba, Obeche, Wawa	(*)	16	Quirce, Hinojosa et al., 2000	3+; case series	5	5	5/5	5/5		nd	5/5	nd	5/5		nd		nd	2/2*	3/3		3	5/	5	5/5	Woodworkers. *2 subjects who didn't undergo SIC PFT+
	• •		Ferrer, Maranon	2	t 1	1	1/1	nd		nd	- 4		nd		nd		nd	nd	1/1			1/		1/1	Worker exposed to Triplochiton scleroxylon
			et al., 2001	3; case report		I	1/1	na		na	nd	nd	na		nu		na	na	1/1			1/		1/1	Worker exposed to Thiplochilon scieroxylon
	-		ABSTRACT Pontier, Popin et	3: case report	1	1	1/1	1/1		nd	nd	nd	nd				1/1	nd	1/1*	_		1/	1	1/1	Worker exposed to abachi wood. * LFT showed ain
			al., 2002 ABSTRACT	3, 0836 Teport			1/1			na	ind ind	na	nd					nu							ostruction, nasal challenge test was also positive.
	-		Hinojosa, Losada	3; case	4	4	4/4	4/4		nd	nd	nd	4/4	_	nd		nd	nd	4/4		4	4/	4	4/4	2 sawmill workers co-exposed to Ramin, 1 woodca
			et al., 1986	reports																		-/			and 1 carpenter. REIA: cross-reactivity with Ramin; also Ramin
	-		Hinojosa, Moneo	3; case	2	2	2/2	2/2		1/2	1/2	nd	2/2		1/2	+	nd	nd	1/1	+	1	2/	2	2/2	Woodworker and construction worker with tracheoto
			et al., 1984	reports																					
			Reijula, Kujala et al., 1994	3; case reports	2	2	2/2	2/2		nd	2/2	nd	2/2		1/2		1/2	nd	2/2		2	2/	2	2/2	Carpenters
			Weber and	3; case report	t 1	1	1/1	1/1		0/1	0/1	1/1	1/1		1/1	-	nd	nd	1/1	+		1 1/		1/1	Woodworker. *IC
			Häußinger, 1988																						
Family Thymelaeceae							•		1																
amin (Gonystylus bancanus)	-	2	Hinojosa, Losada et al., 1986	3; case reports	2	2	2/2	2/2		nd	nd	nd	2/2		nd		nd	nd	2/2		2	2/	2	nd	Sawmill workers. Co-exposure to African maple
			Howie, Boyd et al., 1976	3; case report	t 1	[1]	1/1	nd		nd	1/1	nd	1/1		0/1		nd	1/1	1/1		1	0/	1	nd	Wood worker. IgG+ with Ramin. Diagnosis of extrins allergic alveolitis
SOFTWOOD				1						I					1	<u> </u>									
Family Cupressaceae																									

Agents	Strength of evidence per	Total no. of	Reference	Level of evidence per		Allergic asthma cases										EVIDE			gical resu										Remarks
	agent (three	allergic		study	exposed	due to				wo	RK-RELATI	ED SYMPT	OMS				LF	т	NSB	BHR	sPFT		SIC	2		SI	РТ	Spec	. IgE
	star system of RCGP)	asthma cases		(revised SIGN grading	subjects studied.	mentioned agent, n,														_									
	,	per		system);	n	prevalence (%). Cases with probable	Asth	ma	Rhin	iitis	Conjunct.	Coug	h	Skin	Tot	al								Rea	ction				
		agent, n		study type.		allergic asthma but																							
						specific sensitization not confirmed in	1																						
						parantheses [] or not indicated.					n/n			n/n			n/n		n/n		n/n								
			a	_			n/n Ast	%	n/n Rhin	%	Conj %		%	Skin %	n/n Tot	%	LFT	%	NSBHR	%	PFT %		° %	i (n) I (n/n <mark>SPT</mark>	%	n/n lgE	
California Redwood (Sequoia emperivirens)	-	-	Chan-Yeung and Abboud, 1976	3; case reports	2	[2]	2/2		2/2		nd	1/2		nd	2/2		1/2		nd		nd	2/2			2	0/2		nd	Carpenter and furniture-maker
	-		doPico, 1978	3; case report	t 1	[1]	1/1		1/1		nd	1/1		nd	1/1		1/1		nd		nd	1/1			1	0/1		nd	Retired carpenter
				0, 0000 100011		1.1			., .																	0,1		110	
Eastern white cedar (Thuja occidentalis)	*	1	Malo, Cartier et	2-; cross-	42	[3 (7.1)]	25/42	59.5	nd		nd	nd		nd	nd		0/42	0	18/42	42.9	nd	3/12*	25	1	1	nd		nd	Sawmill workers. *SIC in NSBHR+ only, 1/10 SIC+
			al., 1994	sectional																									plicatic acid (immediate), 1/3 SIC+ with western re- cedar (late), 1 subject underwent SIC to both of the agents, 1 subject had sign. changes in PC20 each he was exposed to <i>Th</i> . occ. but no changes in FEV
			Cartier, Chan et al., 1986	3; case report	t 1	1	1/1		nd		nd	1/1		nd	1/1		0/1		1/1		1/1*	1/1**			1	nd		1/1***	Sawmill worker. *Serial PEFR at work and off work weeks; **SIC with plicatic acid and with western red
			uii, 1000																										cedar; ***IgE with plicatic acid
Vestern red cedar (Thuja plicata)	**	323	Chan-Yeung,	2-; cross-	652	1 (0.2)	27/652	4.1	nd		nd	110/65	16.	nd	nd		X*		94/485	19.4	nd	nd				1/652	0.15	nd	Cedar mill workers. Exposed had sign. higher prev
	~ ~		Vedal et al., 1984	sectional								2	9																of asthma and NSBHR+, and *sign. lower FEV1/FV
			Noertjojo, Dimich-	2- longitudinal	1 243				nd		nd	nd		nd	nd				nd		nd	nd				nd		nd	11 yr follow-up of lung function of non-asthmatic sa
			Ward et al., 1996	study	210				na			110														110		110	workers. *20 subjects with physician diagnosed as
																													(not clear whether WR) were excluded from the fol up; 20/243 had wheezing during initial survey (not of
																													whether WR); **sign. annual declines in FEV1 and
																													in non-asthmatics showed dose-response relat. be level of exposure and the annual decline in FVC
			01		105	(405 (400))	405/405		50/405			100/10			105/105		07/405					105/10	-	40.5	4 50				
			Chan-Yeung, Lam et al., 1982	2-; case series with	125	[125 (100)]	125/125		50/125		nd	109/12 5		nd	125/125		27/125		55/55		nd	125/12	5	12 5	i4 59	nd		nd	125 subjects with OA re-examined after 1-9 years: still exposed and 37/75 no longer exposed remained
				follow-up																									asthmatic; persistence of symptoms related to long
																													duration of both exposure and symptoms prior to diagnosis, and also to higher bronchial responsiver
-																													
			Mue, Ise et al., 1975	2-; cross- sectional	154	19 (12.3)	38/154	24.7	45/154	29.2	45/154 29.3	2 33/154	21. 4	nd	116/154	75.3	nd		nd		nd	23/154	4 14.9	23		86/154*	55.8	nd	Workers of wooden frame factories. *IC; 19/23 SIC were IC+
			Ishizaki, Shida et al., 1973	3+; cross- sectional	1320	22 (1.7)	45/1320	3.4	124/132	9.4	125/13 9.5 20	nd	5	i9/132 4.5 0	303/132 0	23	nd		nd		nd	nd				22/26*	85	nd	Furniture factory workers. *IC done in asthmatics
			Paggiaro and Chan Yeung,	3+; case series	332	32 (9.6)	332/332		nd		nd	nd		nd	332/332		+*		+*		nd	332/33	2	31 #	# 157	nd		32/138	23.2 332 patients with OA due to WRC. Clinical tests do with plicatic acid; *subjects with dual response had
			1987																										lower FEF25-75 and sign. lower mean PC20 com
																													to patients with other patterns of response
1			Chan-Yeung,	3+; case	232	232 (100)	232/232	100	nd		nd	nd		nd	232/232	100	+*		+**		nd	232/23	2 100	25 9	7 109	nd		+***	232 patients with new-onset OA observed ~4 years
			MacLean et al., 1987	series with follow-up																									the initial diagnosis: 136/232 had no further exposu of them were asymtomatic and 81 of them sympto
			1307	ionow-up																									at follow-up; all 96 with continued exposure were
																													symptomatc. *Sign. higher in asymptomatics at tim diagnosis and at follow-up; **sign. higher PC20 in
																													asymptomatics; ***no sign. difference
			Tao, Chan et al	3+; case	28	9 (29 6)	28/28	100	nd		nd	nd		nd	28/28	100	nd		nd		nd	10/20	64.3	2	0 7	nd		0/10*	44.4 Wood workers suspected to have OA due to WRC
			Tse, Chan et al., 1982	series	20	8 (28.6)	20/20	100	na		na	na		na	20/20	100	na		na		na	10/20	04.3	2	9 /	na		0/10	done with plicatic acid and crude cedar in SIC+ sub
																													only
			Côté, Kennedy et	3+; case	23	[14 (60.9)]	18/23	78.3	nd		nd	nd		nd	23/23	100	nd		11/23*	47.8 1	3/23** 56.	.5 14/23**	** 60.9	14		nd		nd	Sawmill workers. *Sign. decrease in PC20 after ret
			al., 1990	series																									to work by SIC+ subjects; **serial PEFR for 2 weel work and for 3 weeks at work: significant decrease
																													work by SIC+ subjects; ***SIC with plicatic acid
	-		Chan-Yeung,	3+: case	22	3 (13.6)	18/22	81.8	12/22	54.5	nd	nd		nd	22/22	100	12/18	66.6	nd		nd	18/22	81.8	4	8 6	3/22	13.6	nd	Woodworkers. 0/22 SPT+ with plicatic acid; 16/16
			Barton et al.,	series with		- (,																			-				with plicatic acid (4 immediate, 5 late, 7 dual)
			1973	follow-up																									
			Gandevia and Milne, 1970	3+; case series	10	3 (30)	6/10	60	8/10	80	nd	5/10	50	nd	10/10	100	6/10	60	nd		nd	4/4	100		4 2	6/9	66.6	nd	Woodworkers. All 6 asthmatics were LFT+; SIC do only in asthmatics; 3/4 SIC+ asthmatics were SPT-
			······································	30162														1									1		Sing in advintance, or 4 SIGT astitutates Weld SP1-
	1		Chan-Yeung and	3; case	4	[4]	4/4		2/4		nd	nd		nd	4/4		0/4	1	4/4		nd	4/4*		3	1	nd		0/4*	Sawmill workers. *SIC and IgE with plicatic acid
			Desjardins, 1992	reports with follow-up														1									1		
			Chap Young	3: case	3	2	2/2	+	2/3		2/3	2/2		nd	2/2		2/3		nd		nd	3/3		1		2/2*		nd	Wood workers *I C (immediate)
			Chan-Yeung, Barton et al.,	3; case reports	3	3	3/3		2/3		2/3	2/3		nd	3/3		2/3		nd		nd	3/3			<pre></pre>	3/3*	1	nd	Wood workers. *I.C.(immediate)
			1971		1		1					1			1		1	1	1								1	1	
				3; case report		[1]	1/1		1/1	-	nd	nd		nd	1/1		0/1	_	nd		nd	1/1				0/1		nd	Carpenter

		Total no.	Reference		Occupa-	Allergic asthma cases								EVIDE	ENCE (pa	thologica	al results)								Remarks
	evidence per agent (three	of allergic asthma		evidence per study	exposed	due to mentioned				WOR	K-RELATED SY	MPTOMS			LF	т	NSBHR	sPFT		SIC			SPT	Spec	. IgE
	star system of RCGP)	astnma cases per agent, n		(revised SIGN grading system); study type.	subjects studied, n	agent, n, prevalence (%). Cases with probable allergic asthma but specific sensitization	Asth	ma	Rhini	tis (Conjunct. (Cough	ŝkin T	otal	-					F	eaction				
						not confirmed in parantheses [] or not indicated.	n/n Ast	%	n/n Rhin		n/n Conj % n/n	n/i Cou % Ski		t %	n/n LFT	% N	n/n SBHR 9	n/n % PFT %	n/n <mark>SIC</mark>	∾ i(n	l (n) d (n) n/n 60	T 9/	n/n laE	9/
Family Pinaceae		Į	1	Į												70		///////////////////////////////////////		70 . (.	<u></u>		1 70	in ige	70
Cedar of Lebanon (Cedra libani)	-	1	Greenberg, 1972	3+; case series	6	1	6/6		2/6		nd 4,	6 no	6/6		0/5		nd	nd	nd			1/6		nd	Workers at joinery works
Cedar			Sosman, Schlueter et al., 1969	3; case reports	2	[2]	2/2		nd	1	nd n	d no	2/2		nd		nd	nd	1/1		1	0/1		nd	Carpenters. See also oak and mahogany
Pine and Spruce	[*]	1	Hessel, Herbert et al., 1995	2-; cross- sectional	94	[7 (7.4)]	7/94*	7.4	nd	1	nd n	d no	nd		+**		nd	nd	nd			nd		nd	Sawmill workers. *Current asthma, not clear whether WR; **sign. decreased FEV1 and FEV1/FVC in expose
Pine (<i>Pinus radiata</i>)			Douwes, McLean et al., 2001	3+; survey	704	[127 (18)]	127/704	18	+*		+* +	** no	nd		nd		nd	nd	nd			nd		nd	Pine sawmill workers from 5 large sawmills. *Sign. increased in exposed; **more common in exposed
Pine (Pinus sylvestris)	-		Spiewak, Bozek et al., 1994	3; case report	1	[1]	1/1		1/1	1	1/1 0,	1 0/	1/1		0/1		nd	nd	1/1		1	0/1		nd	Carpenter co-exposed to ash, oak and beech
Pine (Pinus sylvestris)	1		Skovsted, Schlünssen et al., 2000	3; case report	1	1	1/1		1/1		nd n	d no	1/1		0/1		nd	1/1*	nd			1/1		nd	Furniture maker. *Serial PEFR during working days and off-work
Pine and wood boards	*	9	Schlünssen, Skovsted et al., 2004	2-; cross- sectional	365	9 (2.5)**	82/365	22.5	nd		nd n	d no	nd		nd		•	nd	nd			36/365	5 9.9	9/365	2.6 Woodworkers. Random sample of persons reporting asthma symptoms, rhinitis symptoms, and no respirato symptoms in a questionnaire from 1997-1999 (Schlünssen et al. 2002). "54/365 had asthma symptor and NSBHR+. Spec. IgE measured only for pine. "Highest ORs found for asthma in relation to Spec. Igf for pine.
Coniferous trees (Black spruce (Picea mariana), balsam fir (Abies balsamea), jack pine (Pinus baksiana)	-	-	Malo, Cartier et al., 1986	3; case series	11	[11]	11/11		6/11	6	i/11 n	d no	11/11		2/11	1	11/11	11/11*	0/4			nd		nd	Sawmill employees. *Sign. changes in PEFR at work a compared with periods off work
MUSHROOMS, MOLDS (FUNGI)		1						1 1																	
															11		·								· · · ·
Edible mushrooms															1 1										
Edible mushrooms Psalliata hortensis, Boletus edulis, Champignon de Paris	(*)	8	Symington, Kerr et al., 1981	3+; case series	8	4 (50)	+*		+*		nd n	d no	8/8		1/1		nd	nd	4/8	4		5/8	62.5	nd	Employees in a food manufacturing factory. *Individual WRS not given; clinical tests with dried mushroom extr
Psalliata hortensis, Boletus edulis,	(*)	8	Symington, Kerr et al., 1981 Foti, Eustachio et al., 2008			4 (50) 1	+*		+* nd			d no			1/1 0/1		nd 1/1	nd	4/8	4	1	5/8 nd	62.5	nd 1/1	Employees in a food manufacturing factory. "Individual WRS not given; clinical tests with dried mushroom extr Worker in a pasta factory.
Psalliata hortensis, Boletus edulis, Champignon de Paris	(*)	8	et al., 1981 Foti, Eustachio et	series		4 (50) 1 3	+* 1/1 3/3		+* nd 1/3	1		d no	nd							4	1		62.5		WRS not given; clinical tests with dried mushroom extr Worker in a pasta factory.
Psalliata hortensis, Boletus edulis, Champignon de París Boletus edulis Boletus edulis	(*)	8	et al., 1981 Foti, Eustachio et al., 2008 Torricelli, Johannson et al.,	series 3; case report 3; case reports	3	1				1	nd n	d no	nd 3/3		0/1		1/1	nd	1/1	4	1	nd	62.5	1/1	WRS not given; clinical tests with dried mushroom extr Worker in a pasta factory. Office worker in food company, indirectly exposed, coc and housewife. Worker in a factory producing a single type of mushroom. 'Serial PEFR at work and off-work for 1
Psalliata hortensis, Boletus edulis, Champignon de Paris Boletus edulis	(*) - -	8	et al., 1981 Foti, Eustachio et al., 2008 Torricelli, Johannson et al., 1997 Michils, De Vuyst	series 3; case report 3; case reports	3	1	3/3		1/3		nd n 1/3 n	d no d no 1 no	nd 3/3		0/1		1/1	nd	2/2	4	1	nd 3/3	62.5	1/1 3/3	WRS not given; clinical tests with dried mushroom extr Worker in a pasta factory. Office worker in food company, indirectly exposed, coo and housewife.
Psalliata hortensiis, Boletus edulis, Champignon de Paris Boletus edulis Boletus edulis Pleurotus cornucopiae	(*) - - -	8	et al., 1981 Foti, Eustachio et al., 2008 Torricelli, Johannson et al., 1997 Michils, De Vuyst et al., 1991 Vereda, Quirce	series 3; case report 3; case reports 3; case report	1 3 1 1	1	3/3		1/3 nd		nd n 1/3 n nd 1,	d no d no 1 no 1 no	nd 3/3 1/1 nd		0/1 0/2 0/1		1/1 1/1 1/1	nd nd 1/1*	1/1 2/2 nd	4		nd 3/3 nd	62.5	1/1 3/3 1/1	WRS not given; clinical tests with dried mushroom extr Worker in a pasta factory. Office worker in food company, indirectly exposed, coc and housewife. Worker in a factory producing a single type of mushroom. "Serial PEFR at work and off-work for 1 week Seller of fruits and vegetables. Baker, not sensitized to other baking allergens/additiv
Psalliata hortensis, Boletus edulis, Champignon de Paris Boletus edulis Boletus edulis Pleurotus corrucopiae Pleurotus ostreatus Saccharomyces cerevisiae, powdered	(*) - - -	8	et al., 1981 Foti, Eustachio et al., 2008 Torricelli, Johannson et al., 1997 Michils, De Vuyst et al., 1991 Vereda, Quirce et al., 2008 Beichi- Hemandez, Mora- Gonzalez et al.,	series 3; case report 3; case reports 3; case report 3; case report	1 3 1 1	1	3/3 1/1 1/1		1/3 nd nd		nd n 1/3 n nd 1, nd 1,	d no d no 1 no 1 no	nd 3/3 1/1 nd		0/1 0/2 0/1		1/1 1/1 1/1 1/1 1/1	nd nd 1/1*	1/1 2/2 nd 1/1	4	1	nd 3/3 nd 1/1	62.5	1/1 3/3 1/1 1/1	WRS not given; clinical tests with dried mushroom extr Worker in a pasta factory. Office worker in food company, indirectly exposed, coc and housewite. Worker in a factory producing a single type of mushroom. "Serial PERR at work and off-work for 1 week Seller of fruits and vegetables. Baker, not sensitized to other baking allergens/additives;"serial PERR for at work. SIC- with other baking additives; "serial PERR for at work.
Pealliata hortensis, Boletus edulis, Champignon de Paris Boletus edulis Boletus edulis Pleurotus cornucopiae Pleurotus ostreatus Saccharomyces cerevisiae, powdered Jehydrated yeast Molds, other fungi	(*) - - - -	8	et al., 1981 Foti, Eustachio et al., 2008 Torricelli, Johannson et al., 1997 Michils, De Vuyst et al., 1991 Vereda, Quirce et al., 2008 Belchi- Hermandez, Mora- Gonzalez et al., 1996	series 3; case report 3; case reports 3; case report 3; case report	1 3 1 1	1	3/3 1/1 1/1		1/3 nd nd		nd n 1/3 n nd 1, nd 1,	d nc d nc 1 nc 1 nc 1 nc	nd 3/3 1/1 nd 1/1		0/1 0/2 0/1		1/1 1/1 1/1 1/1 1/1	nd nd 1/1*	1/1 2/2 nd 1/1	4		nd 3/3 nd 1/1	62.5	1/1 3/3 1/1 1/1	WRS not given; clinical tests with dried mushroom exit Worker in a pasta factory. Office worker in food company, indirectly exposed, cod and housewife. Worker in a factory producing a single type of mushroom. "Serial PEFR at work and off-work for 1 week Seller of fruits and vegetables. Baker, not sensitized to other baking allergens/additiv SIC- with other baking additives; "serial PEFR for at w and off-work for 2 weeks
Pealliata hortensis, Boletus edulis, Champignon de Paris Boletus edulis Boletus edulis Pleurotus corrucopiae Pleurotus ostreatus Saccharomyces cerevisiae, powdered dehydrated yeast	(*) - - - *[*]	8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	et al., 1981 Foti, Eustachio et al., 2008 Torricelli, Johannson et al., 1997 Michils, De Vuyst et al., 1991 Vereda, Quirce et al., 2008 Belchi- Hermandez, Mora- Gonzalez et al., 1996	series 3; case report 3; case reports 3; case report 3; case report 3; case report	1 3 1 1	1	3/3 1/1 1/1 1/1 1/1	5.3	1/3 nd nd 1/1		nd n 1/3 n nd 1, nd 1, nd 1, nd 1,	d nc d nc 1 nc 1 nc 1 nc	nd 3/3 1/1 1/1 1/1		0/1 0/2 0/1 0/1		1/1 1/1 1/1 1/1 1/1	nd nd 1/1* nd 1/1*	1/1 2/2 nd 1/1 1/1	4		nd 3/3 nd 1/1 1/1		1/1 3/3 1/1 1/1 1/1 1/1	WRS not given; clinical tests with dried mushroom extr Worker in a pasta factory. Office worker in food company, indirectly exposed, coc and housewife. Worker in a factory producing a single type of mushroom. "Serial PEFR at work and off-work for 1 week Seller of fruits and vegetables. Baker, not sensitized to other baking allergens/additiv SIC- with other baking additives; "serial PEFR for at w and off-work for 2 weeks Baker, "IC+ with rye and with various molds (<i>Aspergille</i> most reactive); SIC- with rye Workers of a biotechnology plant. "Respiratory symptoms other than asthma"; "SPT+ and asthmatice
Psalliata hortensis, Boletus edulis, Champignon de Paris Boletus edulis Boletus edulis Pleurotus cornucopiae Pleurotus ostreatus Saccharomyces cerevisiae, powdered dehydrated yeast Molds, other fungi Aspergillus mix	- - - -	1	et al., 1981 Foti, Eustachio et al., 2008 Torricelli, Johannson et al., 1997 Michils, De Vuyst et al., 1991 Vereda, Quirce et al., 2008 Belchi- Hermandez, Mora- Gonzalez et al., 1996 Klaustermeyer, Bardana et al., 1977 Topping, Scarisbrick et al.,	series 3; case report 3; case reports 3; case report 3; case report 3; case report 2; cross-	1 3 1 1 1	1 3 1 1 1	3/3 1/1 1/1 1/1 1/1		1/3 nd nd 1/1		nd n 1/3 n nd 1, nd 1, nd 1, nd 1,	d ne d ne 1 nc 1 nc 1 nc d nc	nd 3/3 1/1 1/1 1/1 1/1 78/34:		0/1 0/2 0/1 0/1 1/1 1/1 nd		1/1 1/1 1/1 1/1 1/1 1/1 1/1 nd	nd nd 1/1* 1/1* 1/1* 1/1* 1/1* 1/1* 1/1* 1/1	1/1 2/2 nd 1/1 1/1 1/1	4		nd 3/3 nd 1/1 1/1 1/1	3 5.0	1/1 3/3 1/1 1/1 1/1 1/1	WRS not given; clinical tests with dried mushroom extr Worker in a pasta factory. Office worker in food company, indirectly exposed, coc and housewife. Worker in a factory producing a single type of mushroom. "Senial PERR at work and off-work for 1 week Seller of fruits and vegetables. Baker, not sensitized to other baking allergens/additive SiC- with other baking additives; "senial PERR for at we and off-work for 2 weeks Baker, "IC+ with nye and with various molds (<i>Aspergilit</i> most reactive); SIC- with nye Workers of a biotechnology plant. "Respiratory symptoms other than asthma [*] ; "SPT+ and asthmatic tested; 9/18 asthmatics sensitized; subjects with WRS
Pealliata hortensis, Boletus edulis, Champignon de Paris Boletus edulis Boletus edulis Pleurotus corrucopiae Pleurotus ostreatus Saccharomyces cerevisiae, powdered dehydrated yeast Molds, other fungi Aspergillus mix	- - - -	1	et al., 1981 Fot, Eustachio et al., 2008 Torricelli, Johannson et al., 1997 Michils, De Vuyst et al., 1991 Vereda, Quirce et al., 2008 Belchi- Hermandez, Mora- Gonzalez et al., 1996 Klaustermeyer, Bardana et al., 1977 Topping, Scarsbrick et al., 1985	series 3; case report 3; case report 3; case report 3; case report 3; case report 3; case report 4; cross- sectional 3+; cross- sectional with follow-up	1 3 1 1 1 1 343 261	1 3 1 1 1 1 9 (2.6)	3/3 1/1 1/1 1/1 1/1 1/1 1/1 18/343		1/3 nd nd 1/1		nd n 1/3 n nd 1, nd 1, nd 1, nd 1, nd 1, nd 1,	d ne d ne 1 nc 1 nc 1 nc 1 nc 1 nc	nd 3/3 1/1 1/1 1/1 1/1 78/34: 78/26		0/1 0/2 0/1 0/1 1/1 1/1 nd		1/1 1/1 1/1 1/1 1/1 1/1 1/1 nd nd	nd nd 1/1*	1/1 2/2 nd 1/1 1/1 1/1 1/1 1/1 1/1 nd			nd 3/3 nd 1/1 1/1 1/1* 1/1*	3 5.0	1/1 3/3 1/1 1/1 1/1 1/1 1/1 1/1 1/26**	Office worker in food company, indirectly exposed, cool and housewife. Worker in a factory producing a single type of mushroom. "Serial PEFR at work and off-work for 1 week Seller of fruits and vegetables. Baker, not sensitized to other baking allergens/additive SIC- with other baking additives; "serial PEFR for at wo and off-work for 2 weeks Baker, "IC+ with rye and with various molds (Aspergillu most reactive); SIC- with rye Workers of a biotechnology plant. "Respiratory symptoms other than asthma", "SPT+ and asthmatics tested; 9/18 asthmatics sensitized; subjects with WRS had sign. increased prevalence of sensitization 261 original and 76 new employees of biotechnology plant. 78/261 original and 5/76 new employees

Agents	Strength of	Total no.	Reference		Occupa-	Allergic asthma cases								EV	IDENCE (pat	thologi	ical results)								Remarks
	evidence per agent (three	of allergic asthma		evidence per study	tionally exposed	due to mentioned			WORK-F	RELATE	ED SYMPTOM	6			LFI	т	NSBHR	sPFT		SIC		\$	SPT	Spec. Igi	E
	star system of RCGP)	cases		(revised SIGN grading		agent, n,	Asthr	na Rhi	nitis Co	njunct.	Cough	Skir	n	Total							Reaction				
		per agent, n		system); study type.	n	prevalence (%). Cases with probable allergic asthma but specific sensitization																			
						not confirmed in parantheses [] or not indicated.	n/n Ast	% n/n Rhi	n/n % Con		n/n Cou %	n/n Skin	% r	n/n Tot %	n/n		n/n NSBHR %	n/n) I () -I (
Alternaria	[*]	8	Menzies,Comtois et al., 1997	2-, cross sectional	214	7 (3.3)		21.3 87/169		· · · ·	66/169 39		70	nd	nd	~~	nd	PFT %	n/n SIC nd	% 10		n) n/n SP 18/169	9 10,65		Office workers exposed to fungal and house dust mite (see HDM) aeroalergens. Alternaria allergen was significantly associated with respiratory symptoms The population-attributable risk fo work-related respiratory tract symptoms was 9.5% for Alternaria. interpreted as asthma, Sneezing as thinits.
Alternaria	-		Klaustermeyer, Bardana et al., 1977	3; case report	1	1	1/1	nd	nd		nd	nd		1/1	nd		nd	nd	1/1	1		1/1*		nd	Baker. * IC+ with Alternaria, IC- with rye and wheat
Chrysonilia sitophila, common red bread mold	-	3	Tarlo, Wai et al., 1996	3; case report	1	1	1/1	1/1	1/1		1/1	nd		1/1	0/1		1/1	1/1	nd			1/1		1/1	Logging worker. SPT- with wood.
*			Monzn, Ledesma et al., 2009	3; case report	1	1	1/1	1/1	1/1		1/1	nd		nd	0/1		nd	'1/1	'1/1	1		1/1		1/1	Worker in a coffee company.
			Francuz, Yera et al., 2010	3; case report	1	1	1/1	1/1	1/1		1/1	nd		nd	0/1		'1/1	'1/1	nd			1/1*		1/1*	Coffee dispenser operator. *SPT and Spec.lgE+ for grass pollen and birch pollen
Dictyostelium discoideum, slime mould	-	1	Gottlieb, Garibaldi et al., 1993	3; case report	1	1	1/1	1/1	1/1		nd	nd		1/1	nd		nd	1/1	nd			1/1		1/1	Laboratory worker
Mucor	-	1	Enríquez, Fernández et al., 2011	3; case report	1	1	1/1	nd	1/1		nd	nd		nd	0/1		1/1	0/1*	'1/1	1		1/1		1/1	Stucco maker exposed to esparto fibers. PFT decrease nn significant but suggesting an occupational relationship
Neurospora sp.	-	2	Côté, Chan et al., 1991	3; case report	1	1	1/1	1/1	nd		1/1	nd		1/1	0/1		1/1	nd	1/1	1		1/1		1/1	Plywood factory worker
8			Heffler, Nebiolo et al., 2009	3; case report	1	1	1/1	nd	nd		nd	nd		nd	0/1		'1/1	'1/1	nd			1/1*		1/1	Coffee dispenser operator. *SPT for mix of fungi extracts.
Penicillium camemberti	-	1	Merget, Sander et al., 2008	3; case report	1	1	1/1	1/1	nd		nd	1/1		nd	1/1*		nd	nd	nd			1/1		1/1	Sausage packer. *FEV1: 49% predicted, FEV1/FVC:79% predicted. Bronchial challenge not performed due to patient's airway obstruction.
Plasmopara viticola, pseudo mildew of grapewine	-	1	Wenzel Schaubschläger, Becker et al., 1994	3; case report	1	1	1/1	1/1	nd		nd	nd		1/1	0/1		1/1	nd	0/1			1/1		1/1	Greenhouse worker co-exposed and co-sensitized to Alternaria
Rhizopus nigricans	-	1	Gamboa, Jáuregui et al., 1996	3; case report	1	1	1/1	1/1	nd		1/1	nd		1/1	0/1		nd	nd	1/1	1		1/1		1/1	Coal miner co-exposed but not sensitized to other molds
Scopulariopsis brevicaulis	-	-	Lander, Jepsen et al., 1988	3; case report	1	[1]	1/1	nd	nd		1/1	nd		1/1	nd		nd	nd	1/1		1	nd		nd	A tobacco worker. IgG+ to Scopulariopsis brevicaulis
Sporobolomyces salmonicolor	-	-	Seuri, Husman et al., 2000 ABSTRACT	3+; survey	14	[4 (28.6)]	4/14	nd	nd		9/14	nd		13/14	nd		nd	nd	4			0/14		nd	Employees of a water-damaged building. 7/14 nasal Ch-
Mold fungi Mucor Aspergillus	-		Bergmann, Rebohle et al., 1976	3+; survey	32	.*	*	*	nd		*	nd		*	nd		nd	nd	nd			8/30	53.3 26.7		Bakers. *1/3 of 32 had WRS (rhinitis, asthma, bronchitis individual data not listed; 9/30 IC+ with flour
Fungus mixture Mold fungi	-			3+; case	179	,		nd	nd	_	nd	nd	1	79/179	nd		nd	nd	nd			22/30	73.3		*Retrospective analysis of IC tests of 179 bakers with
Mucor Cladosporium	-			series; retrograde analysis																		81/179 23/54 36/179	9 45 43 9 32		allergic airway disease. Prevalence of sensitization sign. higher in symptomatics
Aspergillus Fungus mixture <u>MICROSCOPIC ORGANISMS</u>				anaiyoio																		59/168			
(PROTOCTISTAE) Chlorella (Algae)	-	1	Ng,Tan et al., 1994	3; case report	1	1	1/1	1/1	1/1		1/1	nd		1/1	nd		1/1	1/1*	1/1		1	1/1		nd	Pharmacist. *Serial PEFR for 7 working days and 13 days off
ENZYMES		I	1	I	I		I	1	<u> </u>								II	11	1	L L	1 1	-1	1	1	•
Alpha-amylase from Aspergillus oryzae	**	29	Brisman, Nieuwenhuijsen ei al., 2004	2+; cohort study (prospective)	300	[incidence rate: 3]	36/300	12* 86/300	28.7* 86/30	00 28.7	* nd	nd		nd	nd		nd	nd	nd			24/300) 8*	nd	Bakers and millers. *3 year incidence: sign, increased prevalence ratio (PR) of 3.0 for chest symptoms in the highest exposure category; 21/300 SPT with flour; sensitized astimatics not listed

Agents	Strength of	Total no.	Reference	Level of	Occupa-	Allergic											EVIDE	ENCE (pa	thologi	ical results)										Remarks
	evidence per agent (three	of allergic		evidence per study	tionally exposed	asthma cases due to				WOR	K-RELA	TED SY	MPTON	S				LF	т	NSBHR	sPF	т	SI	5		SPT	r	Spec. I	.gE	
	star system of RCGP)	asthma cases		SIGN grading	subjects studied,	mentioned agent, n,	Asthr	na	Rhini	tis	Coniunc	t. (ouah	Ski	in	Tot	al							React	ion					
	per agent, n		system); study type.		prevalence (%). Cases with probable allergic asthma but specific sensitization not confirmed in parantheses [] or																									
						not indicated.	n/n Ast	%	n/n Rhin		n/n Coni	% n/n	Cou %	n/n Skin	%	n/n Tot	%	n/n	%	n/n NSBHR %	n/n	% n/n SIC	96	i (n) l (n)	d (n) n/r	SPT	94	n/n lgE	%	
*			Nieuwenhuijsen, Heederik et al., 1999	2-; survey	264	[16]				7.6 45	6/256 7	7.6 n	t	17/256	6.6			nd	70	nd	nd	nd	/0				4.7	nd		Workers at 3 bakeries, 3 flour mills and 1 packing station. "None of the asthmatics has sensitized; sign. exposure-reporse relationship between exposure and sensitization
	-		Houba, Heederik et al., 1996	2-; cross- sectional	178	5 (2.8)	9/178	5.1	26/178	14.6 10	0/178 5	5.6 n	ł	19/178	10.7	44/178	24.7	x*		nd	nd	nd			16	/169	9	13/169		Bakers in 14 bakeries. *Individual results not listed; sign. association between alpha-amylase exposure levels and SPT+, and also between sensitization and WR respiratory symptoms; 5 asthmatics SPT+; see also bakery
•			Losada, Hinojosa et al., 1992	3+; survey	83	6	24/80	30.0	47/80	58.8	nd	n	ł	nd		47/80	58.8	nd		nd	nd	6/14*	42.9	6	2	6/83	31.3	43/83		Pharmaceutical-industry workers. *SIC in SPT+ with respiratory symp, not all asthmatics underwent SIC; 1/5 oral Ch induced a 30% decrease in FEV1 (immediate)
*			Baur, Chen et al., 1994	3+; survey (screening)	89		*				*	n	ł			43/89	48.3	nd		nd	nd	nd			1	6/89	17.8	14/89		89 bakers partially selected due to symptoms or as part of a screening study. *43 had asthma, rhinitis, conj. and/or skin symptoms; 34/89 IgE+ to wheat and/or rye; sensitized asthmatics not listed
	-		Brisman and Belin, 1991	3; case reports (index cases) with	4	3 (75)	3/4	75	4/4	100	nd	n	t	nd		4/4	62.5			nd	nd	nd				4/4	100	4/4	100	4 index cases of a factory producing semimanufactured products for bakeries
				survey	20	0	0/20		+*		nd	n	4	+*		11/20*		5/20	25	nd	nd	nd			e	/20	30	1/20		Additional 20 workers of this factory. *Individual symptoms not listed; 3/6 SPT+ nasal Ch+
s	-		Moneo, Alday et al., 1995	3+; case series	25	7 (28)	25/25	100	nd		nd	n	ł	nd		25/25	100	nd		nd	nd	8/25	32	8	1	1/25	44	6/25	24	Asthmatic bakers. 7/8 SIC+ were SPT+
•	-		Quirce, Fernández-Nieto et al., 2002a	3; case reports	4	4	4/4		4/4		nd	n	ł	nd		4/4		2/4		4/4	nd	3/3		2	1	4/4		4/4		3 bakers and 1 employee of an enzyme-processing plant. 2/4 SPT+ with hemicellulase; see glucoamylase
•	-		Valdivieso, Subiza et al., 1994	3; case reports	4	2 (50)	2/4	50	4/4	4	4/4	n	ł	nd		4/4	100	0/4	0	1/4 25	nd	2/2*		2		4/4		4/4		Bakers. *SIC in asthmatics; 2/2 nasal Ch+
•	-		Blanco Carmona, Juste Picón et al., 1991	3; case report	1	1	1/1		1/1		1/1	n	ł	nd		1/1		0/1		0/1	nd	1/1		1		1/1		1/1		Baker
*	-		Birnbaum, Latil et al., 1988	3; case report	1	1	1/1		nd		nd	n	ł	nd		1/1		nd		nd	nd	1/1		1	1	/1*		1/1	\neg	Baker. *IC; also IC+ with flour; SIC- with flour
Alpha-amylase inhibitors of cereal origin	-	3	López-Rico, Moneo et al., 1998	3; case reports	3	3	3/3		2/3		2/3	n	ł	nd		3/3		nd		nd	nd	nd				x*		3/3**		Wood factory workers. *3/3 SPT+ with cereals; **IgE wit 13 alpha-amylase families
Amylase from Bacillus licheniformis	-	4	Hole, Draper et al., 2000	3; case reports	4	4	4/4		4/4		nd	n	ł	nd		4/4		nd		4/4	nd	4/4		1 1	2 .	4/4		4/4		Detergent industry workers
Aspergillus enzymes	(*)		Quirce, Cuevas et al., 1992	: 3+; case series	5		5/5		5/5	:	3/5	n	ł	nd		5/5		0/5		5/5	nd									Bakers. 4/5 SPT+ with wheat and with rye; 5/5 IgE+ with wheat; 4/5 SIC+ with wheat (3 immediate, 1 dual)
Alpha-amylase from A. oryzae	()	5			-	5																5/5		4	1	5/5		5/5		
Cellulase from Aspergillus niger		4				4																4/4		3	1 ·	4/5		4/5		
Aspergillus oryzae enzymes	-	1	Baur, 1981	3; case report	1	1	1/1		nd		nd	n	ł	nd		1/1		nd		nd	nd	1/1*		1						Pharmaceutical worker. *SIC with a mix of A. oryzae enzymes (Protease, Amylase, Lipase)
Amylase from Aspergillus oryzae Protease from Aspergillus oryzae	_																									1/1 1/1		1/1 1/1		
Beta-Glucanase and Phytase	-	1	O'Connor, Bourke et al., 2001	3; case report	1	1	1/1		nd		nd	1/	1	nd		1/1		0/1		1/1	nd	1/1*		1		/1*		1/1*		Director of an animal feed manufacturing plant. Other 22 employees asymptomatic. *SIC+, SPT+, and IgE+ with both phytase and beta-glucanase
Bromelain of Ananas comosus	[*]	13	Gailhofer, Wilders Truschnig et al.,	 3+; cross- sectional with 	4	4	4/4		3/4	:	3/4	n	t I	nd		4/4		nd		nd	nd	nd				3/3		4/4		Workers of a blood grouping laboratory. All symptomatics IgE+; *SPT was done in 3 symptomatics:
			1988	index cases	17	4 (23.5)	4/17	23.5	nd		nd	n	t	nd		4/17	23.5	nd		nd	nd	nd				•		7/17	41.2	2 developed anaphylactic reactions
	1		Gailhofer, Teubl et al., 1987	3; case reports	2	2	2/2		1/2		1/2	n	ł	nd		2/2		nd		nd	nd	nd				2/2	100	2/2	100	Labor workers. SPT- and IgE- with papain
]		Galleguillos and Rodriguez, 1978	3; case reports	2	2	2/2		2/2		1/2	n		nd		2/2		0/1		nd	nd	2/2		1		2/2		nd		Pharmaceutical laboratory workers. 1 subject had asthmatic symptoms also after ingestion of pineapple
			Baur and Fruhmann, 1979	3; case report	1	1	1/1		1/1		nd	n	ł	nd		1/1		nd		nd	nd	1/1		1		1/1		1/1		Pharmaceutical worker

Agents	Strength of	Total no.	Reference		Occupa-	Allergic								—		EVIDENC	E (path	ological re	sults)								<u> </u>	Remarks
	evidence per agent (three	of allergic		evidence per study	tionally exposed	asthma cases due to				WORK	RELAT	ED SYMPTO	OMS				LFT	N	SBHR	sPFT		SIC			SPT	Spe	ec. IgE	
	star system of RCGP)	asthma cases		(revised SIGN grading	subjects	mentioned agent, n,																						
	of RCGP)	per		system);	n studied,	prevalence (%).	Asthn	na	Rhiniti	s C	onjunct.	Cough	Sk	<u>án</u>	Tota	al							Reaction	_				
		agent, n		study type.		Cases with probable allergic asthma but																						
				type.		specific sensitization not confirmed in																						
						parantheses [] or not indicated.				n/	n		n/n				n/n	n/n		n/n								
	ļ'	ļ'						% n/i				n/n Cou			n/n Tot	%	FT S	% NSBH	HR %			% i (r						
Cellulase from Trichoderma reesei	(*)		Vanhanen, Tuomi et al., 2000	3; case series	11	7 (63.6)*	8/11		3/11	1/	11	nd	5/11		11/11	0	/11	7/11	1	nd	8/11	7	1	10/11		8/11	CC	Employees in an enzyme factory. *7/8 SIC+ were SPT+; xo-exposure to xylanase; 5/10 lgE+ and 7/10 SPT+ with ylanase
Cellulase from Trichoderma viride	[*]	2	Ransom and Schuster, 1981	3+; cross- sectional with case report	11	2 (18.2)	2/11	18.2	3/11 :	27.2 n	ł	1/11	9.1 nd		3/11	27.2 (0/1	nd		nd	nd			1/1*		2/11	18.2 E	Experimental plant pathologists. Both asthmatics sensitized
Cellulase	-		Tarvainen, Kanerva et al., 1991	3; case reports	4	2 (50)	3/4	75	2/4	50 3/	4 75	3/4	75 4/4		4/4	0	0/4	2/3	66.6	2/4 50	nd			3/4	75	4/4		8 laboratory assistants and 1 process worker. 2 were co- exposed and co-sensitized to xylanase; see xylanase
Cellulase from Aspergillus niger	-	2	Losada, Hinojosa et al., 1986	3; case reports	2	2	2/2		2/2	1/	2	2/2	nd		2/2		nd	nd		nd	2/2	2		2/2		2/2	P	Pharmaceutical workers
Cellulase from Trichoderma viridae and Fusarium moniliform	† <u> </u>	1	Kim, Nahm et al., 1999	3; case report	1	1	1/1		nd	n	d	1/1	nd	1	0/1		nd	1/1		nd	1/1	1		1/1		1/1	E	Employee in the textile industry.
Detergent enzyme protease	*[*]		Brant, Upchurch et al., 2009	2-; case- control study	884	[221 (25)]**	221/884*	25 21	4/884	25 n	đ	nd	nd		nd		nd	nd		nd	nd			nd		nd	ar 20 19 in be	Cohort of workers in a detergent factory between 1989 and 2002. Probably including cases forn <i>Cullinan et al.</i> , 2000. <i>Brant et al.2004 and 2006</i> . "Incidence rates 1991- 1995: x=5%; 1996-2001 :x=11.6% and 2002: 4%." to information on specific sensitisation but clear relationship between exposure to detergent protease and reports of work related symptoms.
Detergent enzymes (Protease, Amylase, Cellulase)			Brant, Zekveld et al., 2006	3+; Follow-up	35	25 (71.4)**	25/35	71.4 2	6/35	74.3 n	b	nd	nd		nd		nd	nd		nd	nd			33/35	94.3	34/35	97.1 Fi di fo ha sy of	Follow-up of 35 of 45 ex-employees from a factory with liagnosed occupational asthma. Probably including cases on <i>Cullinan et al.</i> , 2000 "At date of diagnosis all 35 and SPT+." 25/35 continued to report respiratory symptoms and were still sensitized even if the magnitude of Spec. IgE at diagnosis or follow-up was not a rogenosic feature for respiratory symptoms.
Detergent enzymes	-		Cullinan, Harris et	3+; survey	350	28 (8)**	54/342*	15.8 68	/342*	19.9 n	b	nd	nd		nd		nd	nd		nd	nd			90/342	2* 26.3	i i	E	Employees in a factory using encapsulated detergent
Amylase Cellulase	-		al., 2000											+	+	+									2 23.4 2 14.9			enzymes.*90 employees had SPT+ to at least one detergent enzyme. Indicated are work-related symptoms
Protease	-		A 17			10 (00 0)]	0/0	50	0.10								_								2 19.3			with enzyme sensitization. ** 42 workers requested
Detergent enzymes			Adisesh, Murphy et al., 2011 ABSTRACT	3; case reports	6	[2 (33.3)]	3/6	50	3/6	50 n	1	nd	nd		nd		nd	nd		nd	nd			nd		nd	Ca	Health-care workers from three different work places. 2 cases of occupational asthma, the others indicated as having work-related rhinitis or asthma
Detergent enzymes	4		Brant, Hole et al.,	3; case	3	3	3/3		3/3	2/	3	2/3	nd		3/3		nd	2/2	2	0/1	3/3 1/1		3	3/3 2/3		3/3 1/2	D	Detergent industry workers
Cellulase from Humicola insolens Lipase from Aspergillus oryzae	-		2004	reports	2												_				2/2		1	2/3		2/2		
Enzyme powder in cheese production, fungal and pancreatic-based	-		Casper, Zacharisen et al., 2008 ABSTRACT	3; case reports	2	2	2/2		1/2	n	đ	nd	nd		nd	(0/2	1/2	2	nd	nd			2/2		nd	W cl	Workers exposed to airborne enzyme powders used in theese production.
Enzymes Alpha-amylase and Lysozyme	-		Santaolalla, De Barrio et al., 2002	3; case report	1	1	1/1		1/1	1/	1	nd	nd		nd	0	D/1	nd		nd	'1/1			1/1*		1/1*	yo	Baker. * SPT+ and Spec. IgE+ to egg white, egg rolk, ovomucoid, wheat flour, barley flour, D.pteronyssinus,D. farinae, G. Fusca and L. destructor
Enzymes	[*]		Vanhanen, Tuomi et al., 1997	3+; cross- sectional	173	1 (0.6)	1/21*	1	1/21*	2/2	:1*	6/21*	1/21*	_	27/173	15.6	nd	nd		nd	nd			21/173		16/173	*1	mployees of a biotechnological plant and laboratory. Individual WRS listed in SPT+ only; **SPT+ with at lease
Alpha-amylase (bacterial) Alpha-amylase (fungal)		1												1	<u>+</u>									5/21		+	1	enzyme; sign. exposure-response relationship for ensitization and for respiratory symptoms
Cellulase Phytase	-	'						$+ \top$				+		+	+	+ +	-+				+	+ $-$	+	14/21 4/21		+	$+ \neg$	
Xylanase	1													\pm	<u> </u>		<u> </u>							15/21	1			
Enzymes	┤	4	Zentner, Jeep et al., 1997	3+; case series	20	4 (20)	4/20	20	3/20	15 1/3	20 5	3/20	15 nd	+	5/20	25	nd	nd		nd	nd	+ $-$	+	10/20 3/20		10/20 1/20		Pharmaceutic factory workers: 10 SPT+ to at least one anzyme and 10 SPT- to enzymes
Amylase from A. oryzae Bromelain of Ananas comosus	-		al., 1337	36163										1										7/20		5/20		
Chymotrypsin from porcine pancreas Lipase from A. oryzae	-													+	+									8/20 3/20		5/20 1/20		
Papain from Papaya fruit	-																							9/20		9/20		
Trypsin from bovine pancrease Flaviastase from Aspergillus niger		3	Pauwels, Devos	3; case	3	3	3/3		nd	n	d	nd	nd		3/3	+	nd	nd		nd	nd			8/20 nd		6/20 3/3		Pharmacy workers
	-		et al., 1978	reports										\perp				-	105						+			
Glucoamylase (amyloglucosidase) from Aspergillus niger	-	4	Quirce, Fernández-Nieto et al., 2002a	3; case reports	4	4	4/4		4/4	n		4/4	nd		4/4	2	2/4 5	50 4/4	100	nd	3/3	3		4/4	100	4/4		B bakers and 1 employee at an enzyme-processing plant. 2/4 SPT+ with hemicellulase
Glucose oxidase from Aspergillus niger	-	1	Baur, 1981	3; case report	1	1	1/1		nd	n	d	nd	nd		1/1		nd	nd		nd	nd			1/1*		1/1	P	Pharmaceutical worker. *IC
Lactase from Aspergillus	[*]	9	Muir, Verrall et al., 1997	3+; cross- sectional	207	9 (4.4)	20/207			15.9 18/3	207 8.7		nd		nd		nd	nd		nd	nd				7 31.4	1 nd	Es	Employees in a lactase-packaging plant. 9 asthmatics sensitized
Lysozyme (lysozyme chloride)	-	1	Park and Nahm, 1997	3; case report	1	1	1/1		1/1	n	d	1/1	nd		1/1		nd	1/1		nd	1/1	1		1/1		1/1	P	Pharmaceutical industry worker. Co-exposure and co- sensitization to peptidase; see peptidase

Agents	Strength of	Total no	. Reference	Level of	Occupa-	Allergic											EVI	DENCE (p	atholog	gical resu	ılts)									Remarks
	evidence per agent (three star system	of allergic asthma		evidence per study (revised	tionally exposed subjects	asthma cases due to mentioned				wo	RK-RE	LATED	SYMPTO	OMS				L	FT	NSB	BHR	sPFT		SIC	2		S	SPT	Spe	ec. IgE
	of RCGP)	cases		SIGN grading system);		agent, n, prevalence (%).	Asthr	na	Rhin	tis	Conju	inct.	Cough	. 5	Skin	т	otal								Rea	action	_			
		agent, n		study type.		Cases with probable allergic asthma but specific sensitization not confirmed in parantheses [] or not indicated.		%		~	n/n			n/n		(n/n		n/n		n/n			• (-) •					
Porcine pancreatic extracts (PPE)	(+)	19	Park, Kim et al.,	3+; case	4	4	n/n Ast 4/4	%	n/n Rhin 1/4	%	Conj nd	% r	n/n Cou nd	% Skir		6 n/n To nd	t %	b LFT nd	%	NSBHR nd	%	PFT %	n/n SIC '4/4	%	1 (n) 1 4	(n) d (n	I) n/n SP1 4/4	%	n/n lgi 4/4	
composed of alpha-amylase and lipase	(*)		2002	series																										
Pancreatin (porcine), containing trypsin, amylase, lipase			Wiessmann and Baur, 1985	3+; case series	14	11 (78.5)	14/14	100	nd		nd		nd	nd		14/14	10	11/14	78.5	7/7	100	nd	8/8	100	8		12/13	92.3	3/4	75 Employees of pharmaceutical company. 3/6 asthmati who did not undergo SIC had BHR+
Pancreatin (porcine and bovine), containing trypsin, alpha-amylase			Baur, Wießmann et al., 1984	3; case reports	4	3 ('75)	4/4		nd		nd		2/4	50 nd		4/4		nd		nd		nd	nd				nd		3/4	75 1 nurse, 3 pharmaceutical workers. Cross-reactivity between porcine and bovine Pankreatin
Pancreatin (alpha-amylase of porcine pancreatin)			Aiken, Ward et al., 1997	3; case report	1	1	1/1		nd		nd		nd	nd		1/1		0/1		1/1		nd	1/1			1	nd		nd	Laboratory worker
Papain of <i>Carica papaya</i>	**	109	Novey, Keenan et al., 1980	2-; cross- sectional	23	8 (34.8)	12/23	52.2	20/23	87	17/23	73.9	9/23	39. 20/2 1	3 87	7 23/23	10	10 x*		nd		nd	nd				nd		10/21	47.6 Pharmaceutical workers. 'Sign. Raw increase and FEV1/FVC decline in the 17 tested; 8 asthmatics IgE- asthmatic not IgE tested
•			Baur and Fruhmann, 1979	2-; cross- sectional	11	5 (45.5)	5/11	45.5	7/11	63.6	1/11	9.1	6/11	54. nd 6		7/11	63.	.6 nd		nd		nd	5/5		4	1	7/11	63.6	7/11	63.6 9 kitchen workers and 2 pharmaceutical workers. All asthmatics sensitized; SIC in asthmatics only
			Baur, König et al., 1982	3+; cross- sectional	33	12 (36.4)	15/33	45.5	15/33	45.5	5/33	15.2	nd	3/33	3 0.	9 17/33	51.	.5 nd		nd		nd	8/9*		5	3	16/33	48.5	15/33	3 45.5 4 selected papain workers with respiratory symptoms and sreening of other 29 papain workers ; *4 sensitize asthmatics did not undergo SIC
8	-		Vogelmeier, Baur et al., 1985	3+; cross- sectional	31	11 (35.5)	17/31	54.8	17/31	54.8	0/31		0/31	0/31	1	17/31	54.	.8 nd		nd		nd	nd				nd		11/31	1 35.5 Papain workers. 14/31(45.2%) IgG+. All IgE+ were symtpomatic
			Milne and Brand, 1975	3; case reports	4	2 (50)	2/4	50	3/4	75	1/4	25	2/4	50 nd		4/4	10	1/4	25	2/4	50	nd	nd				2/2*	100	nd	Food technologists. *Both asthmatics scratch test+
			Tarlo, Shaikh et al., 1978	3; case reports	2	1	1/2		2/2		2/2		1/2	1/2		2/2		0/2		1/2		nd	nd				2/2		2/2	Laboratory technician and packaging plant worker
*	-		Marchioli, Sokol et al., 1977	3; case report	1	1	1/1		nd		nd		nd	nd		1/1		nd		nd		nd	1/1			1	1/1*		0/1	Meat tenderizer production worker. *IC
*	-		Merget, Bergmann et al., 1995	3; case report	1	1	1/1		1/1		1/1		nd	nd		1/1		1/1		nd		nd	nd				1/1		1/1	Grocer, not exposed for the last 8 years.
•	-		Quinones, Alonso et al., 1999 ABSTRACT	3; case report	1	1	1/1		1/1		1/1		nd	1/1		1/1		1/1		nd		1/1	nd				1/1		1/1	Papain worker. Nasal Ch+
u.			Soto-Mera, Lopez Rico et al., 2000	- 3; case report	2	2	2/2		2/2		nd		nd	2/2		nd		nd		nd		nd	nd				2/2		2/2	Beauty workers.
Pectinase from Aspergillus niger	-	2	Hartmann, Walter et al., 1983	3; case reports	2	2	2/2		1/2		nd		1/2	nd		2/2		nd		nd		nd	nd				1/1*		2/2	Employees (secretary and mechanic) of pectinase production. *Scratch test
Pectinase from Aspergillus niger and glucanase from Trichoderma	-	3	Sen, Wiley et al., 1998	3; case reports	3	3	3/3		2/3		3/3		nd	nd		3/3		nd		nd		3/3*	nd				nd		3/3**	Employees in fruit salad processing. *Serial PEFR at work and off-work for 2 weeks; **IgE with blend of pectinase and glucanase
Pepsin (porcine)	-	3	Drexler and Beyer, 1997	3; case report	1	1	1/1		1/1		1/1		nd	nd		1/1		1/1		1/1		nd	0/1				1/1		1/1	Worker checking meat for trichinea. Nasal Ch+ (immediate)
			Anibarro Bausela and Fontela, 1996	5		1	1/1		1/1		1/1		1/1	nd		1/1		0/1		1/1		1/1*	1/1			1	1/1		0/1	to lysozyme. *PEFR for 5 days off-work and 1 day at work
•			Cartier, Malo et al.,1984b	3; case report	1	1	1/1		1/1		1/1		nd	nd		1/1		0/1		1/1		1/1	1/1			1	1/1		1/1	Employee in a pharmaceutical company with perennia asthma
Peptidase from Serratia ssp.	-	1	Park and Nahm, 1997	3; case report	1	1	1/1		1/1		nd		1/1	nd		1/1		nd		1/1		nd	1/1			1	1/1		1/1	Pharmaceutical worker. Co-exposure and co- sensitizazion to lysozyme chloride
Phytase from Aspergillus niger	*[*]	12	Doekes, Kamminga et al. 1999	2-; cross- sectional	11	5 (45.5)	5/11	45.5	nd		nd			18. nd 2		6/11				nd		nd	nd				nd			81.8 Workers in animal feed additives factory. Sign. elevat IgE of exposed compared to non-exposed subjects; SPT+ in 2 external and 3 internal controls
			Baur, Melching- Kollmuss et al., 2002	2-; cross- sectional	53	7 (13.2)	12/53	22.6	35/53	66	16/53	30.2	nd	3/53	3 5.	.7 38/53	71.	.7 nd		nd		nd	nd				nd		15/53	3 28.3 Employees in an animal husbandry. High-exposed sig more frequently IgE+; 7 asthmatics sensitized (person communication)

Agents	Strength of	Total no.	Reference		Occupa-	Allergic asthma cases									EVID	ENCE (pa	atholog	gical results	5)								Remarks
	evidence per agent (three	of allergic		evidence per study	tionally exposed	due to mentioned				WORK	-RELATED	SYMPTOM	6			LF	т	NSBHI	R sPFT		SI	С		SP	т	Spec. I	lgE
	star system of RCGP)	asthma cases		(revised SIGN grading	subjects studied,	agent, n, prevalence (%).	Asthr	na	Rhinitis	c	onjunct.	Cough	Skin	T	otal							React	ion				
		per agent, n		system); study	n	Cases with probable allergic asthma but																					
				type.		specific sensitization not confirmed in																					
						parantheses [] or not indicated.				n/	'n		n/n			n/n		n/n	n/n								
Proteolytic enzymes derived from Bacillus		-	Cathcart,	2-; survey with	731	[166 (*)]	n/n Ast 166/?*	% n/n	Rhin '	% Co		/n Cou % nd	Skin nd	% n/n To nd	%	LFT	%	NSBHR nd	% PFT nd	% n/n S		i (n) I (n)	d (n) _I	n/n SPT nd	%	n/n lgE nd	% INDUSTRY STUDY Surveillance of workers from 5
species	-		Nicholson et al., 1997	follow-up (4- 20 years)																							enzyme detergent factories over 4-20 years, follow-up of the 2 previous studies listed below. "follo confirmed case of enzyme asthma between 1968-1992 within several thousand employees in 5 factories, 16 new cases since 1978; "sign, yearly fall in FEV1 and FVC in 731 subjects between different locations and by smoking habit and no not by enzyme exposure, all subjects with respiratory symptoms were excluded from LFT analysis
Various enzymes from Bacillus subtilis	**	327																									
Protease, Alcalase from Bacillus subtilis,	^^		Flood, Blofeld et		2800	126 (4.5)	126/2800	4.5	nd	n	d	nd	nd	126/28	0 4.5	+**	-	nd	nd	nd			4	150/271	16.6	nd	INDUSTRY STUDY Enzyme detegent workers in 3 UK
proteolytic enzyme			al., 1985	sectional with follow-up (11 years)		incident cases								0*										3			factories, follow-up of the previous study listed below. *All fligures given as incidence over a 11 year period (1969-1980); subjects with SPT+ and VIR asthma or EFV1 fall owing to enzyme exposure; **mean annual FEV1 fall 39 mi in 2244 subjects
Protease, Alcalase from Bacillus subtilis, proteolytic enzyme			Juniper, How et al., 1977	2-; cross- sectional with follow-up (7 years)	1642	[34 incident cases]	34/1642*	2.1	nd	n	d	nd	nd	53/164	2 3.2	7/12	58.3	nd	nd	nd			-	288/164 2	17.5	**	INDUSTRY STUDY Enzyme detergent workers in UK Al figures given as incidence over a 7 year period (1986- 1975); "34/53 symptomatics had new-onset respiratory symptoms and 1924 had work-exacerbated asthma; "70% correlation between RAST and SPT for 330 subjects tested, individual results not listed; sensitized asthmatics not listed
Protease, Alcalase from Bacillus subtilis	-		Pepys, Wells et al., 1973	2-; cross- sectional	65	11	nd		nd	n	d	nd	nd	nd		11/65		nd	nd	nd				26/65		17/65	Enzyme factory workers. All 11 with "lung impairment" (no details listed) were SPT+
Alcalase from <i>Bacillus subtilis</i>	-		Newhouse, Tagg et al., 1970	2-; cross- sectional	271	42	117/271	43.2	•		,	*		nd		11/271 **	4.1	nd	***/46	nd			Ę	**	21	0/31	Enzyme detergent workers. *Individual data not listed; **6/11 LFT+ were sensitized; ***sign. decreased mean FEV1 cross-workshift in 55 sensitized astmatics; ****42/57 SPT+ were asthmatic; 2. survey 6 mo. later
•	-		Slavin and Lewis, 1971	2-; cross- sectional	238	51 (21.4)*	61/238	25.6 31	/238 1:	3.0 n	d	nd	nd	66/238	27.7			nd	nd	nd	_			114/238	47.9	nd	Detergent factory workers. *At least 51 asthmatics sensitized; **at least 40 symptomatics LFT+
•	-		Mitchell and Gandevia, 1971	3+; cross- sectional	98	28 (28.6)	49/98	50 62	2/98 63	3.3 +	,	7/98 7.1	nd	nd		•			nd	nd				51/80	63.8	nd	Workers of a detergent factory, "No sign. difference between symptomatics and asymptomatics; "results not listed; 28 asthmatics SPT+, 10 asthmatics not SPT tested
Proteases from Bacillus subtilis	-		Greenberg, Milne		121	21 (17.4)	28/121	23.1 77	/121 6	3.6 77/	121 63.6 1	9/121 15.	nd	89/121	73.6	31/121	25.6	nd	nd	nd				48/121	39.7	nd	Detergent factory workers. 21/31 obstructive subjects
Alcalase			et al., 1970	sectional								7												42/121	34.7		SPT+
Maxatase Proteinase	-																							36/121 42/121			
Protease, Esperase from Bacillus subtilis			Zachariae, Høegh Thomsen et al., 1981	-2-; survey with 10 year follow- up	667	16 [0.24]	16/667	2.4** 6/	667 0.	.9** n	d	2/667 0.3*	nd	22/667	* 3.3*	'nd		nd	nd	nd				nd		31/667	4.7* Detergent enzyme production workers. Co-exposure an co-sensitization (70/667 IgE+) to Akkalase from Subtilisin A; "WRS given in sensitized subjects only; all symptomatics IgE+; **incidence in 10 years
Proteases from <i>Bacillus subtilis</i> : Maxapem and Esperase; cellulase, alpha- amylase, lipase	-		Vanhanen, Tuomi et al., 2000	3+, cross- sectional	40	1 (2.5)	1/40	2.5 19	9/40 4	7.5 2/4	40 5	5/40 12. 5	2/40	5 19/40	47.5	nd		nd	nd	1/1				9/40	22.5	9/9**	Detergent factory workers. *SIC+ with protease, type of reaction not listed; *IgE done in SPT+ subjects; 1 asthmatic subject SPT+; 6/7 nasal Ch+
Proteolytic enzymes derived from Bacillus species (Esperase)			Liss, Kominsky et al., 1984	sectional	15	1 (6.7)	+*		+*	+		+*	nd	6/15*	40			nd	x***	nd				nd	:		21.4 Detergent workers, 13 currently and 2 previously exposed. *Eye, nose, throat or chest WRS; **no difference between exposed and poperposed; ***sing
Enzymes of <i>Bacillus subtilis</i> (Alcalase and Maxatase)			Pepys, Hargreave et al., 1969	3; case reports	3	3	3/3		1/3	0/	3	3/3	0/3	3/3		3/3		nd	nd	3/3			3	3/3**		nd	Enzmyme workers. *SIC done with Alcalase; **SPT done with Alcalase and Maxatase

Agents	Strength of evidence per	Total no. of	Reference	Level of evidence per	Occupa- tionally	Allergic asthma cases									EVID	ENCE (pa					T							Remarks
	agent (three star system	allergic asthma		study (revised	exposed subjects	due to mentioned				wo	RK-REL	ATED SYMPTOM	5			LF	FT	NSB	BHR	sPFT		SIC			SP	r	Spec.	lgE
	of RCGP)	cases per		SIGN grading system);	studied, n	agent, n, prevalence (%). Cases with probable	Asthr	na	Rhinit	is	Conjur	nct. Cough	Skin	1	otal	_				ĺ		-	Reactio	n				
		agent, n		study type.		allergic asthma but specific sensitization not confirmed in parantheses [] or																						
						parantheses [] or not indicated.	n/n Ast	% r	n/n Rhin	%	n/n Conj	% n/n Cou %	n/n Skin	% n/n T	nt %	n/n	%	n/n NSBHR	%	n/n PFT %	n/n <mark>SIC</mark>	% i(n) I (n) d	(n) n/n	CDT	%	n/n lgE	9/
Subtilisin from Bacillus subtilis			Franz, McMurrain et al., 1971	3; case series	38	22 (57.9)			11/38		nd	nd		5.3 38/3			10.7		//	nd	9/10	90 4		5 25		65.8	nd	Employees of enzyme detergent producing plant; *IC; 22/25 asthmatics SPT+
Maxatase of <i>B. subtilis</i>	_		Dijkman, Borghans et al., 1973	3+; case series	6	5 (83.3)	3/6	50	4/6	66.6	nd	5/6 83. 3	nd	6/6	100	1/6	16.6	5/6	83.3	nd	6/6	100		5 !	5/6	83.3	nd	Workers of a detergent factory
Proteolytic enzymes: Alcalase	(*)	6	Paggiaro, Pardi et al., 1984 ABSTRACT	3+; case series	6	5-6	6/6		nd		nd	nd	nd	6/6		3/6		4/6		2/6	6/6				5/6		+	Enzyme workers
Protease, Pronase E from Streptomyces griseus	-	1	Kempf, Oman et al., 1999	3; case report	1	1	1/1		nd		nd	nd	nd	1/1		1/1		nd		nd	nd				1/1		1/1	Medical laboratory technician
Rennet, not specified	-	1	Jensen, Dahl et al., 2006	3+; cross- sectional	35	[6 (17.1)]*	6/35	17.1	1/35	2.9	nd	nd	9/35	25.7 12/35	* 34.3	3 0/35	0	nd		nd	nd			14	/35*	40	nd	Workers in a rennet producing plant. *SPT + to one or more rennets. 6/14 workers with SPT+ had respiratory symptoms. Not indicated if these were asthma symtom
Rennet of Endothia parasitica, Suparen®	D		Niinimäki and Saari, 1978	3; case report	1	1	1/1		nd		nd	nd	nd	1/1		nd		nd		nd	nd			1	/1*		nd	Cheesemaker. *Scratch test; additional 7 cheesemake exposed but not sensitized, 5 of them had WRS
Trypsin (porcine), inactivated	*	4	Colten, Polakoff et al., 1975	2-; cross- sectional	14	4 (28.6)	4/14	28.6	1/14	7.1	1/14	7.1 2/14 14. 3	nd	4/14	28.6	6 1/4		nd		nd	3/3**	100 3	3	4	/14*	28.6	nd	Workers at the plastics plant. *Scratch-test; **SIC in 3 asthmatics only
Xylanase from Aspergillus niger	-	3	Baur, Sander et al., 1998	3; case report	1	1	1/1		1/1		1/1	1/1	nd	1/1		1/1		nd		nd	1/1				1/1		1/1	Baker. Also SPT+, IgE+ with cellulase of A. niger, alph amylase of A. oryzae and wheat flour
			Tarvainen, Kanerva et al., 1991	3; case reports	2	2	2/2		1/2		2/2	2/2	2/2	2/2		0/2		2/2		1/2	nd			:	2/2	100	2/2	100 Laboratory assistants. Co-exposure and co-sensitization to cellulase; see cellulase
/arious enzymes Alpha-amylase from A. oryzae	-	•	Baur, Sauer et al., 1988	3+; case series	140		•		•		•	nd	nd	140/1	ю	nd		nd		nd	13/20**	8	3	-	nd /140	23.6	nd	*Bakers with WR-asthma, rhinitis and/or conjunctivitis with no signs of sensitization to flour. **SIC done in
Glucoamylase from A. niger Hemicellulase from A. niger			-																					7/	/140 /140	5.0 7.9		sensitized workers
Papain (C. papaya) Protease from <i>B. subtilis</i> Soybean																								1/	100	1.0 1.0 20.7		
CHEMICALS DRUGS																												
Aescin		1	Munoz, Culebras	3: case report	1	[1]	1/1		1/1		nd	1/1	nd	nd	-	0/1	1	1	1 1		1	1 1			nd		nd	Employer in the pharmaceutical industry. Sensitisation
Npha-methyldopa	-	1	et al., 2006 Harries, Newman		1	1	1/1		1/1		nd	nd	nd	1/1		nd		1/1 0/1		1/1 nd	1/1		1		0/1		nd nd	Plantago ovata was also tested: SIC and SPT were page time Chemist in a drug factory
	-		Taylor et al., 1979			. ()																						
Iminophylline	-	1	Rosenberg, Aaronson et al., 1984	3; case reports	2	1 (50)	2/2		2/2		nd	1/2	nd	2/2		0/2		nd		nd	2/2		2		/2*		nd	Pharmaceutical workers. *IC
Amprolium hydrochloride	-	1	Greene and Freedman, 1976	3; case report	1	[1]	1/1		1/1		nd	nd	nd	1/1		0/1		nd		nd	1/1		1		nd		nd	Chemical industry worker mixing poultry feed
Cephalosporine	٢*٦	8																										
-aminocephalosporanic acid (7-ACA)			Briatico-Vangosa, Beretta et al., 1981	3+; cross- sectional	91	5 (5.5)	7/91	7.7	nd		nd	nd	11/91	12.1 18/9	20	nd		nd		nd	nd			1:	3/91	14.3	nd	Workers in cephalosporine production. 5/7 asthmatics were SPT+
Cephalosporin intermediate (7-ACA, 7- aminocephalosporanic acid)	-		Park, Kim et al., 2004	3+; case series	5	1 (20)	2/5	40	1/5	20	nd	nd	nd	2/5	40	nd		2/2	100	nd	2/2	100 2	2	-	1/5	20	2/5	'40 Pharmaceutical plant workers. 1 asthmatic was SIC+ a sensitized
			Coutts, Dally et	3+; case	2	2	2/2		1/2		nd	1/2	nd	2/2		nd	-	nd	++	nd	2/2	1	2		2/2 1/1		nd	Cephalosporin production worker exposed to 7ACA an 7CTD and chemist exposed to cephalexin
Cephalosporins 7-aminocephalosporanic acid (7ACA Tosyalate dihydrate derivative of)		al., 1981	reports																	1/1				1/1			

Agents	Strength of	Total no.	Reference	Level of	Occupa-	Allergic										EVI	DENCE (p	pathologic	cal results)									Remarks
	evidence per agent (three	allergic		evidence per study	tionally exposed	asthma cases due to				WORK-	RELATE	D SYMP	TOMS				L	.FT	NSBHR	sP	FT	S	С		SPT		Spec. IgE	
	star system of RCGP)	asthma cases		(revised SIGN grading	subjects studied.	mentioned agent, n,		1				1																_
		per		system);	n	prevalence (%).	Asthma		Rhinitis	Co	onjunct.	Coug	gh	Skin	То	otal	-						React	ion				
		agent, n		study type.	1	Cases with probable allergic asthma but																						
				(J pc.	:	specific sensitization not confirmed in																						
						parantheses [] or not indicated.				n/r	n		n	'n			n/n		n/n	n/n								
							n/n <mark>Ast</mark>	% n/n	Rhin	% Co	nj %	n/n Cou	% <mark>Sk</mark>	in 9	% n/n Tot	%	LFT	%	NSBHR %	PFT	% n/n S	IC %	i (n) l (n)	d (n) n/n	SPT	%	n/n lgE %	
Cephalosporin (Ceftazidime)			Stenton, Dennis et al., 1995	3; case report	1	[1]	1/1	1	/1	nd	i	nd	n	d	1/1		0/1		1/1	nd	1/1		1* 1*	r	nd		nd	Ceftazidime packaging worker. *SIC done twice, a wee apart
Cefmetazole and 7-aminocephalosporanic cid			Fracchia, Paita et al., 1996 ABSTRACT	3; case report	1	[1]	1/1	r	nd	nd	1	nd	n	d	nd		nd		1/1	nd	1/1			C	0/1		0/1	Cefalosporin manufacture worker
Chlorhexidine	-	-	Waclawski, McAlpine et al., 1989	3+; case reports	2	[2]	2/2	r	nd	nd	1	1/2	n	d	2/2		0/2		0/2	1/1	1/2'		1	r	nd		nd	Nursing auxiliary and midwife. *1. subject had 13% decline in FEV1 as positive reaction listed and 2. subject had 22% decline in FEV1
Cimetidine	-	-	Coutts, Lozewicz et al., 1984	3+;surveywith index cases	4		*		*	nd	i	nd	n	d	4/4		nd		1/3	nd	1/4		1	r	nd		nd	Index cases of cimetidin manufacture workers. *Respiratory symptoms; 1 SIC+ subject was NSBHR-;
					55	[8 (14.5)]	8/55 1	4.5 20	/55 3	6.4 nc	1	nd	n	d	20/55	36.	4 *		nd	nd	nd			0/	/55	0	nd	2/4 nasal Ch+ (late) Cimetidin manufacture workers. 7/8 asthmatic were in daily exposure group; *lower FEV1 and sign. lower FVC
Ciprofloxacin		1	Proding Chor at	3; case	2	1	1/1		/1	nd		nd	<u> </u>	d	1/1	_	0/1		0/1	nd	1/1		1		/1		0/1	in asthmatics
Fluochinolon acid	-		Broding, Chen et al., 1996	reports	2		1/1		/1	nd		1/1	n		1/1		0/1		1/1	nd	1/1		1		//1		0/1	Workers in the Ciprofloxacin-production
Hydralazine	-	-	Perrin, Malo et al., 1990	3; case report	1	[1]	1/1	1	/1	nd	i	nd	n	d	1/1		nd		1/1	nd	1/1		1	C	0/1		0/1	Pharmaceutical worker with previous physician diagnosed asthma
sonicotinic acid hydrazide (INH)	-	1	Asai, Shimoda et al., 1987	3; case report	1	1	1/1	1	/1	nc	1	nd	n	d	1/1		nd		1/1	1/1	1/1		1	1/	/1*		1/1**	Pharmacist. *SPT+ with INH-BSA and IC+ with INH and INH-HSA; **PK+
asamide (Immediate of Furosemide)	-	-	Klusácková, Lebedová et al., 2007	3+; case series with follow-up	5	[3 (60)]	5/5 1	100 5	/5 1	00 2/5	5 40	4/5	80 n	d	5/5	10	0 0/5	0	3/5 60	nd	3/5	* 60	2	1 r	nd		nd	Lasamide production line workers. *3/5 SIC+ and 4/5 nasal Ch+ with 2,4-dichloro-5-chlorsulfonylbenzoic acid, all patients symptomatic 1-3 yrs after removal from exposure
Mitoxantrone	-	-	Walusiak, Wittczak et al., 2002	3; case report	1	[1]	1/1	1	/1	nd	i	1/1	n	d	1/1		nd		1/1	nd	1/1			1 r	nd		nd	Nurse
Opiate		28															_											
	[]	20	D D			04 (50.0)	04/001		100 51			45/00	00 40								01.0	_				5 4 0 0		
piate compounds			Biagini, Bernstein et al., 1992	2-; cross- sectional with follow-up	39	21 (53.8)	21/39* 5	53.8 22	/39 5	5.4 22/3	39 56.4	15/39	38. 16/ 5	39 4	1 nd		nd		nd	x**	31.3 nd				5- 1: 33***	5-100	x	Ethic narcotics manufacture workers. *10/21 asthmatic had previous phys. diagn. asthma, 8 of them new-onse **no sign. reduction in PEFR during workweek compar
M-6-HS-HSA	-														_		_	_						12	2/33			to 3 day nonwork; ***sign. lower epicutaneus threshold concentrations in exposed; ****no evidence of specific IgE
Dihydrocodeine Oxycodone	1																							5/	/33			-
Hydrocodone	-														_		_	_							3/33			-
Codeine Morphine	1																								2/33 9/33			1
pium alkaloids, poppy (<i>Papaver</i> omniferum)			Moneo, Alday et al., 1993	3+; cross- sectional	28	6 (21.4)			nd	nc	1	nd	n	d	6/28				nd	nd	4/4'		4	6/	/28	21.4		Workers of pharmaceutical factory. 6/6 asthmatics sensitized; *SIC done only in asthmatics
piate compounds			Agius, 1990	3+; survey ABSTRACT	112	[4 (3.6)]	4/112 :	3.6 8/	112 7	.1 nd	i	nd	n	d	19/112	17.	0 nd		nd	nd	nd			r	nd		nd	Pharmaceutical workers. See index case Agius 1989
pium alkaloids (Codeine)			Romaguera and Grimalt, 1983	3+; case series	5	0	0/5	3	/5	3/5	5	3/5	5/	5	5/5		nd		nd	nd	nd			3/	/5*		nd	Opium alkaloids workers. *3/5 Patch test+ with mixed opium alkaloids and codeine
pium alkaloids (Papaver somniferum)			Condé-Salazar, Guimaraens et al., 1991	3; case reports	2	1	1/2*	1	/2	nd	1	1/2	2/	2	2/2		nd		nd	nd	nd			2/	2**		nd	Opium alkoloids producing factory workers. *Cough an "respiratory difficulty"; **patch test
piate compounds (Morphine)			Ulinski, Palczynski et al., 1996	3; case report	1	[1]	1/1	1	/1	1/1	1	1/1	n	d	1/1		0/1		1/1	1/1*	1/1		1	r	nd		nd	Pharmaceutical plant worker. *PEFR for 6 days off-wor and 6 days at work; BD+; nasal Ch+ (late)
			Agius, 1989	3; case report	1	[1]	1/1	1	/1	nd	i	nd	n	d	1/1		1/1		nd	nd	nd			r	nd		nd	Pharmaceutical industry worker
enicilline	[*]	4																										
lenicillin	LJ		Shmunes, Taylor et al., 1976	3+; cross- sectional	169	[2 (1.2)]	2/169	1.2 27/	169 1	6.0 14/1	69 8.3	nd	37/	169 21	1.9 67/169	39.	6 nd		nd	nd	nd			1/1	169*	0.06	nd	Penicillin factory workers. *1/169 IC+ with benzyl penicilloyl-polylysine, 5/169 IC ambiquous responses
Penicillin (ampicillin, pivampicillin, vivmecillinam, benzyl penicillin)			Møller, Nielsen et al., 1986	3+; case series	45	[5 (11.1)]	5/45 1	1.1 17	/45 3	7.7 17/4	45 37.7	nd	45/	45 10	00 45/45	10	0 nd		nd	nd	nd			45	/45*	100	nd	Workers producing semi-synthetic beta-lactam antibiotics. *Patch test+ with at least one penicilline (on and 3. day)

Agents	Strength of	Total no.	Reference	Level of	Occupa-	Allergic asthma cases										EVIDI	ENCE (pa	tholog	jical results)										Remarks
	evidence per agent (three star system	of allergic asthma		evidence per study (revised	tionally exposed subjects	asthma cases due to mentioned				WORK-R	ELATE	D SYMP1	OMS				LF	т	NSBHR	sPFT			SIC		s	PT	Spe	c. IgE	
	of RCGP)	cases per agent, n		SIGN grading system); study	studied,	agent, n, prevalence (%). Cases with probable allergic asthma but	Asthm	a	Rhinitis	Con	njunct.	Coug	h	Skin	1	Fotal	-							Reaction	-				
				type.		specific sensitization not confirmed in parantheses [] or not indicated.	1			n/n			n/i				n/n		n/n	n/n									
Azidocillin, bacamipcillin, benzylpenicillin			Stejskal, Forsbeck et al.,	3+; case series	8	[1 (12.5)]	n/n Ast 1/8		Vn Rhin 9 2/8 2	% Conj 25 nd		n/n Cou nd	% <mark>Ski</mark> 6/4	-	% n/n To 75 8/8		nd	%	NSBHR %	PFT nd		nd N	<u>%</u> i (I	n) I (n) d (n	9) n/n SP1 5/8*	62.5	n/n lgE nd		Employees of a antibiotics plant. *Patch test
Penicillin derivate Ampicillin 6APA (6-amino penicillamic acid)	-		1987 Davies, Hendrick et al., 1974	3+; case reports	4	[4]	4/4		3/4	1/4		2/4	2/4		4/4	+	2/4	50	nd	nd		3/4 3/4 2/3	75	3 3 2	0/4		nd		Workers of a penicillin antibiotics producing factory. 1/2 oral Ch with ampicillin induced 36% decline in FEV1 (late); 1/1 oral Ch with benzyl penicillin induced 59%
Benzyl penicillin	-		Jiménez, Antón et	3; case report	1	1	1/1		1/1	nd		1/1	no		1/1		0/1		1/1	nd		2/3 1/1	1	2	0/1		1/1		decline in FEV1 (late) Pharmaceutic laboratory worker. IgE- to ampicillin and
	-		al., 1998 Vandenplas,	3; case report	1	1	1/1		1/1	nd		1/1	no		1/1		1/1		nd	nd		1/1		1	nd		nd		penicillin V; SIC- to penicillin V; oral Ch induced 33% decline in FEV1 (late) Pharmaceutical worker, co-exposed to latex. SPT+, Igf
	-		Delwiche et al., 1997			1	1/1		1/1			1/1	1/		1/1		nd								0/1		1/1*		and SIC+(dual) with latex
mpicillin			Wüthrich and Hartmann, 1982	3; case report	1	1	1/1		1/1	nd		1/1	1/		1/1		na		nd	nd		1/1		1	0/1		1/1-		Employee of an antibiotic-producing factory. *IgE+ with benzyl-penicilloyl
Penicillamine			Lagier, Cartier et al., 1989			[1]	1/1		1/1	nd		nd	no		1/1		1/1		1/1	nd		1/1		1	0/1		0/1		Pharmaceutical worker
Piperacillin sodium (Acylaminopenicillin) Phenylglycine acid chloride (side chain of		4	Moscato, Galdi et al., 1995 Kammermeyer	3; case report 3+; cross-	24	1 4 (16.7)	1/1 6/24*	25	1/1 nd	nd		nd	1/ ⁻		7/24	4 29.2	0/1		0/1 nd	nd		2/2	2		9/24	37.5	nd 3/3***	<u> </u>	Pharmaceutical worker Industrial plant workers. *Wheezing, 4/6 SPT+;
mpicillin, Cephalexin, cephaloglycin)	[*]	-	and Mathews, 1973	sectional	24	4 (10.7)	0/24	25	ilu	na		iiu	i.		1124	23.2	10/24		10	iid iid		22			3/24	57.5	3/5		***ahonomal pulmonary function; individual parameter not listed; **3/3 symptomatics PK-Test+; all symptomatics were SPT+
albutamol base	-	-	Agius, Davison et al., 1994	3; case reports	2	[2]	2/2		1/2	nd		1/2	no		2/2		nd		nd	2/2*		1/1		1	0/1		nd		Pharmaceutical process workers. *Serial PEFR at wor and off work for 3-4 weeks
Salbutamol intermediate - glycyl ompound powder: 2-(N-Benzyl-N-tert- utylamino)-4 '-hydroxy-3 '- ydroxymethylacetophenone diacetate			Fawcett, Pepys et al., 1976	3; case report	1	[1]	1/1		nd	nd		nd	no		1/1		1/1		nd	nd		1/1		1	0/1		nd		Salbutamol production worker. Approx. 18 workers we exposed, one other had symptoms but was not tested
ipiramycin	-	2	Malo and Cartier, 1988	3+; survey	51	[4 (7.8)]***	9/48	18.8	15/48 31	1.3 nd		nd	nc		nd		3/48	6.3	6/43 14.0	0/48	3	3/12*	25 2	1			nd		All 51 employees of a pharmaceutic company. Symptoms and test results in the table reflect the production period during 2, and 3, assessments; "SIC done in BHR and/or subjects with 2.5 fold NSBHR change and/or asthmatics; "SPT 25.5 fold NSBHR interpretable; "**4 DA cases include 1 previously
Spiramycin adipate (Spiramycin base + Idipic acid)	-		Moscato, Naldi et al., 1984	3; case reports	2	[2]	2/2		1/2	nd		2/2	no		2/2		0/2		2/2	nd		2/2		2	0/2*		nd		Pharmaceutical workers. *Patch-test
Spiramycin base Adipic acid	-		Description I at at													<u> </u>						1/1 1/2	1	1				\pm	
Spiramycin	_		Paggiaro, Loi et al., 1979			1	1/1		nd	nd		1/1	1/*		1/1		nd		nd	nd		1/1		1	1/1*		nd		Chick breeder. *SPT+ and patch test+ (both late reaction)
Spiramycin			Davies and Pepys, 1975	3; case report		1	1/1		1/1	nd		1/1	1/		1/1		0/1		nd	nd		1/1		1	1/1		nd		Engineer at the pharmaceutical industry
etracycline	-	1	Menon and Das, 1977	3; case report	1	1	1/1		nd	nd		1/1	no		1/1		0/1		nd	nd		1/1*	1		1/1**		nd		Mechanic in a pharmaceutical company. *FEV1 decline >20% after SIC, IC and oral Ch; **IC
Thiamine	-	2	Drought, Francis et al., 2005	3; case reports	2	2	2/2		0/2	0/2		1/2	0/2	2	2/2		1/2		1/1	1/1		2/2		2	nd		0/1		Workers at breakfast cereal production plant
Tylosin tartrate	-	1	Lee, Wang et al., 1989	3; case report	1	1	1/1		1/1	nd		1/1	no		1/1		1/1		1/1	nd		1/1		1	nd		nd		Worker in a pharmaceutical factory
Polymyxin E (Colistin)	-		Gómez-Ollés, Madrid-San Martín et al., 2010	3; case report	1	[1]	1/1		1/1	nd		1/1	no	1	nd		0/1		1/1*	nd		1/1	1		nd		nd		Worker in a pharmaceutical factory, co-exposure to oth substances. Methacholine concentration of 16 mg/mL was required produce a 20% decrease in FEV1
METALS			+	1		<u> </u>					-				_			1	ı – I – –	· ·					+	+	+		
Numinium	-	1	Simonsson, Sjöberg et al., 1985 ABCTRACT	3+; case- series with follow-up	19	[17 (89.5)]	19/19	100	nd	nd		nd	no		nd		0/19	0	17/19 89.5	nd		nd			nd		nd		Workers exposed to inhaled particles of aluminium fluoride or sulphate at 2 plants. 11/15 still had NSBHR+ in follow ups 2-5 years after and an average of 41 months of non-exposure.
•	1		Vandenplas, Delwiche et al., 1998	3; case report	1	1	1/1		1/1*	nd		nd	no		nd		0/1		1/1	nd		1/1		1	0/1		0/1		Maintenance worker in a leather plant. *Allergic rhinitis since childhood.

Agents	Strength of evidence per	Total no.	Reference	Level of evidence per	Occupa- tionally	Allergic asthma cases								EVIDENCE		ical results)								Remarks
	agent (three star system	of allergic asthma		study (revised	exposed subjects	due to mentioned			WORK-RE	ELATED §	SYMPTON	IS			LFT	NSBHR	sPFT		SIC		s	РТ	Spec. le	JΕ
	of RCGP)	cases per agent, n		SIGN grading system); study type.	g studied, n	agent, n, prevalence (%). Cases with probable allergic asthma but specific sensitization not confirmed in parantheses [] or not indicated.	Asthma		s Conj n/n		Cough	n/n		n	/n	n/n	n/n			eaction				
Chromium	-	5	Park, Yu et al., 1994	3; case reports	4	4	n/n Ast % 4/4	n/n Rhin 2/4	% Conj nd	% n	/n Cou % nd	5 Skin 1/4	% n/n To nd		FT %	NSBHR %	PFT %	6 n/n SIC 4/4	<u>% i (n)</u> 3	1 (n) d (n 1		%	n/n lgE nd	% 2 employed in metalplanting factories, 1 in a cement factory, 1 in the construction industry. *SPT- subjects he a positive patch test
	_		Leroyer, Dewitte et al., 1998	3; case report	t 1	1	1/1	1/1	nd		'1/1	nd	nd	0	/1	•	nd	1/1	1				nd	Roofer. *NSBHR increased after SIC. **Skin patch test positive.
Chromium and Nickel	(*)	13	Novey, Habib et al., 1983	3; case report	t 1	1	1/1	nd	nd		'1/1	nd	nd	1.	/1	nd	nd	1/1	1		0/1		1/1	Electroplater
			Bright, Burge et al., 1997	3; case series	5 7	7*	7/7	nd	nd		nd	nd	nd	4.	17	nd	2/4	Ch:7/7 Ni:2/5	3	2 2 2	Ch: 2/7 Ni: '2/7		nd	Electroplaters. *7 have chrome-induced asthma, 2 of them also have a significant reaction to nickel. 1 worker developed acute asthma after high exposure to chrome
	_		Jesus Cruz, Costa et al., 2006	3; case report	t 1	1	1/1	nd	nd		nd	nd	nd	0.	/1	0/1	nd	1/1*		1	1/1*		nd	Worker in a metalworks company. SPT+ to nickel only, SIC+ with late response to nickel and immediate response to chromium.
			Fernandez-Nieto, Quirce et al., 2006	3; case reports	4	4	4/4	nd	nd		nd	nd	nd	0.	/4	4/4	nd	Ch:4/4 Ni:2/4	1	2 1 1 1	Ch: 2/4 Ni:2/4		1/4	2 from an electroplating factory, 1 worker from a cement factory, 1 manual metal-arc welder. 1 patient had been included in a previous report (Sastre et al. 2001).
Chromate	-	-	De Raeve, Vandecasteele et al., 1998	3; case report	t 1	[1]	1/1	nd	nd		1/1	1/1	nd	0.	/1	1/1	1/1	1/1		1	nd		nd	Cement floorer.
Cobalt	-	2	Gheysens, Auwerx e al., 1985	3; case reports	3	[3]	3/3	3/3	nd		nd	nd	nd	1.	/3	3/3	2/2	3/3		3	nd		nd	Diamond polisher.
			Wittczak, Walusiak et al., 2003	3; case report	t 1	1	1/1	nd	nd		1/1	nd	nd	n	d	nd	nd	1/1		1	0/1		nd	Dental technician.
•	_		Krakowiak, Dudek et al., 2005	3; case report	t 1	1	1/1	'1/1	nd		1/1	nd	nd	n	d	nd	nd	nd			1/1			Diamond polishing disc former. *Nasal provocation with cobalt chloride caused a significant increase in the proportion of eosinophils, basophils and albumin and a positive lymphocyte transformation.
Cobalt and nickel	-	-	Shirakawa, Kusaka et al., 1990	3; case series	\$ 8	[6 (75)]	8/8 100	nd	nd		nd	nd	nd	7.	/8 87.5	8/8 100	nd	Co:8/8 Ni:7/8	100 3 87.5 4	3 2 3	6/8 5/8	75 62.5	5/8 4/8	 Workers in a hard metal plant diagnosed as having occupational asthma. Cross-reactivity between nickel ar cobalt is possible.
Iron	-	-	Muñoz, Cruz et al., 2009	3; case reports	3	[3]	3/3	nd	nd		nd	nd	nd	0	/3	3/3	nd	3/3	2	1	nd		nd	Welders of iron.
Manganese	-	-	Wittczak, Dudek et al., 2008	3; case report	t 1	[1]	1/1	nd	nd		nd	nd	nd	1/	1*	1/1	1/1	1/1		1	0/1		**	Welder. *FEV1 decreased from 3.551 (85% predictive values) to 2.541 (57%), FVC from 4.341 (80%) to 5.981 (115%), "Increase in the proportion of eosinophils and basophils in induced sputum after manganese chloride
Nickel sulfate	-	2	Malo, Cartier et al., 1982	3; case report	t 1	1	1/1	nd	nd		nd	'1/1	nd	0	/1	1/1	1/1	1/1	1		1/1		1/1	challenge. Worker in a metal-plating factory.
,	-		Block, Yeung et al., 1982	3; case report	t 1	1	1/1	nd	nd		nd	'1/1	nd	1.	/1	1/1	nd	1/1	1		1/1			Metal polisher. SIC+ to work-dust and isolated nickel sulfate. Sensitization to chromium is possible. *No evidence of IgG or IgM antibodies by hemagglutination studies or gel diffusion.
Soft corrosive soldering fluxes: Zinc chloride and ammonium chloride	-	-	Weir, Robertson et al., 1989	3; case reports	2	[2]	2/2	nd	nd		nd	nd	nd	2	/2	2/2	2/2	2/2*	2		nd		nd	1 worker making tins, 1 worker repairing car radiators. *First case had greater fall in FEV1 in SIC with the flux than in SIC with ammonium chloride. SIC with zinc chloride alone produced no fall. SIC in the second case
Platinum salts	**	96	Niezborala, Garnier et al., 1996	2+; prospective cohort study	77	10 (13)	10/77 13	15/77 '1	19.5 nd		nd	7/77	'9.1 nd	r	ıd	nd	nd	nd			18/77	23.4	nd	was only performed with the flux. Workers in a refinery hired between 1979 and 1991. Follow-up with SPT every six months.

Agents	Strength of evidence per	Total no. of	Reference	Level of evidence per	Occupa- tionally	Allergic asthma cases											EVI			gical result											Remarks
	agent (three			study	exposed	due to				wo	RK-REI	LATED	SYMPTON	IS				L	FT.	NSBH	IR	sPFT		SIC			SF	т	Spec	c. IgE	
	star system of RCGP)	cases		SIGN grading	subjects studied,	agent, n,	Asthr	ma	Rhini	itis	Conju	nct.	Cough	Sk	in	<u> </u>	Total								React	ion					-
		per agent, n		system); study type.	n	prevalence (%). Cases with probable allergic asthma but specific sensitization																									
						not confirmed in parantheses [] or not indicated.					n/n			n/n																	
						not indicated.	n/n Ast	%	n/n Rhin	%		%	n/n <mark>Cou</mark> %	Skin	%	n/n T			%	n/n NSBHR	%	n/n PFT %	n/n <mark>SIC</mark>	% i	(n) I (n)	d (n) n	/n <mark>SPT</mark>	%	n/n lgE	%	
			Venables, Dally e al., 1989	t 2+; prospective cohort study	91	21 (23.1)	21/91	23.1	nd		nd		nd	2/91	2.2	49/9	1 53.	8 nd		nd		nd	nd				22/91	24.2	nd		91 workers of a platinum refinery who started work between 1973 and 1974 with follow-up every 3-6 months until 1980. Smoking was the only significant predictor of SPT+ with platinum salts.
H	_		Cristaudo, Sera e al., 2005	t 2-; cross- sectional	153	10 (6.5)*	10/22*	45.5	1/22*	4.5	nd		nd	6/22*	'27.3	3 nd		nd		nd		nd	nd			:	22/153	14.4	nd		Workers in a catalyst production plant. SPT with different platinum salts. "Work-related symptoms of the sensitized workers.
			Bolm-Audorffl, Bienfait et al., 1992	2-; cross- sectional	65	9 (13.8)	16/65	24.6	14/65	21.5	6/65	9.2	nd	nd		15/6	5 23.	1 0/65		nd		nd	nd				12/65	18.7	•		Workers in the chemical industry with exposure to platinum salts.*Higher total IgE and Spec.IgE in employees with work-related symptoms.
			Merget, Schultze- Werninghaus et al., 1991	2-; cross- sectional	35	31 (88.6)*	35/35	100	32/35	91	24/35	68.5	nd	16/35	46	nd		5/35**	* 14.	3 24/27**	88.8	nd	22/27	81.5			27/35	77.4	nd		Workers from two platinum refineries with work related symptoms seen between 1983 and 1990. "31 showed either SPT+ or SIC+. **8 were not submitted to SIC for medical or technical reasons. **5 with FEV1/VC = 65%, rest not indicated.
9			Pepys, Pickering et al., 1972	2-; cross- sectional	16	8 (50)*	16/16	100	nd		nd		nd	nd		nd		5/16*	* 31.2	5 nd		nd	8/16	50	7	1	10/16	62.5	nd		Worker in a platinum refinery. "8 workers had SPT+ and SIC+. **5 workers with slight airways obstruction.
			Merget, Schultze- Werninghaus et al., 1988	3+; cross- sectional	30	7 (23.3)	8/30	26.6	8/30	26.6	7/30	23.3	nd	4/30	13.3	3 nd		nd		nd		nd	nd				10/26*	38.5	nd		6 former and 27 actual workers in a platinum refinery. The symptomatic group had a higher exposure to platinum salts, doubtful work-related symptomatics were not included.
	_		Hunter, Milton et al., 1945	3+; cross- sectional	91*	[52 (57.1)]*	52/114*	45.6	nd		nd		nd	13/114	11.4	4 nd		nd		nd		nd	nd			1	0/16**	62.5	nd		114 Workers in four refineries, *91 exposed to platinum salts.**SPT was performed in half the workers of one refinery, the rest refused or the test was unsatisfactory.
Palladium	-	1	Daenen, Rogiers et al., 1999	3; case report	1	1	1/1		1/1		1/1		nd	nd		nd		0/1		1/1*		nd	1/1		1		1/1		nd		Worker exposed to nickel, tin, palladium, lead and gold. Isolated sensitization to palladium. *moderate NSBHR.
Stainless steel welding fumes	-	-	Hannu, Piipari et al., 2007	3+; survey	34	[32 (94.1)]*	28/35*	80	nd		nd		nd	nd		nd		3/34	8.8	6/34	17.6	5/9	32/34	94.1	9 16	9	0/24	0	nd		Welders diagnosed with asthma symptoms during the years 1994–2003. Follow-up after 6 months, 6 welders could continue with welding work. *28 were diagnosed with QA tenar the groups 20 herd (20 herd)
Vanadium	-	-	Musk and Tees 1982 ABSTRACT	3; case report	4	[4]	4/4		nd		nd		nd	nd		nd		nd		2/4			nd				nd		nd		with OA before the survey, 32 had SIC+. Workers from a vanadium pentoxide refinery.
Zinc	-	1	Malo and Cartier, 1987	3; case reports	2	[2]	2/2		nd		nd		nd	nd		nd		2/2		2/2		nd	2/2		2		nd		nd		Solderers processing galvanized metal. One also showed fever and leukocytosis which suggests the presence of metal fume fever or hypersensitivity pneumonitis.
*			Malo, Cartier et al., 1993 ABSTRACT	3; case report	1	1	1/1		nd		nd		nd	nd		nd		0/1		1/1		1/1	1/1		1		0/1		0/1		Worker in a plant where metals were galvanized in heated zinc.
Rhodium salts	-	1	Merget, Sander e al., 2010	t 3; case report	1	1	1/1		'1/1		nd		nd	nd		nd		0/1		1/1		nd	1/1		1		1/1		nd		Operator of an electroplating
DYES																															
Carmine from Dactylopius coccus	**	11	Tabar-Purroy, Alvarez-Puebla et al., 2003	2-; cross- sectional	24	2 (8.3)	5/24	20.8	2/24	8.3	2/24	8.3	nd	nd		nd		1/14*		6/14**	42.8	nd	nd				10/24	41.7	4/10***	40	Workers in a dye factory. Same factory and 9 identic workers as in the study of <i>Quirce</i> , <i>Cuevas et al.</i> , 1994 (see below) "FEV1<80% "14 workers had either sensitization to carmine allergen or work-related symptoms, 4/6 workers with NSBHR+ had work-related symptoms ***Spec. IgE was present in 4 subjects with positive SPT
*	1		Quirce, Cuevas e al., 1994	t 2-; cross- sectional	10	1 (10)	2/10	20	3/10	30	1/10	10	nd	nd		nd		nd		1/10	10	1/10 10	1/10	10	1		3/10*	30	1/10*		9 dye factory workers, 1 ex-worker with former work- related Asthma. "Worker with asthma symptoms is sensitized

Agents	Strength of	Total no.	Reference	Level of	Occupa-	Allergic								EVIDE	ENCE (pa	athologic	cal result	s)								Remarks
	evidence per agent (three star system	of allergic asthma		evidence per study (revised	tionally exposed subjects	due to			۷	VORK-R	ELATED SYMPTO	MS			LF	т	NSBH	IR sPFT		ŝ	SIC		:	SPT Sp	ec. IgE	
	of RCGP)	cases per agent, n		(revised SIGN grading system); study type.		agent, n, prevalence (%). Cases with probable allergic asthma but specific sensitization	Asthr	na F	hinitis	Con	junct. Cough	Skin	Tot	al	-						Re	action	_			_
						specific sensitization not confirmed in parantheses [] or not indicated.	n/n Ast	% n/n R	hin %	n/n Conj	% n/n Cou	n/n % <mark>Skin</mark> %	n/n Tot	%	n/n LFT	%	n/n NSBHR	n/n % PFT %	/		i (n) l	(n) d (n) n/n <mark>SP</mark>	T % n/n lg	1 F %	
			Ferrer, Marco et al., 2005	3; case report	1	1	1/1	1/	-	1/1	nd	nd	nd		nd	/0	1/1	nd	n			(, u (1/1	1/1		Butcher
			Acero, Tabar et al., 1998	3; case report	t 1	1	1/1	1/	1	1/1	nd	nd	1/1		nd		1/1	1/1*	1/	1		1	1/1	1/1		Spice warehouse worker. *PEFR for 6 weeks at work and off-work; oral Ch induced a 50% decrease in PEFI
			Stücker, Roggenbuck et al., 1996	3; case report	t 1	1	1/1	1/	1	nd	nd	nd	1/1		nd		nd	nd	n	1			1/1	1/1		Flavourer in a food factory
			Rodriguez, de la Cuesta et al.,	3; case report	t 1	1	1/1	1/	1	nd	1/1	nd	1/1		nd		0/1	1/1	1/	1		1	1/1	nd		Worker in a factory making carminic acid
			1990 Burge, O'Brien et al., 1979	3; case report	1 2	2	2/2	no		nd	nd	nd	nd		1/2*		nd	nd	2/:	2		2	0/2	1/2		A worker in a dye factory and a blender of cosmetics. *FEV1 /FVC
			Añíbarro, Seoane et al., 2003 ABSTRACT	3; case report	2	2*	2/2	no	I	nd	nd	nd	nd		nd		2/2	nd	2/:	2			2/2	2/2		2 butchers using a mixture of additives with carmine. *SPT, Spec.IgE and SIC were positive to isolated carmine.
D&C Blue Dye No. 2 (Indigotine)	-	1	Miller, Lummus et al., 1996 ABSTRACT	3; case report	1	1	1/1	1/	I	nd	1/1	nd	nd		nd		nd	nd	1/	1	1		0/1	0/1		Worker exposed to FD&C Blue Dye No. 2 and other dyes.
enna (black)	-	1	Starr, Yunginger et al., 1997	3; case report	1	1	1/1	1/	I	1/1	1/1	nd	nd		•		1/1	1/1	no	I			1/1	1/1		Worker in an herbal shop. *mild airway obstruction indicated.
inasol dyes	-	4	Topping, Forster et al., 1989	3+; case series	6	4 (66.6)*	5/6	83.3 4/	66.	6 1/6	16.6 nd	1/6	nd		nd		nd	nd	no	1			nd	5/6	83.3	Employees in a wool dye house. *1/5 with asthmatic symptoms was not sensitized.
onascus ruber	-	1	Vandenplas, Caroyer et al., 2000	3; case report	1	1	1/1	1/	1	1/1	nd	nd	1/1		0/1		1/1	nd	1/1			1	1/1	1/1		Food manufacturer handling chinese red rice (ferment with <i>M. ruber</i>). *SIC+ with red rice
eactive Dyes	**	28	Nilsson, Nordlinder et al., 1993	2-; cross- sectional	162	3 (1.8)*	6/162	3.7 8/10	52 5	nd	nd	7/162 4.3	3 17/162	10.5	11/13	84.6	3/15	20 nd	no	1			5/15	33.3 4/15	5 26.6	5 Employees in 15 textile plants (1142 workers). 17 employees with work related symptoms, 15 had furthe investigation. *3 workers had asthma and were
			Park, Kim et al., 2007	2-: caes series	11	11	11/11	no	1	nd	nd	nd	nd		8/11*		11/11*	nd	11/	11	5	6	11/11	nd		sensitized 11 patients with diagnosed occupational asthma by SN *After 10 years of exposure cessation and in 2 follow- ups, reduced FEV1 and NSBHR+ presisted although SPT+ had nearly dissappeard (SPT+: 3/11)
			Park, Kim et al., 1989	3+; case series	9	9	9/9	4/	9	nd	nd	nd	nd		**		8/9	nd	8/8		4	4	9/9	8/9		Dye process workers. SIC not performed in 1 worker. **Baseline FEV1 indicated in ml.
			Romano, Sulotto et al., 1992	3; case report	1	1	1/1	no	1	nd	nd	1/1	nd		•		0/1	nd	1/	1	1		1/1	nd		Wool and cotton dyer. *mild airway obstruction indicate
			Alanko, Keskinen et al., 1978	3; case reports	4	4	4/4	4/4	1	nd	nd	nd	nd		0/4		nd	nd	4/-	1	1		4/4	3/4		Workers wxposed to different reactive dyes
BIOCIDES										-											1 1					
hloramine T	(*)	9	Kujala, Reijula et al., 1995	3; case report	1	1	1/1	no	1	nd	nd	nd	nd		0/1		1/1	nd	1/	l		1	1/1	1/1		Cleaner.
			Blasco, Joral et al., 1992 ABSTRACT	3; case report	1	1	1/1	1/	1	nd	nd	nd	nd		nd		nd	nd	'1/	1		1	1/1	1/1		Dairy worker.
			Bourne, Flindt et al., 1979	3+; case series	7	7	7/7	3/	7	nd	4/7	1/7	nd		nd		nd	nd	no	1			7/7	nd		Brewery workers
luteraldehyde	-	1	Ong, Tan et al., 2004	3; case report	1	[1]	1/1	nc	1	nd	nd	nd	nd		0/1		1/1	1/1	1/	1		1	nd	nd		Laboratory technician.
	_		Quirce, Gomez et al., 1999	3; case report	1	1	1/1	no	1	1/1	1/1	nd	nd		0/1		0/1	nd	1/1		1		0/1	nd		Nurse. *First SIC was negative and turned positive whe repeated 1 week later. No late reaction was observed b a nocturnal asthma in the following days.

Agents	Strength of	Total no.	Reference	Level of	Occupa-	Allergic										E	VIDENCI	E (patho	logical re	esults)									Remarks
	evidence per agent (three	allergic		evidence per study	tionally exposed	asthma cases due to				WOR	K-RELA	ATED S	MPTOM	6				LFT	N	ISBHR	sPFT		S	IC		5	SPT	Spec.	lgE
	star system of RCGP)	asthma cases		(revised SIGN grading	subjects studied,	mentioned agent, n,			Dhiait	41-	0		0	01-1		T !								De					
		per agent. n		system); study	n	prevalence (%). Cases with probable	Asthr	na	RNINN	tis	Conjune	ct.	Cough	Skir	<u>n</u>	Total								Re	action				
		agent, n		type.		allergic asthma but specific sensitization																							
						not confirmed in parantheses [] or																							
						not indicated.	n/n Ast	%	n/n Rhin		n/n Conj	% n/n	Cou %	n/n Skin	%	n/n Tot	// n	/n FT %	n/n		n/n PFT %		• •/	i (n) I	(n) d (n) n/n <mark>SP</mark> 1	T 0/	n/n <mark>IgE</mark>	o/
			Gannon, Bright et		8	[7]	8/8		nd		nd		nd	nd		nd		/8	4/8	//	7/7	7/8			5 2		/0	nd	Endoscopy and x-ray workers. 3 Workers also had SIC+
			al., 1995	series																									to formaldehyde.
*			Chan-Yeung, McMurren et al.,	3; case report	1	[1]	1/1		nd		nd		nd	nd		nd	1	/1	1/1	1	1/1	1/1			1	nd		nd	Respiratory technologist,
			1993																										
Chlorhexidine		-	Waclawski,	3; case	2	[2]	2/2		nd		nd		nd	nd		nd	C	/2	1/2		nd	2/2		2		nd		nd	Nurse
	-		McAlpine et al., 1989	reports		.,	-																						
			1505																										
Hexachlorophene	_	1	Nagy, Orosz et al., 1984	3; case report	1	1	1/1		1/1		nd		nd	nd		nd	r	nd	1/1	1	nd	1/1		1		0/1		nd	Children's nurse
	-		al., 1964																										
			E			141																							
Ortho-Phthalaldehyde	-	-	Fujita, Ogawa et al., 2006	3; case report	1	[1]	1/1		nd		nd		nd	1/1		nd	r	nd	nd	1	nd	nd				nd		nd	Medical worker. Diagnose of occupational asthma based on symptoms, clinical examination and treatment effects.
Peracetic acid-hydrogen peroxide		-	Cristofari-	3; case	2	[2]	2/2		2/2		2/2	1	/2	nd		nd	C	/2	2/2	2	1/1	1/1		1		nd		nd	Nurses. 1 nurse had PFT, the other SIC
	-		Marquand, Kacel et al., 2007	reports																									
FUNGICIDES																													
Tetrachloroisophthalonitrile		-	Honda, Kohrogi e	3: case report	1	[1]	1/1		nd		nd		nd	nd		nd	C	/1	1/1	1	nd	1/1			1	•		0/1	Farmer. *Skin patch test was positive.
	-		al., 1992			.,	-																						
Captafol	_	-	Royce, Wald et	3; case report	1	[1]	1/1		1/1		nd		nd	nd		nd	C	/1	1/1	1	1/1	1/1			1	0/1		0/1	Chemical manufacturing worker.
	-		al., 1993																										
			Chalten Linch at	2		[4]	4/4				-		14			a d		4	4 (4			14.14		1		0/4			Maximum technician are and at work to a same t
Tributyl tin oxide (TBTO)	-	-	Shelton, Urch et al., 1992	3; case report	1	[1]	1/1		nd		nd	1	/1	nd		nd	0	/1	1/1	1	nd	'1/1		1		0/1		nd	Venipuncture technician exposed at work.to a carpet sprayed with TBTO.
Fluazinam and chlorothalonil		-	Draper, Cullinan	3; case	2	[2]	2/2		nd		nd		nd	nd		nd		1/2	1/2	:	2/2	2/2			2	nd		nd	Workers in a fungicide formulation plant. 1 worker
	-		et al., 2003	reports																									exposed to fluazinam, the other to chlorothalonil.
ISOCYANATES																													
Toluene Diisocyanates (TDI)	**	9	Zedda, Cirla et	2-; cross-	42	[35 (83.3)]	42/42	100	nd		nd		nd	nd		nd		•	11/1	18	nd	35/42	83	20	10 5	nd		nd	Workers with symptoms of asthma (33) or asthma and
, , ,	**		al., 1976	sectional		• • •																							chronic bronchitis (9). SIC was a spray-painting test. **Mean FEV1: 96% predicted
																													Wearrie VI. 30% predicted
н			Moscata, Dellabianca et al.,	2-; cross- sectional	113	[46 (40.7)]	113/113	100	nd		nd	1	nd	nd		nd	14	/46 30	0.4 67/1	13 59.3	nd	46/113	3 40.7	13	19 14	nd		nd	Employees in polyurethan plastics industries, furniture industry, auto-body repairmen or carpenters. Auto-body
			1991	sectional																									repairmen were co-exposed to MDI and were also
			Baur, Fruhmann		105	0 (1 0)	55/405															10/17	70.0	-	2 5			0/405	challenged with it but did not respond. 4.6 Workers exposed to TDI. Co-exposure to MDI in a fifth of
			et al., 1981	3+; cross- sectional	195	9 (4.6)	55/195	28.2	na		nd		nd	nd		nd	r	nd	nd	1	nd	12/17	70.6	5	2 5	nd		9/195	them. All with Spec. IgE+ were symtomatic and SIC+.
		1																											SIC was performed in 17 symptomatics.
	-		Siracusa, Curradi	3; case report	1	[1]	1/1		nd		nd	1	/1	nd		nd	C	/1	nd	1	1/1*	1/1		+	1	nd		nd	Carpanter. *PEF was a measurement of circadian
			et al., 1978																										change of airflow during work after SIC was followed by recurrent nocturnal asthma. The patient was diagnosed
																													as having nocturnal asthma
Hexamethylene diisocyanate (HDI)	*	3	Vandenplas, Cartier et al.,	2-; cross- sectional	20	3 (15)*	20/20	100	nd		nd		nd	nd]	nd	6/	20	15/2	20 75	nd	10	50	6	1 3	nd		3/19	15.8 *Spray painters. Workers had Spec.IgE+ and Spec. IgG+; 1 other workers had only Spec.IgG+. *Of the 10
		1	1993																										workers with SIC+, 3 had IgE and IgG
		1						1							1											1			and 1 IgG only.

Agents	Strength of evidence per	Total no. of	Reference	Level of evidence per	Occupa- tionally	Allergic asthma cases										E	/IDENCE	(patholo	gical resu	ılts)									Remarks
	agent (three	allergic		study	exposed	due to mentioned				WOR	K-RELA	TED SYM	PTOMS					LFT	NSB	BHR	sPFT		SIC			SI	РТ	Spe	ec. IgE
	star system of RCGP)	asthma cases		(revised SIGN grading		agent, n,	Asthr	na	Rhini	tis	Coniunct	Co	uah	Skin		Total		_						Reac	tion				
		per agent, n		system); study		prevalence (%). Cases with probable																	_						
		_		type.		allergic asthma but specific sensitization not confirmed in																							
						parantheses [] or not indicated.					n/n			n/n			n/r		n/n		n/n								
							n/n Ast	% r	√n <mark>Rhin</mark>	% (Conj	% n/n <mark>C</mark>		Skin	%		% LF1	%	NSBHR	%	PFT %	n/n <mark>SIC</mark>	% i			n/n <mark>SPT</mark>	%	n/n lgE	
1,5-naphthylene diisocyanate (NDI)	-	-	Harries, Burge et al., 1979	3; case reports	3	[3]	3/3		1/3		1/3	1/3		nd		nd	nd		1/3		nd	3/3		2	1	nd		nd	Workers in a factory where various isocyanates w Used. Co-exposure to MDI and TDI, SIC with TDI MDI was negative.
			Baur, Wieners et al., 2000	3; case report	1	[1]	1/1		nd		nd	nd		nd		nd	nd		1/1		nd	1/1		1		0/1		0/1	Worker in the plastics industry.
n	-		Baur, Chen et al., 2001	3; case series	6	[5 (83.3)]	5/6	83.3	2/6	33.3	nd	2/6	33. 3	nd		nd	3/6	50	3/6	50	nd	3/6	50	1 1	1	0/6	0	0/6	Workers engaged in the production of different sy resin articles using NDI. 1 worker had an extrinsic alveolitis associated with pulmonary hemorrhage i NDI exposure.
Methylene diphenyldiisocyanate (MDI)	*[*]	10	Liss, Bernstein et al., 1988	3+; cross- sectional	26	1	7/26		5/26		nd	nd		nd		nd	nd		nd		•	nd				1/26		1/26**	Core- and mold-area employees who were regula exposed to MDI.*Significant FEV1 decrease in the exposed group. Individual data not shown. ** Plus
1			Tse, Johnson et al., 1985	3+; cross- sectional	76	5 (6.6)**	10/76	13.2	nd		nd	40/7	6 52. 6	nd		nd	nd		10/76	13.2	nd	nd				nd		2/76*	Spec.IgG+ in 4 workers. 2.6 Foundry workers. Spec. IgG + in five workers. ** t asthma cases had either Spec.IgE+ or Spec. IgG
	-		Zammit-Tabona, Sherkin et al., 1983 ABSTRACT	3+; case series	11	2 (18.2)**	11/11	100	nd		nd	nd		nd		nd			•		nd	'6/11	54.5	4	2	nd		2/11	18.2 Foundry workers. Co-exposure to formaldehyde t was negative in all 11 workers. "SIC + workers ha evidence of air-flow obstruction in LFT and greate NSBHR than the others. "1 was SIC-
u			Stingeni, Bellini et al., 2008	3; case report	1	1	1/1		nd		nd	nd		1/1		nd	nd		nd		nd	1/1		1		nd		1/1	
и			Donnelly, Buick et al., 2004	3; case report	1	[1]	1/1		nd		nd	nd		nd		nd	0/1		nd		nd	'1/1		1		nd		nd	Nurse.
			Perfetti, Brame et al., 2003	3; case report	1	[1]	1/1		nd		nd	nd		nd		nd	0/1		0/1		nd	1/1		1		nd		nd	Worker in a toy manufacture. Symptoms started accident spill of MDI in her work area and persiste removal from exposure.
			Valks, Conde- Salazar et al., 2003	3; case report	1	1	1/1		nd		nd	nd		1/1		nd	nd		nd		nd	1/1				nd		1/1	Worker in a factory where plastic components we manufactured. Spec. IgE and SIC + to MDI and T Worker was diagnosed as having occupational co urticaria and asthma.
Various isocyanates (TDI, HDI)	*[*]		Deschamps, Sow et al., 1998	3+; cross- sectional	96	2 (2.1)	44/96	45.8	nd		nd	nd		nd		nd	nd		nd		nd	nd				nd		2/68	
/arious isocyanates	_		O'Brien, Newman	3+; cross-	24	[16 ('66.6)]	24/24	100	nd		nd	nd		nd		nd	nd		12/24	50	nd		+	_	-	nd		nd	Workers handling diisocyanates. Probably cross-
TDI			Taylor et al., 1979	sectional																		16/24	66.6	5	11				reactivity between the different isocyanates becau subjects with asthmatic reactions to TDI reacted t
MDI																						8/24	37.5	4	4				and 3 of these 8 also reacted to HDI.
HDI	1																					3/9	33.3	1 2	\square				
Various isocyanates			Cartier, Grammer et al., 1989	3+; case series	62	9 (14.5)	62/62	100	nd		nd	nd		nd		nd	14/6	2 22.6	6 46/62	74.2	nd							9/62**	* 14.5 Workers exposed to various isocyanates. *SPT d 7/9 workers with Spec.IgE+ or Spec. IgG+. **9 workers
TDI MDI					6 17																	4/6	66.6 58.8	7 15	7	1/7*	'14.3	4	had Spec. IgE and Spec.IgG antibodies. No work only Spec. IgE antibodies but 20 only Spec.IgG.
HDI					39																	15/39	_		-	6/7	14.3	+	only open. Ige anaboutes but 20 only open.ige.
Various isocyanates	-		Pezzini, Riviera	3+; case	28	11 (39.3)	28/28	100	nd	\vdash	nd	nd	+	nd		nd	nd		9/28	32.1		28/28		9 12	7	nd	-	11/28	39.3
TDI			et al., 1984	series	22	. ,																						5/6	83.3 Workers exposed to TDI or MDI.
MDI Various isocyanates	-		Minov, Karadzinska- Bislimovska et al., 2008	3; case reports	6 2	[2*]	2/2		nd		nd	nd		nd		nd	0/2		2/2		1/2	nd				nd		6/22 nd	27.3 Automobile painters with isocyanate-based aeros *One patient with occupational asthma, the other was diagnosed as having work-exacerbated asthm
Triglycidyl isocyanurate (TGIC)	-	-	Piirila, Estlander et al., 1997	3; case report	1	[1]	1/1		nd		nd	nd		1/1		nd	0/1		1/1		1/1	1/1			1	0/1		0/1	Spray painter
ANHYDRIDES																													
Tetrachlorophtalic anhydride	(*)		Schlueter, Banaszak et al., 1978	3+; case series	5	[5]	5/5		nd		nd	nd		nd		nd	2/3		3/4		1/1*	3/3*		2	1	nd		0/5	Workers in the production of epoxy resin. One wo couldn't have SIC because of his condition, the ot spirometric decreases in PFT and no further invest

Agents	Strength of	Total no.	Reference		Occupa-	Allergic										EVID	ENCE (p	athologi	ical resu	ılts)											Remarks
	evidence per agent (three star system			evidence per study (revised	tionally exposed subjects	asthma cases due to mentioned				wo	ORK-RELA	TED SYN	IPTOM	S			LI	FT	NSB	BHR	sPF	т		SIC			SF	т	Spe	c. IgE	-
	of RCGP)	cases per agent, n		SIGN grading system); study type.		agent, n, prevalence (%). Cases with probable allergic asthma but specific sensitization not confirmed in parantheses [] or	Asthr	ma	Rhir	iitis	Conjunc	t. Ci	ough	Skin	То	tal	-								Reacti	ion					-
						not indicated.	n/n Ast	%	n/n Rhir	%	n/n Coni	% n/n C	ou %	n/n Skin	% n/n Tot	%	n/n	96	n/n NSBHR	o/_	n/n PFT	% 1	n/n <mark>SIC</mark>	% i	(n) (n)	d (n) n/	/n SPT	%	n/n laE	. %	
			Howe, Venables et al., 1983	3+; case series	7	7	7/7		nd		1/7	2/7	_	nd	nd		nd	70	0/7	70	nd		4/4	70	2		7/7	70		70	Workers exposed to an epoxy resin powder containing TCPA. * RAST to TCPA-HSA were significantly elevated in all of the 7 asthmatic workers.
Phthailic anhydride	*[*]	6	Nielsen, Welinder et al., 1988	3+; cross- sectional	60	1 (1.7)	5/60	8.3	19/60	31.6	21/60	35 nd		nd	nd		0/5*	0	2/3*	66.6	nd		1/1*				1/1*		1/1*		Workers in 2 plants producing alkyde and unsaturated polyester resins. Time-weighted average concentration were 6,6 mg/m3Probably the same plants as in Wernfors, Nielsen et al., 1986. "LFT, NSBHR, SIC, SPT and Spec. Ige of the 5 workers with asthma.
*			Wernfors, Nielser et al., 1986	a 3+; cross- sectional	118	4 (3.4)	21/118	17.8	28/118	23.7	nd	nd		nd	nd		4/13*	30.8	3/11*		nd		2/2*	100		2 4	4/11*	'36.4	nd		Workers in 4 plants producing alkyd or polyunsaturated polyester resins. Time-weighted average concentration were 3-13 mg/m3.13 workers had chronic bronchils. "LFT: NSBHR, SIC and SPT were only performed in 11 out of the 21 asthmatics. 2 out of 11 asthmatics had Prausnitz-Kützner-Test and 4 non-asthmatics heavly
			Ward and Davies, 1982	3; case report	1	[1]	1/1		1/1		nd	nd		nd	nd		1/1		nd		nd		1/1			1	nd		nd		Worker grinning metals and solid plastics. Asthma occured after working with cured resin.
×			Maccia, Bernstein et al., 1976 ABSTRACT	3; case report	1	1	1/1		1/1		1/1	nd		nd	nd		nd		nd		nd		1/1		1		nd		1/1		Worker exposed to phthalic anhydrides
Phthalic anhydride and chlorendic anhydride	-	1	Keskinen, Pfäffli et al., 2000	3; case report	1	1	1/1		nd		nd	nd		1/1	nd		nd		1/1		1/1		nd				1/1		1/1		Mechanic.
Methyl tetrahydrophthalic anhydride (MTHPA)	*	3	Nielsen, Welinder et al., 1992	3+; cross- sectional	170	2 (1.2)*	18/170	10.6	94/170	55.3	51/170 3	30 16/1	70 9.4	nd	nd		nd		34/170	20	nd		nd			2	25/170	'14.7	28/170	16.5	144 workers exposed to MTHPA and 26 subjects previously exposed in the same factory. *55 current and the 26 former workers were highly exposed. In this group 2 had asthma and were sensitized. The other sensitization rates are not indicated.
			Nielsen, Welinder et al., 1989	3; case report	1	1	1/1		1/1		nd	nd		nd	nd		0/1		1/1		nd		nd				1/1		1/1		Worker exposed to MTHPA.
Hexahydrophthalic anhydride	*	5	Moller, Gallagher et al., 1985	2-; cross- sectional	27	4 (14.8)*	4/27	14.8	10/27	37	13/27 4	8.1 nd		nd	nd		0/27	0	nd		0/27	0	nd				nd		12/27	44.4	Workers with occupational exposure to hexahydrophthalic anhydride. *4 workers had work related asthma, they also had Spec. IgE+.
×			Chee, Lee et al., 1991	3; case report	1	1	1/1		nd		nd	nd		nd	nd		nd		nd		1/1		1/1			1	nd		nd		Laboratory technician.
Maleic anhydride	-	1	Lee, Wang et al., 1991	3; case report	1	1	1/1		1/1		nd	nd		nd	nd		nd		1/1		nd		1/1			1	nd		nd	-	Assistant technician. Co-exposure to phthalic anhydride.
Trimellitic anhydride	[*]	4	Zeiss, Patterson et al., 1977	3+; cross- sectional	14	4 (28.6)	4/14	28.6	4/14	28.6	nd	nd		nd	*		nd		nd		nd		nd				4/4	100	3/4		Industrial workers exposed during the chemical manufacture of TMA. "The 4 asthma cases also suffered from rhinitis, 4 workers had respiratory symptoms with malaise, fever, chills etc. and 6 workers had irritant respiratory symptoms. SPT+ and IgE+ cases are asthm:
Various anhydrides Phthalic acid anhydride Trimellitic acid anhydride Triethylene tetramine	-	-	Fawcett, Newmar Taylor et al., 1977		7	[6 (85.7)]	6/7	85.7	nd		nd	nd		nd	nd		5/7*		nd		nd		5/7** 3/7 1/7 1/7	71.4 42.9 14.3 14.3	2	1	nd		nd		Workers exposed to epoxy resin systems. 1 worker with chronic bronchitis, *LFT was indicated as a mild obstruction. **The sixth worker with asthma was SIC+ to TDI
AMINES			•											•						. 1								. 1			
Amino-ethyl ethanolamine	-	-	Pepys and Pickerting, 1972	3; case reports	3	[3]	3/3		nd		nd	nd		nd	nd		0/3*		nd		nd		3/3		1	2	nd		nd		Cablejointers exposed to amino-ethyl ethanolamine. * 1 with signs of mild airways obstruction.
Dimethyl ethanolamine	-	-	Vallieres, Cockcroft et al., 1977 ABSTRACT	3; case report	1	[1]	1/1		1/1		nd	1/1		nd	nd		nd		nd		•		1/1			1	0/1		nd		Spray painter. *Decrease in PFT.
Ethylenediamine	-	2	Lam and Chan- Yeung, 1980 ABSTRACT	3; case report	1	[1]	1/1		nd		nd	nd		nd	nd		nd		nd		nd		1/1		1		0/1		0/1		Worker developing color photographs.

Agents	Strength of evidence per	Total no. of	Reference	Level of evidence per	Occupa- tionally	Allergic asthma cases									EV			ical results)								Remarks
	agent (three star system	allergic asthma		study (revised	exposed subjects	due to mentioned				WORK-RI	ELATE	SYMPTOM	S			LFI	т	NSBHR	sPFT		SIC		s	SPT	Spec. I	JΕ
	of RCGP)	cases per agent, n		SIGN grading system); study type.	n	agent, n, prevalence (%). Cases with probable allergic asthma but specific sensitization not confirmed in parantheses [] or not indicated.	Asthn	na	Rhinitis	Conj n/n	unct.	Cough	Ski	<u>n</u>	Total	n/n		n/n	n/n			Reaction				
			Nakazawa, Matsuit	3; case reports	2	2	n/n Ast 2/2		Rhin 4	% Conj nd	%	n/n Cou % nd	Skin nd	%	n/n Tot %	6 LFT 0/2	%	NSBHR % 2/2	PFT %	n/n SIC 2/2	% i (I	n) I (n) d (2	n) n/n SP1 nd	T %	n/n lgE 2/2	% Employee in a chemical factory
,	_		Ng, Lee et al., 1991 ABSTRACT	3; case report	1	[1]	1/1	r	nd	nd		nd	nd		nd	nd		1/1	1/1	1/1		1	nd		nd	Chemical worker.
Ethanolamine and triethanolamine	-		Savonius, Keskinen et al., 1994	3; case reports	3	[3]	3/3	2	2/3	1/3		1/3	nd		nd	0/3		1/3	3/3	'3/3	2	1	nd		nd	Workers exposed to azodicarbonamide.
Diethanolamine	-		Piipari, Tuppurainen et al., 1998	3; case report	1	[1]	1/1	r	nd	nd		nd	nd		nd	0/1		1/1	1/1	1/1		1	nd		nd	Worker welding black iron.
Paraphenylenediamine	-		Silbermann and Sorrell, 1959	2-,cross- sectional	80	[59 (73.8)]	59/80*	73.8 38	3/80	nd		4/80 5	18/80	22.5	nd	nd		nd	nd	37/50	74		nd**		nd	Fur workers. *30 had only asthma symptoms, 29 had asthma and other allergies. ** Patch test was done in workers with 47 workers with asthma, 31 were positive after several hours until 4 days after.
Pieperazine	-	-	Hagmar, Bellander et al., 1982	3+, cross- sectional	130	[29 (22.3)]	29/130	22.3 r	nd	nd		nd	nd		nd	19/107 *	17.8	5/7 71.4	nd	1/1		1	nd		nd	Factory workes handling amines. 33 were diagnosed wi asthma, 29 due to piperazine, 3 due to ethylenediamine and 1 due to an antaparasitic drug.
Piperazine dihydrochloride	-	1	Pepys, Pickering et al., 1972	3; case reports	2	1+[1]	2/2	r	nd	nd		nd	nd		nd	0/2		nd	nd	272		2	1/2		nd	Chemists.
Pieperazine and n-methyl-piperazine	-		Welinder, Hagmar et al., 1986	3; case report	2	2	2/2	r	nd	nd		nd	nd		nd	0/2		0/1	nd	nd			1/2		2/2	Workers in a chemical plant.
Piperazine citrate	-		Quirce, Pelta et al., 2006	3; case report	1	1	1/1	1	1/1	nd		nd	nd		nd	0/1		1/1	nd	1/1		1	1/1		nd	Process operator in a chemical factory
OTHER CHEMICALS		1 1			∟I			<u> </u>					ļ		·			<u> </u>			ļļ	<u> </u>	-		↓	
3-amino-5-mercapto-1,2,4-triazole	-		Hnizdo, Sylvain et al., 2004	:	45	[6*]	11/45		4	42	31	22	nd		nd	8/42	19	3/26	3/10	nd			nd		nd	Workers in a specialty chemical plant. Survey after repo of 8 new-onset cases. * 6 of 11 asthma cases with criteria of OA, sensitzation is not confirmed.
Azodicarbonamide	-	-	Slovak, 1981	2-, cross- sectional	151	[28 (18.5)]	28/151	18.5 8/	/28 28	8.5 7/28	25	11/28 39. 3	nd		nd	0/151	0	nd	0/151 0	nd			0/151	0	nd	Workers exposed to azodicarbonamide dust; weighted average levels in the range of 2-5 mg/m3.
*			Malo, Pineau et al., 1985	3; case report	2	[2]	2/2	3	1/2	1/2		nd	nd		nd	2/2		2/2	nd	2/2		1 1	nd		nd	Workers exposed to azodicarbonamide.
n			Normand, Grange et al., 1989	3; case report	4	[4]	4/4	r	nd	nd		nd	nd		nd	1/2		nd	nd	'2/4		1 1	nd		nd	Workers exposed to azodicarbonamide.
			Kim, Cho et al., 2004	3; case report	: 1	[1]	1/1	r	nd	nd		nd	nd		nd	1/1		1/1	0/1	'1/1		1	0/1*		nd	Worker in an azodicarbonamide producting factory. *Patch-test was positive after 48 and 96 hours.
Epoxy resin	-	1	Hannu, Frilander et al., 2008	3; case report	1	1	1/1	1	1/1	nd		nd	1/1		nd	0/1		1/1	nd	1/1	1		1/1		1/1	Construction worker
Formalin	-		Hendrick and Lane et al., 1975	3; case reports	2	[1]	2/2	3	1/2	nd		nd	nd		nd	nd		nd	nd	'½		1	nd		nd	Nurse and pathologist exposed to formalin.
*			Hendrick and Lane et al., 1975	3+; survey	28	[2 (7.1)]	5/28	17.9 r	nd	nd		nd	nd		nd	0/28	0	nd	nd	2/4	50	2	nd		nd	Staff of a haemodialysis unit.
Formaldehyde			Burge, Harries et al., 1985	3+; case series	15	[3 (20)]	15/15	100 1	/1	nd		nd	nd		nd	nd		4/14 28.6	nd	7/15	46.6 4	3	nd		nd	Workers occupationally exposed to formaldehyde. Co- exposure to isocyanates, phenol or other chemicals. Workers with immediate SIC reactions also had NSBHR + and the symptomes are indicated to be due to an irritant effect of formaldehyde.

Agents	Strength of	Total no. of	Reference		Occupa-	Allergic asthma cases										EVIDE		athologic											Remarks
	evidence per agent (three	allergic		evidence per study	exposed	due to		-	-	wo	RK-RELATE	D SYMPT	OMS				LF	FT	NSB	HR	sPFT		s	IC		SF	т	Spec. IgE	
	star system of RCGP)	asthma cases		(revised SIGN grading	subjects studied.	mentioned agent, n,																							
		per		system);	n	prevalence (%). Cases with probable	Asth	ma	Rhin	itis	Conjunct.	Coug	1 5	kin	То	tal								Kea	ction				
		agent, n		study type.		allergic asthma but specific sensitization																							
						not confirmed in parantheses [] or	1																						
						not indicated.					n/n		n/n				n/n		n/n		n/n								
			Nordman.	21:0000	230	[12 (5.2)]	n/n Ast 230/230	%	n/n Rhin nd	%	Conj %		% Skir		n/n Tot	%	LFT 1/12	% N 8.3	SBHR 9/11		2/12	% n/n SI 25 '12/1	C %	i(n) I (n/n SPT nd	%	n/n lgE %	220 subjects expected to formaldebude: mean
			Keskinen et al., 1985	3+; case series	230	[12 (5.2)]	230/230	100	na		na	nd	nd		nd		1/12	0.3	0/11	12.1	3/12	25 12/1.	2 100	0	+ 2	na		nd	230 subjects exposed to formaldehyde; mean concentratiom: 4,8 mg/m ³ .12 considered as having occupational asthma after LFT, SIC and NSBHR. These comparisons and the 42 concent have been been been been been been been be
1	-		Grammer, Harris	3; case report	1	1	1/1		nd		nd	nd	nd		nd		0/!		0/1		nd	0/1				nd		1/1	are only indicated for the 12 cases here. Worker in a formaldehyde manufacturing plant.
			et al., 1993																										
	-		Kim Cana at al	2	1	[4]	4/4				ad						4./4		4/4		4/4	4/4				0/4		0/4	Wedness and the formal data and a Company to att
			Kim, Song et al., 2001	3; case report	1	[1]	1/1		nd		nd	nd	nd		nd		1/1		1/1		1/1	1/1				0/1		0/1	Worker exposed to formaldehyde. Co-exposure to oth chemicals.
			0.1			40 (00.0)	00/55	00.4	04/55	50.4			45/5				0/55	0	00/55	50.0		0/40	10.0	-		10/55	100.0		In the second seco
Persulphate salts	*	20	Schwaiblmair, Vogelmeier et al., 1997	2-, cross sectional	55	13 (23.6)	38/55	69.1	31/55	56.4	nd	nd	15/5	5 27.3	nd		0/55	U	32/55	58.2		9/46	19.6	5	4	13/55	'23.6	nd	Hairdressers exposed to persulfate salts. SPT+ and SIC+ subjects were out of the symptomatic group.
	-		Parra, Igea et al.,	3; case report	1	1	1/1		nd		nd	nd	1/1		nd		0/1		1/1		0/1	1/1			1	1/1		0/1	Hairdresser.
			1992																										
			Pepys, Hutchcroft	3; case	1	1	1/1		'1/1		'1/1	nd	nd		nd		0/1		nd		nd	'1/1			1	'1/1		nd	Hairdresser. Co-exposed to henna. SIC+ with
			et al., 1976	reports																									henna(immediate asthma response)
			Munoz, Cruz et	3+; case	8	5 (62.5)	8/8	100	6/8	75	nd	nd	3/8	37.5	nd		7/8	87.5	7/8	87.5	nd	7/7	100	1 3	5 1	5/8	62.5	nd	Hairdressers and cosmetician exposed to persulphate
			al., 2003	series	0	0 (02.0)	0,0		0,0		na		0,0	01.0	na			01.0		01.0	iid iid		100			0,0	02.0	10	salts.
	-		Moscato, Pignatti	3+; case	47	[21 (44.7)]*	47/47	100	11/47	23.4	nd	nd	17/4	7 36.2	nd		0/47	0	14/33	42.4	nd	21/47	44.7	4 1	4 3	0/14	0	nd	Hairdressers. SIC performed with ammonium persulfa
			et al., 2005	series																									and SIC+ with permanent hair dyes in 2 cases and in 1 with latex. *Co-exposure to permanaent hair-dyes; in 2 cases occupational asthma due to persulfates confirm
Polyfutictional aziridine	*	4	Kanerva, Keskinen et al., 1995	2-; cross- sectional	9	4 (44.4)	7/9	77.7	4/9	44.4	nd	nd	4/9	44.4	nd		nd		2/9	22.2	nd	7/9	77.7	1 8	5 1	4/4	100	0/5 0	Workers exposed to PFA (parquet layers, fibreboard Spray painter, salesman).
WORKSITES			1333																										
Farming																													
Farming	**	30	Walusiak,	2+; case-	100	30 (30)	79/100	79	92/100	92	38/100 38	83/100	83 nd	-	100/100	100	nd		X*		nd	38/10	0	23	15	47/100	47		Randomly selected symptomatic workers in small
	**		Krawczyk-	control																			·				_		nonspecialized farming. *Results not listed; 38 subject
animals cereal	-		Adamus et al., 2004																							7/100 22/100	7 22	4/100 4 18/100 18	Ch+); 30/38 subjects with OA were SPT+ to occupatio
hay and straw																										35/100	35		allergens (25/38 SP1+ to hay or straw, 17/38 SP1+ to
storage mites																										16/100	16	25/100 25	animals); cereal farming and SPT+ to cereals and SPT to storage mites were sign. risk factors of OA and/or ORh
Co-exposure to various lab animals			1		11			1 1		1 <u> </u>			-	_		1				L1			_						
Laboratory animals: urinary proteins from		140	Gautrin, Infante-	2++;	373	28 (7.5)*	22/373	5.9*	99/373	26.5*	nd	nd	81/37	3 21 7	94/370	25.4	nd		53/203	26.1	nd	nd				129/373	34.6*	nd	Animal laboratory apprentices. Peak incidents of SPT+
rat, mouse and dander from rabbit	***	110	Rivard et al., 2001	prospective cohort study over 3-4 years.	0.0	20 (1.0)	22010	0.0	00,010	20.0	nd -	1.0	0.00		0.0010	20.1	iid iid		50/200	20.1	i d					120,010	01.0		are max. 1-2 years after begin of exposure, and that of OA througout the first 3 yrs; OA cases: subjects with SPT+ and 3.2 fold decrease in PC20, only 6/28 OA cases had asthmatic WRS; *cumulative incidence ratio
Laboratory animals: urinary proteins from	4		Gautrin, Ghezzo	2+;	395	27 incident	27/395*	+	115/364		115/36	nd	nd	_	nd		nd	<u> </u> ,	30/395	7.6	nd	nd		++	+	85/395*		nd	Apprentices in animal-health technology. "Incident case
rat, mouse, rabbit and dander from rabbit			et al., 2002	prospective cohort study over 32 or 44 months		cases	211000		*		4*	10			nu -				50,000	1.0	i d	10				00,000			at 32 or 44 months; 30/85 SPT+ subjects had significa changes in NSBHR+ referred to as 30 incident cases of probable OA, 9/30 had asthma symptoms at baseline, 9/30 had asthma symptoms at follow-up
aboratory animals (rats, rabbits, mice,	-		Botham, Davies	2+;	383	[6 incident	6/383	1.6*	22/383	5.7*	11/383 2.9*	nd	12/38	3 3.1*	36/383	9.4*	nd	+	nd		nd	nd		++	+				Laboratory animal workers during their first 3 years of
guinea pigs)			et al., 1987	prospecitve cohort study		cases]																							exposure at research facilities. "Incidence after 1 year of exposure; "rafter 1 year of exposure 40-64 % of the 36 symptomatics were IgE+ to rat, and 70-86% to at least one animal; sensitized asthmatics not listed
Laboratory animals: rat, mouse, guinea pig, rabbit			Kruize, Post et al., 1997	2+; retrospective cohort study	99	8 (8.2)*	8/98	8.2*	14/98	14.3*	11/98 11.2'	nd	15/9	8 15.3	19/99	19.2*	nd		nd		nd	nd				nd		nd	Laboratory animal workers. Average time of follow-up 9 yrs; "cumulative incidence ratic; incident density ratio fc WRS: 19.7 per 1000 person-years; exposure and atop were sign. predictors of WRS

Agents	Strength of evidence per	Total no.	Reference	Level of evidence per	Occupa-	Allergic											EVIDEI			jical result	ts)									Remarks
	evidence per agent (three star system	of allergic asthma		evidence per study (revised	tionally exposed subjects	asthma cases due to mentioned				wo	ORK-RE	ELATED	SYMPTOM	S				LF	т	NSB	HR	sPFT		SIC			SF	τ	Spec	:. IgE
	of RCGP)	cases		SIGN grading	studied,	agent, n, prevalence (%).	Asthr	ma	Rhin	nitis	Conj	junct.	Cough	Skir	1	Tota	1								Reacti	on				
		agent, n		system); study	n	Cases with probable allergic asthma but																								
				type.		specific sensitization not confirmed in																								
						parantheses [] or not indicated.					n/n			n/n				n/n		n/n		n/n								
									n/n Rhin		Conj		n/n <mark>Cou</mark> %				%	LFT	%	NSBHR	<i>1</i> 0 ·	FT %		% i	(n) l (n)				n/n <mark>IgE</mark>	
Laboratory animals: rat, mouse, rabbit, hamster, guinea pig			Renström, Malmberg et al., 1994	2+; prospective cohort study over 4 years.	38	5-6 (13-16)	7/38	18.4	8/38	21.1	8/38	21.1	nd	nd		8/38	21.1	x*		x*		nd	nd				7/38**	18.4	x***	Laboratory technicians at follow-up after 4 years. "No difference between exposed and unexposed; "SPT+ with at least 1 hair extract; "no results listed; sign. increase in asthma in exposed; 6/7 symptomatics sensitized
Laboratory animals: rat, mouse, rabbit, hamster			Renström, Malmberg et al., 1995	2+; prospective cohort study	38	3 (7.9)	4/38	10.5	6/38	15.8	5/38	13.2	nd	4/38	10.5	8/38	21.1	X*		8/9**		nd	nd				7/38***	18.4	4/7****	Laboratory technicians, same cohort as above. "No difference between LAA and non-LAA, "BHR in LAA subjects: sign. change in BHR responsiveness; ""STPT+ with at least 1 hair extract; ""IgE in SPT+; sign. correlation between WRS and sensitization; 3 asthmatics sensitized
Laboratory animals: mouse, rat, guinea pig, rabbit, hamster, dog, cat, monkey etc			Aoyama, Ueda et al., 1992	3+; cross- sectional	5641	[121 (2.2)]	121/5641	2.2	1065/56 41*	18.9	+*		nd	594/56 41	10.5 1	303/56 41	23.1	nd		nd		nd	nd				nd		nd	Workers at 137 laboratory animal facilities. *Rhinitis and/or conjunctivitis
Laboratory animals (urine)			Venables, Tee et al., 1988	2-; cross- sectional	138	12 (8.7)	15/138	10.9	51/138	37	51/138	8 37	nd	25/138	18.1 6	60/138	43.5	nd		nd		nd	nd				17/133*	12.8	49/130*	37.7 Employees in a pharmaceutical company. *SPT+ and IgE+ with at least one urin extract; 7/15 asthmatics STP+
Guinea pig Mouse	-																										10/133 7/133		23/130 40/130	and 12/15 asthmatics IgE+
Rabbit Rat	-																										6/133 13/133		20/130	
Laboratory animals: rat, mouse, rabbit, guinea pig, hamster, cat	_		Agrup, Belin et al., 1986	2-; cross- sectional	65	4 (6.2)	5/65	7.7	15/65	23.1	nd		nd	nd		23/65	35.4	nd		X*		nd	nd				4/65**		4/65**	6.2 Laboratory technicians and animal keepers with past exposure, from 25 laboratories. *All 5 asthmatics BHR+; **with at least one animal; 4/5 asthmatics sensitized
					124	9 (7.3)	10/124	8.1	34/124	27.4	nd		nd	2/124	1.6 3	34/124	27.4	x*		x**		nd	nd				25/124**	20.2	25/124**	20.2 Currently employed laboratory technicians and animal keepers, from 25 laboratories. WRS: animal related
Rat Mouse					83/124																						15/19		15/19	symptoms. *1/10 asthmatics LFT+; **all 10 asthmatics BHR+; ***with at least one animal; 9/10 asthmatics
Guinea pig	-				55/124 35/124																						10/19 9/19		10/19 9/19	sensitized; exposure, SPT, and IgE for individual animals given for current technicians only
Hamster					1/124																						9/19		9/19	given for current technicians only
Cat Rabbit	-				26/124 55/124																						8/19 6/19		8/19 6/19	
Laboratory animals			Fuortes, Weih et al., 1996	2-; cross- sectional	103	[14]			30/103?	29.1			7/103 6.8	?			34	•		17/103	16.5	nd	nd						nd	University employees. *No sign. difference between exposed and controls; exposed were sign. more likely to
Cat Dog					24/103 11/103		43/103	42.1	nd		nd		7/103 6,9	nd	3	35/103	34											23.3 10.7		have WR asthmatic symptoms and NSBHR+. ** Intradermal skin test was performed.
Gerbil Guinea pig	_				7/103 9/103																							6,8 8.7		
Hamster Mouse	-				8/103 11/103																							7.8		
Rabbit Rat	-				13/103 20/103																							12.6 19.4		
Laboratory animals	-		Beeson, Dewdney	2-; cross- sectional	69	3 (4.4)	3/69	4.4	13/69	18.8	13/69	18.8	nd	6/69	8.7	15/69	21.7	nd		nd		nd	nd				8/15* 5/15	53.3	8/15*	53.3 Animal workers at pharmaceutical research cite. *SPT in
Guinea pig (Cavia porcellus) Mouse	-		et al., 1983	sectional																							3/15	20	6/15	53.3 Animal workers at pharmaceutical research cite. *SPT in 33.3 symptomatics with at least 1 animal allergen, IgE with at 40 least 1 urinary protein; all asthmatics sensitized
Rabbit Rat	-				-																						4/15 7/15	26.6 46.6	3/15 3/15	20 20
Laboratory animals: dander of rat, rabbit, mouse, guinea pig, cat, dog, harnster	_		Lutsky, Neuman et al., 1975	3+; survey	1293	[136 (10.5)]	136/1293	3 10.5	191/129 3	14.8	191/12 93	2 14.8	111/12 8.6 93	111/12 93	8.6 1	91/129 3	14.8	nd		nd		nd	nd				nd		nd	Laboratory animal workers from 39 animal facilities
Laboratory animals			Davies and McArdle, 1981	3+; survey	585	[18 (3.1)]	18/585	3.1	64/585	10.9	37/585	5 6.3	nd	13/585	2.2 1	14/585	19.5	nd		nd		nd	nd				nd		nd	Animal workers in 3 pharmaceutical companies and 1 university medical school
Laboratory animals (rats, rabbits, mice, guinea pigs)			Gross, 1980	3+; cross sectional	399	10 (2.5)	30/399	7.5	59/399	14.8	nd		nd	nd	Ę	59/399	14.8	nd		nd		nd	10/12*	`83.3	4	6	10/10**	100	nd	Laboratory animals workers at large medical center. *SK done in 10/30 asthmatics; **SPT done in SIC+
Laboratory animals: dander of hamster, rat, cat, mouse, dog, and rabbit			Lincoln, Bolton et al., 1974	3+; cross- sectional	404	[13 (3.2)]	13/404	3.2	22/404	5.5	15/404	4 3.7	nd	15/404	3.7 2	27/404	6.7	nd		nd		nd	nd				98/404	24.3	nd	Members of biology division. All 27 symptomatics in a high exposure group of 238 subjects. 24/27 symptomatics sensitized to at least one animal; sensitized asthmatics not given
Laboratory animals: dander extracts of guinea pig, mouse, rat etc.			Slovak and Hill, 1981	3+; cross- sectional	146	13 (8.9)	15/146	10.3	48/146	32.9	nd		nd	nd	2	48/146	32.9	x*		nd		nd	nd				22/48**	45.8	nd	Employees in a pharmaceutical company. "Sign. decrease in FEV1/FVC in asthmatics; "SPT with animal dander in symptomatics only; 13/15 asthmatics sensitized
Co-exposure to various lab animals (rat, mouse, guinea pig, cat, rabbit and/or hamster)			Sjösted and Willers, 1989	3+; cross- sectional	101	9 (8.9)	11/101	10.9	27/101	26.7	nd		nd	nd	2	27/101	26.7	nd		nd		nd	nd				16/27*	59.25	nd	Laboratory technicians at 25 research laboratories at Lund University.*SPT in symptomatics; 9/11 asthmatics SPT+ with at least one animal allergen

Agents	Strength of	Total no.	Reference	Level of	Occupa-	Allergic											EVIDE	ENCE (path	ological resu	ults)										Remarks
	evidence per agent (three star system	of allergic asthma		evidence per study (revised	tionally exposed subjects	asthma cases due to mentioned				WORK	-RELA	TED SYN	IPTON	IS				LFT	NSI	BHR	sPFT		:	SIC		s	PT	Sp	ec. IgE	
	of RCGP)	cases per agent, n		SIGN grading system); study type.		agent, n, prevalence (%). Cases with probable allergic asthma but specific sensitizatior not confirmed in parantheses [] or not indicated.	Asthn		Rhinit	n	/n	. Ci		n/n			otal	n/n	n/n		n/n				eaction	-				
aboratory animals: rat, mouse, rabbit, namster, guinea pig, cat, dog			Krakowiak, Palczynski et al.,	3+; cross- sectional	68	7 (10.3)	n/n Ast 7/68		n/n Rhin 16/68	% C	onj 9 /68 27		iou %	nd	%	n/n To nd	t %	LFT X	% NSBHF nd	R %	PFT %		nd	, i (n)	l (n) d (n) n/n SPT 21/68**	. % 30.8	n/n lg 12/21	JE %	Zoo workers, co-exposed and co-sensitized to feathers *Individual results not listed; **SPT with fur extract; ***IgE in over
_aboratory animals: guinea pigs, rats,			2002 Krakowiak, Szulc	3+; survey	60	5 (8.3)	8/60	13.3	4/60	6.7 r	nd	nd		nd				+	+							14/26*		+		SPT+ Laboratory animal workers. *SPT in atopics; 5 subjects
nice, rabbits, hamsters			et al., 1997 ABSTRACT																											with OA had SPT+ and IgE+ to at least one animal
BAKERY CONFINEMENT																														
Alkaline hydrolysis wheat gluten derivative (AHGD)	-	1	Lachance, Cartier et al., 1988	3; case report	t 1	1	1/1		1/1	1	/1	nd		nd		1/1		0/1	0/1		nd	1	//1	1		1/1		1/1		Employee in a biscuits producing company. SPT- with individual extracts of cereals; SIC- with wheat
Bakery	**		Brisman, Järvholm et al., 2000	2+; retrospective cohort study	2226	[incident density ratio: 3]	30/2226	1.3*	253/222 6	11.4* r	nd	nd	I	nd		nd		nd	nd		nd	r	nd			nd		nd		Bakers. "Cumulative incidence ratio; incident density rat (number of new cases/1000 person-years) for astima: 30, for thinis 300, sign, association between the dust concentration at onset of disease and the risk for astim or thinitis, but not of the cumulative exposure; same cohort as Brisman, Järvholm 1995
Bakery			Brisman et Järvholm, 1995	2+; retrospective cohort study	2226	[incident density ratio: 3]	*		nd	r	nd	nd	1	nd		nd		nd	nd		nd	r	nd			nd		nd		Persons trained as bakers answered a postal questionnaire. "Incidence rate for asthma among men who worked as bakers 3.0 cases per 1000 person-years same cohort as <i>Brisman, Järvholm</i> 2000
Bakery	-		Cullinan, Cook et al., 2001	2+; prospective	300	Incidence: 1	36/300***	4.1*	87/300	11.8* 87/	300 11	.8*	nd	33/300	3.5*	109/30	10	nd	nd		nd	r	nd			35/300*				Bakery and flour mill workers without previous exposure followed for a median of 40 (1-91) months. *Incidence
Alpha-amlyase Flour	_			cohort study																							2.5* 2.2*			(cases per 100 py); **SPT+ to either flour or &-amlyase ***incidence of sensitized asthmatics was 1 case per 10
																														person years; sign. association between exposure and WRS and SPT+
Bakery	-		Brisman, Lillienberg et al.,	2+; nested clinical case-	45		25/45		20/45	r	nd	nd	1	nd		45/45	;	•	18/25**	*	nd	r	nd			17/45***		nd		Bakers. *Sign. lower mean FEV1 in asthmatics; **BHR asthmatics; ***SPT+ with flour and/or alpha-amlyase; O
Alpha-amylase Flour (any)	-		2003	referent study	'	6 (13.3) 10 (22.2)																				8/45 16/45				for SPT+ to flour or alpha-amylase for new-onset asthr was 5.8-7.0
Bakery	-		Houba, Heederik	2-; cross-	393		29/393	7.4	83/393	21.1 58/	393 14	1.8 nd	1	nd		nd		nd	nd		nd	r	nd			nd				Bakery workers. 15/91 asthmatics and/or with rhinitis
Alpha-amlyase Wheat flour	-		et al., 1998	sectional						-		-		-			-											26/34 36/34	46 7.5 46 10.4	were lgE+; asthmatics with lgE+ not listed
Bakery	_		Cullinan, Lowson	2-; cross-	344		46/322	14.3	92/322	28.6 92/	322 28	8.6 nd		27/322	8.4	58/264	* 22.0	nd	nd		nd	r	nd					nd		Bakery and flour mill workers. Initial cross-sectional
			et al., 1994	sectional																						10/055	5.4			survey of the same cohort of Cullinan, Cook et al., 200 *New WRS in subjects without previous occup. exposu
Alpha-amylase Mixed flour																										18/355 17/355				to flour; WRS were related to exposure intensity; 5
Lepidoglyphus destructor						5 (1.5)																				58/335	17.3			asthmatics were SPT+ with L. destructor
Bakery (wheat flour)	-		Talini, Benvenuti et al., 2002	3+; survey	297	5 (1.7)	*		nd	r	nd	nd	1	nd		nd		57/283 2	0.1 22/62**	*	nd	6/1	5***	1	3 2	37/283	13.1	nd		111 millers from 3 mills, 186 bakers from 2 bakeries. *I subjects who had asthma-like symptoms and/or FEV1 433% were selected for further tests, **C262 asthmati underwent NSBHR;***SIC done in 15 NSBHR+ subject 3/6 SIC+ were SPT+, 2/3 subjects previously diagnose with OA were SPT+
Bakery			Musk, Venables et al., 1989	2-; survey	279	[30 (10.75)]	30/234*	12.8	44/234*	18.8 r	nd	nd	I	nd		59/234	* 25.2	22/239 9	9.2 81/249	9 32.5	nd	r	nd			99/259				Bakers. *WRS in main exposure group
Acarus siro Glycyphagus destructor																										58/259 59/259				-
Glycyphagus domesticus																										46/259	17.8			
Tyrophagus longior Tyrophagus putrescentiae																										62/259	23.9 17.4			-
Tribolium confusum	1																									28/259	10.8			4
Mixed flour	-											_					_			_						14/259 9/259				-
Wheat grain Mould mix	1	1														1										6/259	2.3			
Baker's yeast Aspergillus fumigatus	-						L	-							-			+ $-$								3/259 1/259	1.2			4
Asperginus rumigatus Bakery	1		Smith, Lumley et al., 1997	3+; cross- sectional	383	2 (0.5)	2/383	0.5	10/383	2.6 r	nd	nd		nd	1	78/383	3* 20.4	nd	nd		nd	r	nd			1/208	0.04			Bakers from 19 plant bakeries. *Short-lived WRS, refered to as non-specific respiratory irritation; both
Alpha-amylase]																									63/383				asthmatics were SPT+ to amylase, 1/2 asthmatics SPT
Rice flour Soya flour	-	1						$\left \right $				_		-	-	+	-	+				_	_			14/383 24/383	4		_	to wheat, soya and rice
Wheat flour	1	1																								24/383	6			
Bakery			Droste, Myny et al., 2003	2-; cross- sectional	246				•		•	nd				56/246	6 22.8		nd		nd	r	nd			37/246*	15.0			Bakers. *Individual symptoms not listed; **sign. lower FEV1/FVC ratio; **SPT+ to any bakery allergen; sign.
Alpha-amlyase (fungal)	4	1	1					1 1						-		+		+ +		-		_				18/246 8/246	12.2			increased risk of WRS and SPT+, and sign. association between SPT+ and WRS

Agents	Strength of	Total no.	Reference	Level of	Occupa-	Allergic								EVID	ENCE (pa	atholo	ogical resu	ults)								Remarks
	evidence per agent (three	of allergic		evidence per study	exposed	asthma cases due to			W	VORK-R	ELATED SYMPTON	IS			LF	FT	NSE	BHR	sPFT		SIC			SPT	Spe	c. IgE
	star system of RCGP)	asthma cases		(revised SIGN grading	subjects studied.	mentioned agent, n,																				
	,	per		system);	n	prevalence (%). Cases with probable	Asthn	ia R	hinitis	Con	unct. Cough	Skin	n To	otal	-							Reaction				
		agent, n		study type.		allergic asthma but specific sensitization																				
						not confirmed in parantheses [] or																				
						not indicated.		9/		n/n	N	n/n	N	~	n/n		n/n		n/n							
Wheat							n/n Ast	% n/n Ri	nin %	Conj	% n/n Cou %	Skin	% n/n Tot	%	LFT	%	NSBHR	۶ %	PFT %	n/n SIC	% (n) I (n) d	(n) n/n SF 30/24			%
	-		De Zotti, Larese	2-; cross-	226	11 (4.9)*	11/006	4.9 31/2	26 12 7	7 nd	nd	nd	42/226	18.6	6 nd	_	nd		nd	nd			31/22			Bakers and pastry makers. *SPT+ with wheat and/or
Bakery and pastry			et al., 1994	sectional	220	11 (4.9)	11/220	4.9 31/2.	20 13.7	na na	nd	na	42/220	10.0	o nu		na		na	nd						alpha-amylase; sign. correlation between WRS and
Alpha-amylase from A. oryzae Flours (wheat, rye, barley)	-													_									17/22	6 7.5 6 21.7		sensitization to wheat or alpha-amylase; **SPT+ with Acarus siro, Glycyphagus domesticus, Lepidoglyphus
Wheat flour	-																						27/22	6 11.9		destructor and/or Tyrophagus putrescentiae
Storage mites																							40/220	11.1		
Bakery			Jeffrey, Griffin et al., 1999	2-; cross- sectional	224	[47 (21)]	47/224	21 60/2	24 26.8	60/22	4 26.8 46/224 20	. nd	98/224	43.8	8 nd		nd		0/13*	nd			nd		57/204	27.9 Bakers from 18 small bakeries. PFT done in
Alpha-amylase			al., 1999	study							5														31/204	asthmatics; WRS sign. associated with IgE+ to wheat 15.2 and amylase, sensitized asthmatics not listed;
Barley Rye flour	-													_									_		32/204 33/204	15.7
Wheat flour				-																					49/204	24
Bakery, wheat			Prichard, Ryan et al., 1984	2-; cross- sectional	200	10 (5.0)	20/200	10 nd		nd	nd	nd	nd		x*		77/200	38.5	nd	nd			27/20	0 13.5	nd	176 bakers, 24 bread slicers and wrappers. *Individual results not listed; sign. increased prevalence of WR ches
																										symptoms among bakers as compared to slicers and wrappers; sign. increased bronchial hyperreactivity and
																										sign. increased SPT+ in asthmatic bakers; 10/20
																										asthmatics SPT+
Bakery			Storaas,	2-; cross-	183		27/180	15.0 76/1	80 42.2	2 nd	nd	nd	nd		nd		nd		nd	nd				3* 20.2		Bakery workers. *SPT+ with a least one storage mite
Acarus siro Lepidoglyphus destructor	-		Steinsvag et al., 2005	sectional																			16/18 9/183		15/183 12/183	
Wheat Rye																							7/183	3.8	20/183 18/183	10.9
Barley																							6/183	3.3	14/183	7.7
Oats Alpha-amylase	-													_	_										9/183 4/183	
Bakery			Houba, Heederik	2-; cross-	178	5 (0.0)	9/178	5.1 26/1	78 14.6	6 10/17	3 5.6 nd	19/178	10.7 44/178	24.7	r nd		nd		nd	nd			25/16	9* 14.8		Bakers in 14 bakeries. *SPT+ with at least one
Alpha-amylase Wheat			et al., 1996	sectional		5 (2.8)																	16/16 14/16	9 8		8 occupational allergen; 5 asthmatics SPT+ with alpha- 5 amylase; see also alpha-amylase
Rye Storage mites	-																						8/169			
Wheat flour			Prichard, Ryan et	2-; cross-	176	9 (5.1)	19/176	10.8 nd		nd	nd	nd	19/176	10.8	3 +*		72/176	40.9	nd	nd			26/17	6 14.8		Male bakers. *Results not listed; 9/19 asthmatics were
			al., 1985	sectional																						SPT+
Bakery			Baur, Degens et al., 1998	2-; comparative	89	83 (43)	31/83	37.3 32/8	3 38.6	5 17/83	20.5 nd	9/83	10.8 38/83	45.8	3 13/76	17.1	1 10/76	13.2	nd				25/88	* 28.4	49/89*	55.1 Bakers. *with at least 1 bakery allergen; 41/142 symptomatics not sensitized
Wheat flour	-		u., 1000	survey																			14/88		47/89	52.8
Rye flour Alpha-amylase																							10/88	19.3	30/89 17/89	19.1
Soy bean flour Bakery	-			3+; case	104		58/103	56.3 92/1	03 89.3	3 61/10	3 59.2 nd	12/103	11.7 103/103	3 100	26/94	27.7	7 18/94	19.1	nd	63/89	70.8		1/88		17/89 69/104*	
-				series																						
Wheat flour Rye flour	-																						49/10 38/10	4	64/104 51/103	
Alpha-amylase																							25/10 11/10	4	10/81 22/104	
Soy bean flour Bakery			Brant, Berriman	3+; survey	239	9 (3.8)*	37/239	15.5 63/2	39 26.4	4 63/23	9 26.4 nd	nd	73/239	31	nd		nd	n	ıd	nd			x **	3	27/210	12.8 Supermarket bakery workers. *9/34 asthmatics IgE + to
Alpha-amylase	-		et al., 2005			5 (2.1)										_								_	9/210	either flour or alpha-amylase; ** no data available
Wheat flour						8 (3.3)																			9/210 24/210	11.4
Bakery (wheat, rye, barley and oats)	-		Järvinen, Pirilä et	3+; cross-	234	13 (5.6)	21/234	9.0 54/2	34 23.1	1 nd	nd	11/234	4.7 58/234	24.8	8 nd		nd		nd	nd			11/21	•	9/21*	Bakers. *IC and IgE in asthmatics with at least one flour;
			al., 1979	sectional																						13 asthmatics sensitized
Bakery, wheat flour			Bohadana,	2-; cross-	44	[9 (20.5)]	9/44*	20.5 8/4	4 18.2	2 nd	10/44 22	. 10/44	22.7 26/44	59			11/44	25	nd	nd			5/44	11	nd	Bakers. *Respective symptoms in non-exposed controls
			Massin et al., 1994	sectional							7															25/164 (15.2%); **sign. lower baseline FEV1 and FVC; sign. greater proportion of subjects with WRS and
																										NSBHR+ among exposed; sensitized asthmatics not listed
Bakery, wheat flour	-		Hur, Koh et al.,	3+; survey	392	6		nd	_	nd	nd	nd	67/392*	* 17.1			7/16*	+	nd	6/7*	6		23/38	7 5.9	25/381	6.6 Korean bakery workers. *NSBHR and SIC were only
			2008																							performed in symptomatic workers who aggreed. **6/7 had work-related symptoms, 53 had lower respiratory
																										symptoms. The diagnosis of the 6 asthma cases was
																										based on symptoms, NSBHR and SIC. Cross-reactivity to rye flour likely.
Barley (Hordeum vulgare)	1		Vidal and	3; case report	t 1	1	1/1	1/1		1/1	1/1	nd	1/1		0/1		1/1		nd	1/1	1		1/1		1/1	Grain and flour warehouse worker. Oral Ch with barley
			González- Quintela, 1995																							and with barley-made beer induced a 20% decline in FEV1
Buckwheat (Fagopyrum esculentum or		4	Schumacher.	3: case	2	2	2/2	2/2		2/2	nd	nd	2/2	-	nd		nd	+	nd	nd	+	+	2/2*		2/2	Baker and pharmacist. *1/1 SPT+ and 1/1 Scratch test+
schulentum)	-		Schmidt et al.,	reports		2		212		212			212		10		10			110			22		212	
			1993																							

Agents	Strength of	Total no.	Reference	Level of	Occupa-	Allergic										EVID	ENCE (pa	atholog	gical resul	lts)										Remarks
	evidence per agent (three star system	of allergic asthma		evidence per study (revised	tionally exposed subjects	asthma cases due to mentioned				wo	RK-REI	LATED SYI	иртом	s			LF	т	NSB	HR sF	PFT		SIC			S	РТ	Spe	c. IgE	-
	of RCGP)	cases per		SIGN grading system);		agent, n, prevalence (%).	Asthr	na	Rhini	tis	Conju	nct. C	ough	Skin	То	tal	-						-	Reac	tion					_
		agent, n		study type.		Cases with probable allergic asthma but specific sensitization not confirmed in parantheses [] or																								
						not indicated.	n/n <mark>Ast</mark>	% 1	n/n <mark>Rhin</mark>	%	n/n Conj	% n/n (ou %	n/n <mark>Skin</mark>	% n/n Tot	%	n/n LFT	%	n/n NSBHR	n/n % PFT	%	n/n <mark>SIC</mark>	% i	i (n) I (n	n) d (n)	n/n <mark>SPT</mark>	%	n/n lgE	%	
-		ĺ	Valdivieso, Moneo et al., 1989	3; case report	1	1	1/1		1/1		nd	n	1	1/1	1/1		0/1	ĺ	1/1	nd		1/1			1	1/1		1/1		Creperie worker
			Park and Nahm, 1996	3; case report	1	1	1/1		1/1		nd	n	ł	nd	1/1		nd		nd	nd		1/1		1		1/1		1/1		Buckwheat flour noodle maker. Also IgE+ and SPT+ with wheat flour
			Choudat, Villette et al.,1997 ABSTRACT	3; case report	1	[1]	1/1		nd		nd	n	1	nd	1/1		nd		nd	nd		1/1		1		nd		nd		Pancake maker. SIC- with wheat flour
Rye flour (Secale cereale)	(*)	7	Armentia, García Casado et al., 1997	3; case series	9	5 (55.5)	4/9	44.4	8/9	88.8	8/9	88.8 no	i	nd	9/9	100	nd		5/9	55.5 nd		5/9*	55.5			9/9	100	9/9	100	Carpenters. *Reaction type not listed; 9/9 conj Ch+
и			Letran, Palacin et al., 2008	3; case reports	2	2	2/2		2/2		2/2	n	1	nd	nd		0/2		2/2	1/1		2/2*		2		2/2		2/2		Bakers, SIC+and Spec.IgE+ for rye flour, not to wheat flour.
Soybean processing (Bakery, animal feeding, food processing)																	1	1	1						\square			1		
Soybean	*[*]	31	Zuskin, Skuric et al., 1988	2-; survey	27	[2 (7.4)]	8/27	29.6	9/27	33.3	12/27	44.4 15/	27 55. 6	nd	nd	1	7/27		nd	X*		nd				nd		nd		Soy bean workers. *Sign. cross-shift decrease on monday and friday; 2 subjects had OA defined as WR asthmatic symptoms and PFT+
Soybean			Cummings, Gaughan et al., 2010	2-; cross- sectional	147	6*	18/147	12	12/147	8	nd	11/1	47 8	nd	nd		15/136	11	12/102	12 nd		nd				9/132	7	28/135	21	Workers in a soy processing plant. Participation Rate: 52%. 6 workers had work-related asthma symptoms and had high levels of spec. IgE to soy.
Soybean			Zuskin, Kanceljak et al., 1991	2-; cross- sectional	19	2 (10.5)	6/19	31.6	7/19	36.8	10/19	52 11/	19 57. 9	nd	nd		X*		nd	X*		nd				19/19**	100	3/19	15.8	Soybean workers. *Sign. lower pre-shift FVC, FEV1, and FEF25, also sign. cross-shift reduction of FVC, FEV1, FEF50, and FEF25; **IC; OA defined as WR asthmatic symptoms and LFT+
Soybean (Hull)			Maggio, Monso et al., 2003	3; case report	1	1	1/1		nd		nd	n	i	nd	nd		0/1		1/1	nd		1/1*		1		1/1		nd		Worker in an animal feed factory. *First SIC with soya flour was negative,a second SIC with soybean hull was positive.
Soybean hulls	_		*	3+; case series	31		*		*		nd	n	i	nd	31/31		nd		nd	nd		nd				12/31		7/12**		Study of the prevalence of sensitization in 365 subjects with asthma and /or rhinitis, of whom 31 were occupationally exposed.
Soybean flour Soybean lectin			Baur, Pau et al., 1996	3+; case series	14	12 (85.7)	12/14	85.7	7/14	50	3/14	21.4 2/1	4 14.	1/14	7.1 14/14	100	nd		nd	nd		nd				nd		14/14 3/14	100	14 symptomatic bakers with 14/14 IgE+ to crude soybean flour, 12/13 IgE+ to wheat, 10/13 IgE+ to rye
Soybean lipoxidase Soy trypsin inhibitor																												6/14	42.9 85.7	and 5/13 IgE+ to alpha-amylase (A. oryzae)
Soybean lecithin			Lavaud, Perdu et al., 1994	3; case reports	2	2	2/2		2/2		nd	2/	2	nd	2/2		nd		nd	nd		2/2		2		2/2		2/2*		Bakery employees. *IgE+ with soybean flour; additionally 2/2 SPT+ with soybean dust, flour, pulp; 1/2 SPT+ with wheat, bakery dust; 2/2 IgE+ with soybean flour; 1/2 IgE + with wheat
Soybean trypsin inhibitor			Quirce, Fernández-Nieto et al., 2002	3; case reports	2	2	2/2		nd		nd	n	đ	nd	2/2		nd		2/2	nd		2/2		2		2/2		2/2		Bakers. Also 2/2 SPT+, IgE+, SIC+ with wheat flour and soybean flour
Soybean flour			Quirce, Polo et al., 2000	3; case reports	4	4	4/4		4/4		4/4	n	I	nd	nd				4/4			4/4		3	1	4/4		3/4		Bakers and/or confectioners.
Soybean flour			Roodt and Rees, 1995	3+; survey	22	0*	0/22*		nd		nd	5/2	2 22. 7	nd	nd		nd		nd	nd		nd				8/22	36.4	8/22	36.4	Workers in soy bean mill. *0/22 subjects with WRA, defined as wheeze with chest tightness, 5/22 subjects had WR breathlessness, which was sign. higher in exposed subjects
Soybean flour	1		Bush, Schroeckenstein et al., 1988	3; case report	1	1	1/1		1/1		nd	1/	1	nd	1/1		1/1		1/1	nd		1/1		1		1/1		1/1		Food-processing plant worker
			Bush, Cohen et al., 1977	3; case report	1	1	1/1		1/1		1/1	1/	1	nd	1/1		0/1		1/1	nd		1/1		1		1/1*		0/1		Secretary of a dairy food product company. *IC
Brewery Brewery		-	Godnic-Cvar,	2-: cross-	97	[2 (2.1)]	30/97	30.1	5/97	5.2	37/97	38.1 15/	97 15	nd	nd	-	· ·	-	nd		-	nd	┞──┦	+	11			nd		Brewery workers. *Sign. decreased FVC, FEV1, FEF50,
Barley Brewer's yeast Corn Grain weevil (Sitophilus granarius)	-	-	Zuskin et al., 1999	sectional	51	(= (² . 1))	00101	00.1	0.01	V.2	5.101															14/97 13/97	15.5 14.4 13.4 21.7			and FEF25 as compared to predicted; "sign. across- shift changes; 2 OA, defined as WR asthmatic symptoms and PFT+, but not listed whether sensitized; sign. higher prevalence of WRS and SPT+ with mold, hops, and
Hops (Humulus lupulus)																										21/97 15/97	15.5	1		barley in exposed

Agents	Strength of	Total no.	Reference	Level of	Occupa-	Allergic									EVID			ogical resu												Remarks	
	evidence per agent (three	allergic		evidence per study	exposed	asthma cases due to				wo	ORK-RELATED	SYMPTO	OMS			LF	FT	NSE	BHR	sPFT			SIC			SPT	S	Spec. IgE			
	star system of RCGP)	asthma cases		(revised SIGN grading	subjects studied.	mentioned agent, n,																									
	,	per		system);	n ,	prevalence (%) Cases with probable	Asthr	na	Rhiniti	is	Conjunct.	Cough	SI	kin	Total	-							F	Reaction	-						
		agent, n		study type.		allergic asthma but specific sensitizatio	t																								
						not confirmed in																									
						parantheses [] or not indicated.	n/n Ast	~			n/n Conj % r		n/n	% n/n		n/n		n/n		n/n PFT											
Molds							n/n Ast	% r	n/n Khin	%	Conj % r	n/n Cou	% Skin	1 % n/n	ot %	LFT	%	NSBHR	۶ %	PFT	% n	n/n <mark>SIC</mark>	% I (n) I (n) d (n) n/n SI 16/9		% n/n l 6.5	IgE 9	%		
moldo																									10/0						
														+ $+$			-	-		\vdash				$\left \right $							
												Τ									Τ		T	1 1							
					+			+								+	-		+	+		-		+	+		-	_			
lenge, i: immediate, l: late, d: dua	al response type;	SPT: skin	prick test; IC: int	racutaneous te	st; IgE: mea	surement of sp	ecific IgE a	intibodie	s; maxin	nal exp	piratory flow: N	MEF; for	rced expira	atory flow a	test, obst 25%,509	ructive pa %,75%: F	attern; FEF25	; BHR: br 5, FEF50,I	ronchial FEF75;	l hyperresp ; nd: not do	onsive	eness; PF test don	T: pulmo e, no indi	onary fui ividual r	nction te esults gi	st, seri: ven; O	il (pre-, di A: occupa	uring, a ational a	nd post-shift) PEI asthma; nasal Ch:	7 at work; SIC: specific nasal challenge test; co	c inhalati onjunctiva
llenge, i: immediate, l: late, d: dua	al response type;	SPT: skin	prick test; IC: int	racutaneous te	st; IgE: mea	surement of sp	ecific IgE a	intibodie	s; maxin	nal exp	piratory flow: N	MEF; for	rced expira	atory flow a	test, obst 25%,509	ructive pa %,75%: F	attern; FEF25	; BHR: br 5, FEF50,I	ronchial FEF75;	l hyperresp ; nd: not do	onsive	eness; PF test don	T: pulmo e, no indi	onary fui ividual r	nction te esults gi	st, seri: ven; O	ıl (pre-, dı A: occupa	uring, a ational a	ind post-shift) PEI Isthma; nasal Ch:	⁷ at work; SIC: specific nasal challenge test; co	c inhalatio njunctiva
llenge, i: immediate, l: late, d: dua	al response type;	SPT: skin	prick test; IC: int	racutaneous te	st; IgE: mea	surement of sp	ecific IgE a	intibodie	s; maxin	nal exp	piratory flow: N	MEF; for	rced expira	atory flow a	test, obst 25%,509	ructive pa %,75%: F	attern; FEF25	; BHR: br 5, FEF50,1	ronchial FEF75;	l hyperresp ; nd: not do	onsive	eness; PF test don	T: pulmo	onary fui ividual n	nction te: esults gi	st, seri: ven; O	ıl (pre-, dı A: occupa	uring, a	nd post-shift) PEI asthma; nasal Ch:	² at work; SIC: specific nasal challenge test; co	c inhalatio onjunctiva
llenge, i: immediate, l: late, d: dua	al response type;	SPT: skin	prick test; IC: int	racutaneous te	st; IgE: mea	surement of sp	ecific IgE a	intibodie	s; maxin	nal exp	piratory flow: N	MEF; for	rced expira	atory flow a	test, obst 25%,509	ructive pa %,75%: F	attern; FEF25	; BHR: br 5, FEF50,I	ronchial FEF75;	l hyperresp ; nd: not do	onsive	eness; PF test don	T: pulme, no indi	onary fui ividual n	esults gi	st, seri: ven; O	ıl (pre-, dı A: occupa	luring, an	nd post-shift) PEI ssthma; nasal Ch:	⁷ at work; SIC: specific nasal challenge test; co	c inhalatio
llenge, i: immediate, l: late, d: dua	al response type;	SPT: skin	prick test; IC: int	racutaneous te	st; IgE: mea	surement of sp	ecific IgE a	intibodie	s; maxin	nal exp	piratory flow: N	MEF; for	rced expira	atory flow a	test, obst 25%,509	ructive pa %,75%: F	attern; FEF25	; BHR: br 5, FEF50,1	ronchial FEF75;	l hyperresp ; nd: not do	onsive one; x:	eness; PF test don	T: pulme e, no ind	onary fui ividual n	esults gi	st, seri: ven; O	ıl (pre-, dı A: occupa	luring, a	ond post-shift) PEI sthma; nasal Ch:	² at work; SIC: specific nasal challenge test; co	c inhalatio
llenge, i: immediate, l: late, d: dua	al response type;	SPT: skin	prick test; IC: int	racutaneous te	st; IgE: mea	surement of sp	ecific IgE a	intibodie	s; maxin	nal exp	piratory flow: N	MEF; for	rced expira	atory flow a	25%,509	ructive pa %,75%: F	attern; FEF25	; BHR: br	ronchial FEF75;	l hyperresp ; nd: not do	onsive one; x:	eness; PF test don	T: pulm	ividual n	esults gi	st, seri: ven; O	ıl (pre-, dı A: occupa	uring, a	nd post-shift) PEI isthma; nasal Ch:	⁷ at work; SIC: specific nasal challenge test; co	c inhalatic
llenge, i: immediate, l: late, d: dua	al response type;	SPT: skin	prick test; IC: int	racutaneous te	st; IgE: mea	surement of sp	ecific IgE a	intibodie	s; maxin	nal exp	piratory flow: N	MEF; for	rced expira	atory flow a	25%,509	ructive pa %,75%: F	attern; FEF25	; BHR: br 5, FEF50,I	ronchial FEF75;	l hyperresp ; nd: not do	onsive one; x:	eness; PF test don	T: pulme, no indi	onary fui ividual n	esults gi	st, seria	A: occupa	luring, aa ational a	Identify PEI Identify PEI Identify PEI Identify PEI	² at work; SIC: specific nasal challenge test; co	c inhalatic
llenge, i: immediate, l: late, d: dua	al response type;	SPT: skin	prick test; IC: int	racutaneous te	st; IgE: mea	surement of sp	ecific IgE a	intibodie	s; maxin	nal exp	piratory flow: N	MEF; for	rced expira	atory flow a	25%,509	k,75%: F	attern; FEF25	; BHR: br 5, FEF50,I	ronchial FEF75;	hyperresp ; nd: not dc	onsive one; x:	eness; PF test don	T: pulme, no indi	onary fur ividual n	action teresults gi	st, seri: ven; O	A: occupa	luring, au ational a	u d post-shift) PEI Isthma; nasal Ch:	⁷ at work; SIC: specific nasal challenge test; co	c inhalatic
llenge, i: immediate, l: late, d: dua	al response type;	SPT: skin	prick test; IC: int	racutaneous te	st; IgE: mea	surement of sp	ecific IgE a	intibodie	s; maxin	nal exp	piratory flow: N	MEF; for	rced expira	atory flow a	25%,509	ructive pa %,75%: F	attern; FEF25	; BHR: br 5, FEF50,1	ronchial FEF75;	hyperresp ; nd: not dc	onsive one; x:	eness; PF test don	T: pulme e, no indi		action teresults gi	st, seri: ven; O	A: occupa	luring, aa	I d post-shift) PEI Isthma; nasal Ch:	² at work; SIC: specific nasal challenge test; cc	c inhalatic
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llenge, i: immediate, l: late, d: dua	al response type;	SPT: skin	prick test; IC: int	racutaneous te	st; IgE: mea	surement of sp	ecific IgE a	intibodie	s; maxin	nal exp	piratory flow: N	MEF; for	rced expira	atory flow a	Lest, obst.	ructive pa %,75%: F		; BHR: br 5, FEF50,I	FEF75;	hyperresp ; nd: not dc	ionsive pne; x:	test don				st, serir; O	A: occupa		and post-shift) PEI Isthma; nasal Ch:	⁷ at work; SIC: specific nasal challenge test; co	c inhalatitiva
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lenge, i: immediate, l: late, d: dua	al response type;	SPT: skin	prick test; IC: int	racutaneous te	st; IgE: mea	surement of sp	ecific IgE a	intibodie	s; maxin	nal exp	piratory flow: N	MEF; for	rced expira	atory flow a				; BHR: br (Fig. 2); BHR: br (F	PEF75;			Lest don							nd post-shift) PEI Issthma; nasal Ch:	² at work; SIC: specific nasal challenge test; cc	e inhalative
llenge, i: immediate, l: late, d: dua	al response type;	SPT: skin	prick test; IC: int	racutaneous te	st; IgE: mea	surement of sp	ecific IgE a	intibodie	s; maxin	nal exp	piratory flow: N	MEF; for	rced expira	atory flow a				: BHR: br	ronchial FEF75;			Lest don							nd post-shift) PEI Issthma; nasal Ch:	² at work; SIC: specific nasal challenge test; cc	e inhalatik njunctive
llenge, i: immediate, l: late, d: dua	al response type;	SPT: skin	prick test; IC: int	racutaneous te	st; IgE: mea	surement of sp	ecific IgE a	intibodie	s; maxin	nal exp	piratory flow: N	MEF; for	rced expira	atory flow a				: BHR: br	ronchial FEF75;			Lest don							nd post-shift) PEI Issthma; nasal Ch:	⁷ at work; SIC: specific nasal challenge test; co	c inhalatii njunctiva
llenge, i: immediate, l: late, d: dua	al response type;	SPT: skin	prick test; IC: int	racutaneous te	st; IgE: mea	surement of sp	ecific IgE a	intibodie	s; maxin	nal exp	piratory flow: N	MEF; for	rced expira	atory flow a				: BHR: br () () () () () () () () () () () () ()	ronchial HEFF75;			test don							ad post-shift) PEI sthma; nasal Ch:	⁷ at work; SIC: specific nasal challenge test; co	s inhalatii njunctiva
llenge, i: immediate, l: late, d: dua	al response type;	SPT: skin	prick test; IC: int	racutaneous te	st; IgE: mea	surement of sp	ecific IgE a	intibodie	s; maxin	nal exp	piratory flow: N	MEF; for	rced expira	atory flow a					ronchial Hereitan			Lest don							ad post-shift) PEI isthma; nasal Ch:	⁷ at work; SIC: specific nasal challenge test; co	e inhalatic
llenge, i: immediate, l: late, d: dua	al response type;	SPT: skin	prick test; IC: int	racutaneous te	st; IgE: mea	surement of sp	ecific IgE a	intibodie	s; maxin	nal exp	piratory flow: N	MEF; for	rced expira	atory flow a					ronchial TFEF75;			Lest don							a d post-shift) PEI Issthma; nasal Ch:	² at work; SIC: specific nasal challenge test; co	c inhalatic
number of subjects; n/n: number of illenge, i: immediate, I: late, d: du illenge test: conj. Ch; oral Ch: oral 	al response type;	SPT: skin	prick test; IC: int	racutaneous te	st; IgE: mea	surement of sp	ecific IgE a	intibodie	s; maxin	nal exp	piratory flow: N	MEF; for	rced expira	atory flow a					ronchial TFEF75;			Lest don				st, seriri, O			Intervention of the second secon	⁷ at work; SIC: specific nasal challenge test; co 	c inhalatic
llenge, i: immediate, l: late, d: dua	al response type;	SPT: skin	prick test; IC: int	racutaneous te	st; IgE: mea	surement of sp	ecific IgE a	intibodie	s; maxin	nal exp	piratory flow: N	MEF; for	rced expira	atory flow a					ronchial TFEF75;			Lest don				series of the se			nd post-shift) PEI sisthma; nasal Ch:	⁷ at work; SIC: specific nasal challenge test; cc	c inhalatii njunctiva

Agents	Strength of	Total no.	Reference	Level of	Occupa-	Allergic									EVID	ENCE (pa	atholo	gical result	ts)										Remarks
	agent (three	allergic		study	exposed	asthma cases due to			w	ORK-RE	LATED S	YMPTON	IS				FT	NSBH		sPFT		SI	C		S	PT	Spe	c. IgE	
	star system of RCGP)	asthma cases		(revised SIGN gradin	subjects studied,			DL		0		0	01-1	n T									Read						-
		per agent, n		system); study	n	prevalence (%). Cases with probable allergic asthma but specific sensitization not confirmed in parantheses [] or not indicated.	Astoma	KN	Initis	Conju	nct.	Cougn	SKI	n 1	otai								Read	tion					
		ugoni, ii		type.		allergic asthma but specific sensitization																							
						not confirmed in parantheses [] or																							
						not indicated.	n/n Ast	% n/n Rhi	in %	n/n Conj	% n/n	Cou %	n/n Skin	% n/n To	t %	n/n LFT	%	n/n NSBHR	%	n/n PFT %	6 n/n	SIC %	i (n) I (n	n) d (n)	n/n <mark>SPT</mark>	%	n/n lgE	%	
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Agents	Strength of	Total no.	Reference		Occupa-												EVIDE	NCE (path	nologic	cal results)										Remarks	
	evidence per agent (three star system	of allergic asthma		evidence pe study (revised	exposed	asthma cases due to mentioned				WOR	(-RELA	TED SY	мртом	S				LFT		NSBHR	sPF	т		SIC		:	SPT	s	Spec. Ig	JΕ	
	of RCGP)	cases per agent, n		SIGN gradin system); study type.	ng studied, n	agent, n, prevalence (%). Cases with probable allergic asthma but specific sensitization not confirmed in	Asthn	na	Rhinit	s	Conjunct	t. (Cough	Sk	dn	Tot	al								Reaction						
						parantheses [] or not indicated.	n/n Ast	%	n/n Rhin		n/n onj s	% n/n	Cou %	n/n Skin		n/n Tot	%	n/n LFT	%	n/n NSBHR %	n/n PFT	%	n/n <mark>SIC</mark>	% i(n) I (n) d	(n) n/n <mark>SP</mark>	T %	n/n	lgE	%	