

(From the Amsterdam Clinic for Allergic Diseases, Chief: P. J. v. d. Werff)

OCCUPATIONAL DISEASES AMONG WORKERS IN THE BULB INDUSTRIES

(Preliminary Report)

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INTRODUCTION

Flowerbulb growing is generally known to be a Dutch industry par excellence (arable land for tulips: some 8,500,000 acres). The methods of growing and cultivating the Liliaceae and the Amaryllidaceae, the cultivation of ever new varieties and subvarieties and sports, both in colour and in shape, the further refinement of these varieties, the use of various methods of preparation for forcing of the bulbs, the study of diseases of bulbous plants, preventive measures and methods of controlling a variety of pathogenic agents, have always been given considerable attention. Due to the eminent work of "Het Laboratorium voor Bloembollenonderzoek" at Lisse, Holland, (the Lisse Laboratory for Bulb Research of the Wageningen Agricultural University) formerly directed by Prof. Dr. E. van Slogteren, and at present by Prof. Dr. Ir. J. P. H. van der Want, a fortunate and highly effective combination was formed of scientific principles with the great practical experience of the Associated Bulb Growers of Holland.

In view of this it is all the more remarkable that—until recently—affections which occur in the workers in these in-

dustries have been given so little attention. It should be borne in mind that we—specialized allergologists—saw only a relatively small number of patients suffering from these occupational affections. In former years our enquiries among general practitioners in the South-Holland district revealed that they, too, observed few changes in this category.

Controlling industrial physicians likewise reported but few cases of unfitness for work due to these occupational diseases, and the workers in the tulip districts of South-Holland will tell you that violent symptoms are an exception among them. A marked contrast is found in the tulip district of North-Holland and in the hyacinth nurseries in South-Holland, although in these districts, too, absenteeism caused by affections of an allergic or highly similar nature is not as a rule high.

I shall subsequently return to this point.

Only a few people—and these usually from the so-called one-man or two-man nurseries—seek medical advice because work threatens to become impossible, with all the social and personal consequences of this.

A large number of affected workers in these districts can attain a rapid cure by elimination, that is by avoiding the noxious agents, because other possibilities of work in agriculture and market-gardening are abundant. The less severely affected moreover, know from experience that—due to the temporary nature of the work—the affection as a rule is arrested after some time, and disappears.

Tables I and II demonstrate what is meant by “temporary, i.e. seasonal nature of the work”. This working arrangement holds true especially for the smaller nurseries in the North-Holland district. The arrangement at the large hyacinth and tulip nurseries handling export, chiefly in the South-Holland district (Lisse and Hillegom), is illustrated in Tables III and VI. The last reason which often prevents the seeking of medical advice, finally, lies in the fact that both patients and a great many general practitioners seem to be convinced that treatment will be of no avail in any case. This belief is based partly on the fact that relatively few monographs on the sub-

ject have appeared in the literature, while textbooks often merely make casual mention of these affections, if any at all. (*Welker et al., Caulfield, Feinberg, Cooke, Vaughan, Schwartz et al., Frankland*).

I. CLINICAL COURSE AND SYMPTOMS

A discussion of the modes of manifestation of symptoms forces me to distinguish between two groups, namely:

- a. On the one hand, the group of the tulip-growers.
- b. On the other hand, the group of the hyacinth bulb industry.

As regards the nurseries of narcissus (with the subvarieties jonquil and daffodil), these probably belong to the second category.

This is best illustrated on the basis of two examples, as follows:

ad a) D.B. is a "small" farmer-tulipgrower aged 52, resident of a North-Holland district. The patient's own history and the familial history are both characteristic. Patient has worked with the bulbs since age 15. Five years after his initiation he developed his first eczema of the hands during the period of about eight weeks, in the course of which bulbs are pulled, sorted and counted. The affection was localized to the characteristic sites of contact: underneath the nails and on the dorsal side of the fingers and hands.

Soon after this the entire face was affected, the eyelids showing the most marked changes; even when tight-fitting dust-goggles were worn there was irritation of the eyelids during work, although contact between fingers and eyelids was painstakingly avoided! As work was continued, the affection gradually spread to cover the entire body. All symptoms disappeared and remained absent throughout a period of twenty years—from age 25 to age 45—during which the patient had no contact with flowerbulbs. As soon as he returned to bulb growing the skin changes on fingers, eyelids and cheeks recurred, associated with sneezing and dry coughing, stuffy and wheezing respiration, and occasionally severe asthma in the winter and in August, often preceded by eosinophilic rhinitis and, as patient himself had noticed, connected chiefly with the dust in the bulb-sheds and with damp weather. There was a positive allergic familial history: several relatives with infantile eczema, hayfever and bronchial asthma in the paternal line: e.g. patient's father, working in the similar branch, had similar symptoms; the paternal grandmother had shown vesicular eczema of the hands, arms and face during the season of blackberry picking, and also Quincke's angioneurotic oedema of the eyelids and, to a lesser extent, of the glottis region.

The changes in working conditions are demonstrated, without a great many words, in this year survey:

TABLE I

January	February	March	April	May	June
					
Working in sheds Cleaning of sheds	Working in sheds	Tillage	Potato planting Sowing in drills	Cutting the flowers off the bulbs	Hoeing
					
Storage of carrots and beetroots	Tillage Digging Milling		Cutting the flowers off the bulbs	Weeding	Potato- digging
					
			Weeding	Weeding face and finger-tips	

TABLE II

July	August	September	October	November	December
					
Bulb-digging	Sorting and counting of the bulbs	Potato- digging	Beetroot- pulling	Bulb-planting	Ploughing
Eczema hands Moist bulbs. no dust.					
					
				Hands, mild facial symptoms	

TABLE III

January February March  bulbs thatched April  four inch growth	May to June 10th.  stripping of flowers	Latter half of June  full growth July  bulb pulling  bulbs in racks	August  Bulb drying sorting and preparation for export. Temperature 60°-85° E Bulb sorting check - ing and preparation of seedlings firing 85° up to 104° in September	October November  bulb planting following 4% formalin - bath	December  cleaning of sheds
Inconvenience in all workers and also affecting ALL visitors within 30 minutes					

After this instance of so-called "*tulip-fire*", associated with characteristic symptoms of allergy of the respiratory tract, a contrasting picture is found in the second example, which is a case of so-called "*hyacinth scabies*".

ad b) Patient G.S. aged 41, is a foreman in a hyacinth nursery, who started this work in the South-Holland district after finishing elementary school and has since remained in this branch. There are no known cases of allergy in the family. He was considered eminently suited to this work because he has a hard, dry, leather-like skin. Like everyone else in this industrial branch, he chiefly developed skin symptoms—and also tightness of the chest associated with a febrile-chill sensation and general dysphoria—especially during the so-called "firing" of the hyacinth bulbs and during the period of sorting, peeling and cutting of the bulbs (Table III).

The bulbs are dipped into a formaldehyde solution before planting, against contamination due to moulds, after having been previously treated with organic mercury compounds while still in the sheds.

Additional irritation of the air passages and the mucosa of the eye occurs at bulb-planting time.

The symptoms shown by this patient (as by all the other workers) include a particularly disagreeable itch with redness and swelling of the skin, associated in some cases with a papulous vesiculous and particularly follicular and peri-

poritis pattern, not only affecting the uncovered parts of the skin but also developing elsewhere on the body.

There are, however, certain sites of predilection, such as the volar side of the forearms, the eyelids, the perinasal region, retro-auricular skin parts, lower jaw and cervical margins; in addition, all spots subject to pressure or friction, such as the dress-line, inguinal region, the inside of the thighs, genitals and perianal region.

There are also conjunctival symptoms with very marked lachrymation, rhinitis with a marked aqueous secretion, hyperhidrosis during work. Later in the day, particularly when the patient comes outside in cold air, after work and during the night, the itch and swelling of the skin increase, and tightness of the chest, febrile sensations and general dysphoria show aggravation.

Apart from this syndromal difference between the affected workers in the two branches there is also an *individual* difference in manifestations between workers in a given nursery, which brings me to my second point:

II. AETIOLOGY AND PATHOGENESIS

As always, the factors involved can be divided into:

- a. endogenous and
- b. exogenous factors.

ad a) Brief mention can be made of the following well-known general endogenous factors: hereditary disposition, a possibly pre-existent latent or manifest allergy, the individual degree of susceptibility at the time and, in this case, particularly the anatomical and physiological condition of the skin, eyelids and conjunctivae, sinus and respiratory tract.

ad b¹) Exogenous promoting and sometimes even provoking factors include the general conditions such as changes in temperature, sunlight, heat and cold, humidity of the material and the surrounding atmosphere, ventilation of workshops, pollution of the material by bacteria, moulds and decaying organic substances, the intensity of work, duration and rate of speed of activities, intensity and duration of exposure to the noxious agents in the widest sense.

Still other promoting factors can be enumerated, such as insufficient hygiene or (much more important) excessive cleanliness involving abundant use of water and soap, which reduces the alkali-neutralizing power of the skin, a property probably even more important than sebaceous products and sweat (*van Heusden*); while cleansing agents such as alkaline, irritant or caustic soaps, grease solvents, turpentine or turpentine substitutes, and sharp white sand lead to a further reduction of the natural defence powers of the skin, or cause additional irritation and allergic symptoms respectively (cf. *Jordan et al.*, *Schwartz et al.*).

ad b²) Exogenous factors characteristic of the bulb districts are:

1. Primary aspecific irritants: mechanical and very probably also chemical irritation and poisonousness caused by the needle crystals ("Raphiden-Kristalle" cf. *Frey*) of calcium oxalate monohydrate, which can reach any site of the skin right through the clothes and which penetrate the skin. Their irritant effect has long been known (*Jurine, Rudolphi*); the workers themselves speak of "hyacinth scabies itch".

One of the subjects currently under investigation is the extent to which the concentration of oxalic acid and calcium oxalates (from 0.0119 mg to 0.0392 mg per gramme) or the quantity of raphide-producing cells may be responsible for the noxious effect—variable with various types of flower—of hyacinthi and narcissi, and probably even of tulips although the latter have not been demonstrated to possess raphide-producing cells.

In hyacinthi, the cells of the youngest part of the root apices are still free of crystals. Two to three enlarging protoplasmic vacuoles press the cellular nucleus against the wall, while the raphides begin to form in the interstitial strands of plasma.

Each raphide has its own layer of plasma. The crystal sheaths unite at the end of the raphide bundle and, therefore, stay together. Upon incision of the bulb, the characteristic viscous mucus escapes from the opened cytoplasmic vacuoles. In this, the raphide bundle remains relatively firmly embedded (cf. *Netolitzky, Robijns*).

In narcissi, numerous raphide bundles occur, but only in the so-called slime

vessels. These extend through the plants over considerable lengths, and they are filled with slime, raphides and alkaloids. The slime vessels are formed during the plant's growth from ordinary parenchymal cells, initially filled with a single raphide bundle. Subsequently these cells no longer divide but are greatly elongated, while the septa dissolve so that the vessels are formed.

When the narcissus flowers are twisted off, very marked slime secretion occurs; an open slime vessel is squeezed empty over its entire length by the turgor of the surrounding intact cells (*Beijer*).

The mechanical irritation involved in the handling of bulbs is obvious at a mere inspection of the bulbs: the tulip and the narcissus with their dry, fragile, hard, bark-like, woody skin; the hyacinth bulb, surrounded as it is by thin, squamous, membranous layers which are detached and form minute particles when exposed to dry heat.

2. Specifically allergenic substances known as sensitizers. It should be pointed out, in this respect, that organic, e.g. phenyl, mercury compounds, ferric chloride and ferric hydroxide are used in very many nurseries, although not in all, for disinfection of bulbs and to prevent contamination by moulds, bacteria and insects in the sheds.

Tulips are often sprayed with A.-Avertis or Vermate against leaf blister.

Hyacinth bulbs are immersed in a 4 % formaldehyde solution, and furthermore in organic mercury compounds.

Narcissus bulbs for cultivation are immersed in organic mercury compounds at 43.5°C ., against eelworm sickness, which is found only in Narcissus and varieties.

Chlorinated hydrocarbon insecticides such as DDT are no longer used, with the possible exception of some small nurseries.

Parathion and nicotine are virtually out of use, with the exception of occasional application in the growing of gladioli.

Naphthalene is used in gladioli.

—Otherwise, we actually know very little about the allergen fractions of the juices (*Benjamins*, 1932, *Pasteur Vallery-Radot*), their chemical composition, acetone-, ether- and alcohol-soluble poly-hydrobenzenes and such bound to lipoids

(*Milford*), or a relatively simple micromolecular compound activated by chemical or absorptive binding to the colloidal protein (albumin)molecule (*Benjamins*, 1936, *Prausnitz*).

Other possibilities include lipoids and ethereal oils and also alkaloids and proteins (*Walker, Wise et al.*); furthermore plant resins (*Cooke, Feinberg, Vaughan, Schwartz*) and histamine related substances with a similar effect (*Benjamins*, 1931). Fungi are chiefly found in hyacinths and also in narcissi of Verger group, hence the formaldehyde bath.

Chemical irritant and erosive effect of this substance on the skin, palpebrae, ocular mucosa and the mucosa of the air passages is well known, but the same holds true also for its sensitizing power.

3. Not only can primary irritant and allergenic characteristics be combined in a single substance but also—both in vivo and in vitro—constituents with separate chemico-irritant or chemico-toxic, or allergenic properties are sometimes inseparable.

This is particularly true with regard to oxalic acid compounds involved in preparing allergen extract, due to which the allergen skin test is altered again: the immediate whealing type of reaction and delayed reactions (distinct in their turn as contact-type and tuberculin-type reactions), sometimes seen in combination (*Bruun, Schwartz et al.*).

This holds true not only for the actual plant juices and pollen grains but also for the minute air-borne villi originating from flowerbulbs and airborne seeds. Furthermore it holds true also for the dry, sharp, small bulb scales which, invading the periungual region during work, cause chemical as well as mechanical irritation, exert a chemico-toxic affect and can doubtless be allergogenous.

Calcium oxalate needles, moreover, quite apart from their own irritant effect, may act as a vehicle of the firmly adherent raphide-cytoplasm and viscous mucus.

All the abovementioned factors, the combination of general and characteristic, aspecifically irritant and specifically allergic factors, are certainly involved in the case of tulip-growers,

while it is chiefly the aspecifically irritant substances with a chemical toxic effect that are of paramount importance in the hyacinth and narcissus industries.

In some cases a single factor may be of exceptionally predominant importance, as illustrated by the case of a man aged 26 who upon his return from military service in the tropics, developed a Quincke's oedema-like swelling of the entire facial skin, with superficial eczematous efflorescences and, though less marked, angio-neurotic oedema of the dorsal skin of the hands within 24 hours.

Possibilities taken into account included a possible influence exerted by domestic allergens, the transition from barracks to the home environment, the influence of the "psychosomatic re-union with his wife" together with a nutritional allergy arising from the home-coming meal.

Firstly, these factors were found to be of no provoking significance whatever. Secondly, the skin changes were found to be attributable to mercury allergy arising from contact with subject's son, who had been treated for impetigo contagiosa by the house doctor, who prescribed a white mercury precipitate ointment. Thirdly, it was found that before joining the army the man had been forced to leave various posts in large bulb industries due to marked eczema developing within 1-2 days of his starting work.

Finally it was elicited that subject had worked until his enlistment in a small, so-called oneman nursery where, in contrast with customs at the large farms, the bulbs were *not* treated with preparations containing organic mercury compounds, such as Germisan, Aretan, Pernosan, Ceresan or whatever may be the beautiful names attached to these products.

III. FREQUENCY AND TYPE OF REACTIONS IN THE DIFFERENT BRANCHES OF INDUSTRY

a) With regard to *hyacinth nurseries* it is a remarkable fact that special varieties and subvarieties cause the most frequent inconvenience (among the blue-scaled: Marconi; among the white-scaled: Carnegie, City of Haarlem and finally, the most malignant of them all as is so often the case in this world, the satin-white unblemished beauty: the Innocence).

The term "dermatitis venenata" might still be applicable to these cases, as 100 % of the workers, and also visitors, are affected to a more or less marked degree so that calcium oxalates appear to have an obligatory mechanicochemical irritant and probably also chemico-toxic effect (Table III). As

a rule, work can be continued despite the disagreeable sensations of the hyacinth scabies itch.

It is a striking fact that papules and vesicles develop in an average of 1 out of every 60 workers, as a result of this work. There is certainly a possibility, therefore, of a genuine allergic or toxic-allergic component, e.g. in the ethereal constituents bromstyrol and styrol-alcohol, or of a hyperergic reaction on the part of the patient, due to a possibly transient increase in susceptibility at that time.

Deep fissures sometimes develop, and secondly infection may give rise to large sores in some cases, paving the way, via mycosis and pyoderma, to mycids or bacterids elsewhere on the skin of the body or on the conjunctivae. In very sporadic cases hyacinth-growers have periodically developed genuinely allergic bronchial asthma involving no other demonstrable factors than occupational condition.

b) In the narcissi departments changes on the fingers, hands and the eyelids, genitals and perianal region occur in 20 (sometimes to nearly 100!) out of every 100 workers, depending on the varieties especially cultivated there (viz. the Poetas-group).

Particularly during the period of pinching-off the flowers and of the bulb-packing, the so-called "narcissus rot or lily rash" occurs with the aspect of localized exfoliative dermatitis, but as a rule not to a degree so serious as to necessitate discontinuation of work.

Throughout the years I have seen only one boy who developed vesiculous eczema of the fingers within three days rapidly spreading over the entire body afterwards.

c) The skin changes in tulip growers, "the tulip fire", chiefly consist of desquamation of the skin beneath and around the nails, sometimes with fissures and painfulness; skin lesions on the palpebrae and the cheeks present the features of erythematous-squamous dermatosis, with swollen, red, usually parchment-dry, thickened and rigid palpebrae.

These skin changes are largely dependent on the district and the varieties as a rule cultivated there. The changes should

be regarded as chiefly an allergic contact eczema subsequently, after epidermal sensitization, in all probability with the development of cutaneous allergy and an atopic effect following resorption through the skin, as clearly illustrated in the case history of D.B., when he protected his eyelids with dust-goggles.

The intensity of the affection indicates certain individual differences. In this connection it is remarkable that another of my patients—a tulipgrower from North-Holland—told me: "it is human families that are affected by certain tulip varieties and so-called sports" (cf. Tables IV and V).

TABLE IV

Allergen pattern of D.B., born May 4th, 1907.

Diagnosis: eczema of the hands and eyelids, rhinitis, bronchial asthma.

Group	Varieties	Subjective complaints	Immediate reaction	Delayed reaction 20 hours
Triumph tulips: medium flowering	1. Dreaming Maid	?	+	+++
	2. Preludium	yes	++	+++
	3. Prominence	yes	++	+++
Double Late tulips: medium flowering	4. Clara Carder	no	o	+
	5. Valona	?	o	+++
Parrot tulips: medium flowering	6. Admiral Karel Doorman	?	o	o
	7. Black Parrot	yes	+++	+
	8. Red Champion	no	o	o
Darwin tulips: late-flowering	9. Bartigon	?	+	+++
	10. Copland's Purple	yes	+±	+++
	11. Rose Copland	yes	+±	+++++
	12. Royal Delight	?	+	+++

Intracutaneous tests. Evaluation:

diameter < 5 mm: ± to o
up to 7.5 mm: +
up to 10 mm: +±
up to 12.5 mm: ++
up to 15 mm: +++
> 15 mm: ++++

Preparation of all these
extracts with isotonic saline.

TABLE IV (cont.)

Further Allergens:

	house dust	+±	} type of reaction: immediate whealing, no delayed reaction
	chocolate	+	
	chicken	+	
	pork	+	
	onions	+	
	fine dust of his own bulb-sheds...	+++	
Characteristic fungus association found in the bulb industries (<i>author</i> , 1958)	Penicillium species, a.o. <i>P. corym-</i> <i>biferum</i> Westl.	o	
	Mucorales	o	
	Fusarium spec. (selective soil in- vader in bulbfields)	+±	
	Botrytis cinerea Pers.	+±	
	Botrytis: parasitic species of this form genus	+±	
	Trichoderma vir. Pers. ex. Fr. ...	o	
	All other allergens:	o	
	Histamine 1/1.000.000	+	

No contact with:

Reaction:

immediate

delayed

hyacinthi	o	++++
gladioli	+	++
narcissi	o	+±
Fosteriana, very early flowering botanical tulip:	o	++
Mad. Lafeber (syn.: Red Emperor)		

In this respect, differences are discernible even during the processing. The Rose Copland, very commonly cultivated in the North-Holland district and transported to the large packing-departments in South-Holland, is the most notorious: it causes trouble during the handling of bulbs (sorting and skinning) in 40 % of all workers. During the flower-chopping, however, it is Preludium which causes more marked reactions than any other variety.

TABLE V

Allergen pattern of Mrs. N.A. K.-L., born September 15th, 1913.

Diagnosis: eczema of the hands, face, especially eyelids, and neck.

Exacerbation immediately with contact of her husband's overalls, and, during the "black" periods, soon after his home-coming. Had to discontinue working in the nursery and sheds, due to "tulip fingers", 2 years ago.

Groups	Varieties	Subjective complaints	Immediate reaction	Delayed reaction 20 hours
Single Early tulip	1. Brilliant Star ...	yes	+±	+++
Double Early tulips	2. Electra	?	±	++
	3. Peach Blossom .	no	o	++
Mendel tulip	4. Her Grace	yes	o	+++++*
Triumph tulips	5. Elmus	?	+±	+++++
	6. Alberio	?	o	++
Parrot tulip	7. Red Champion .	no	o	++
Darwin tulips	8. Clara Butt	yes	+	++++++*
	9. Copland's Purple	yes	o	+++
	10. Rose Copland ...	yes	+	+++++
	11. William Pitt	?	+	+++++
				and general systemic reaction lasting 2 days

* with bulla.

Intracutaneous tests.

Evaluation see Table IV

Isotonic saline extracts.

Narcissi	±	+±
Gladioli	+±	++++++
Chrysanthemum	+	±
Grasspollens	++	o
House Dust	+++	o
Shed Dust	+++++	+
Feathers	+++++	+++++
Moulds	+±	o
Tomato	+±	o
Spinach	+	o
Carrot	+	o
Radish	+	o
Banana	+±	o
All other Allergens	o or ±	o
Histamine 1/1,000,000	++	o

TABLE VI

Latter half of December  cleaning of sheds January February March  bulbs thatched	April  weeding  chopping	May-June  chopping  Weeding  excision of blistered leaves ("fire cutting")	July  bulb pulling July-August-September  drying of bulbs at 60°F, sorting, skinning, counting and packing for export	October  preparing of seedlings, firing up to 72°F  cleaning of sheds	November and first half of December  bulb planting
Symptoms of: Eczema 4% - 20% (40%) Respiratory tract: Bronchial Asthma and eosinophilic rhinitis 4% - 2% Bronchitis with expectoration 20% Sneezing and dry cough 100% (during drying of bulbs at 60°F and during firing up to 72°F)					

The aetiological factors are not yet known with complete certainty. This question is among the many problems still in the stage of continued investigation. It is beyond doubt—meanwhile—that besides a primary irritant effect an allergic cause is the chief factor in these cases as shown not only by experiments including controls but also by therapeutic results.

After three months' hyposensitization the abovementioned D.B. was capable of work in the course of the worst period without developing tulip fingers or tulip fire of the face.

(During work in the sheds in damp weather, on the other hand, he immediately reacted by coryza in a degree in no way diminished.)

Shed-work causes symptoms, too, especially manifestations of vasomotor rhinitis, furthermore allergic conjunctivitis or eosinophilic bronchitis and/or attacks of bronchial asthma (Table VI).

IV. THERAPY AND PREVENTION

Therapy and prevention in these cases do not essentially differ from those in other cases of occupational allergy. Only

protecting ointments and such have been seen to develop an adverse rather than a favourable effect in some cases.

If allergy is involved, then an attempt at specific desensitization certainly deserves consideration; histamine injections, too, may be suitable therapy. Although our annual number of cases is relatively small, yet we have the impression, based on findings obtained over a longer period of time, that the percentage of failures of desensitization is neither smaller nor larger than the failure percentage in desensitization therapy against pollens in cases of hayfever, against house dust and moulds in cases of vasomotor rhinitis, or eosinophilic bronchitis, seasonal asthma, etc.

COMMENT

Above, I have attempted to present a general survey. Throughout this entire field, there are still a great many questions which require an answer; not only allergological questions but also dermatological problems, and problems of occupational medicine.

With regard to the first category, the above must have shown how very little is known as yet, in this still almost virginal field, about the true nature of the allergogenous and aspecifically primary irritant factors, their chemical composition, their chemico-irritant, systemic poisonous, toxic-allergic or purely allergic affect. The problems encountered in obtaining reliable test material, as regards the water-soluble as well as the alcohol-, ether- or acetone-soluble fractions, have been outlined.

Regarding the second category:

The possible mechanism of action of these factors is chiefly an allergological-dermatological question.

This primarily concerns the process of habituation: the mechanism of "hardening up": i.e. the cellular and humoral adaptation of the shock organ with regard to the empirical fact that such a large percentage of workers in this industry show symptoms during an initial period after which, when

work in continued with some prudence (contact not too prolonged and work not too intensive) a tolerance is attained, to some degree, without further special measures.

Secondly the continued existence, for several weeks in some cases, of an almost intractable contact eczema after discontinuation of contact, as also seen in two flower vendors due to chrysanthemum and in a housewife due to pollen of a certain tulip variety.

It is possible that aspecifically irritant substances of the contact material have invaded the skin pores and the sebaceous and sudoriferous glands and hair follicles in these cases; or allergogenous particles may have invaded, thus giving rise to skin efflorescences for some considerable time after discontinuation of contact.

Such particles could even be excreted again with the skin products, thus giving rise to further spread from the centre. This, however, is merely a supposition without any certainty. It is equally well justifiable to take the view that, in more or less longstanding cases, these substances are taken up into the organism, to maintain by atopy the changes at the freshly affected and therefore less resistant sites.

With regard to the third category, the social factor: its connection with the aetiology and pathogenesis, and the financial consequences from the point of view of the workers is a close connection indeed, because Dutch legislation states that a chemico-toxic dermatitis is to be considered: "an Accident", whereas an allergic dermatosis comes under the rules of the "Sickness Insurance Act".

SUMMARY

A general survey was presented of the various ways in which occupational affections become manifest in workers in the bulb industries, the many possible exogenous and endogenous factors, the incidence of the affections and the types of reaction in the various branches of these industries. Various questions which arose during a general preliminary investiga-

tion have led to co-operation of allergologists, dermatologists and works medical officers. The results of further investigations will be discussed in future publications in this journal.

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