

NOTES - RESEARCH

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Use of *T. confusum* Duv. to aid assessment
of "chromatographic" properties of wheat
towards fumigant gases.

The differential sorption shown by wheat stored in country elevator annexes towards the components of fumigant mixtures¹ was further investigated in grain column experiments. Methyl bromide, ethylene dibromide and carbon tetrachloride (MB, EDB and CT) were applied singly and in admixture to the surface of 5-foot columns of wheat of 15.8% moisture content.² EDB applied singly was strongly sorbed at the surface of the column. MB diffused downward more rapidly and in greater concentrations. Addition of CT caused considerably greater amounts of EDB and MB to penetrate to the bottoms of the wheat columns. The fumigant concentrations found throughout the columns were in general agreement with mortalities of adults of *Tribolium confusum* Duv. That EDB + CT was more effective than EDB + MB as an insecticide at lower levels of the wheat column is explained partly by the improved downward distribution and persistence of EDB when CT was present. Behaviour of wheat as a chromatographic column towards fumigant mixtures applied in the vapor phase was also demonstrated in a subsequent investigation.³

References Cited

1. Berck, B. Proc. Xth Intern. Congress of Entomol. 4, 99 (1956).
2. Berck, B. Can. Dept. Agric. Publ. No. 1104 (1961).
3. Berck, B. and J. Solomon. J. Agric. Food Chem. 10, 163 (1962).

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Ineffectiveness of 10% CO₂ in air in the control
of *Tribolium confusum* Duv.

Experimental varieties of cereal seed stored in burlap bags in a concrete storage vault at this Station suffered substantial damage by a resident infestation of mice. The author recommended increasing the CO₂ content of the vault atmosphere as a rodenticide, since fumigation with

conventional fumigants at the prevailing low temperature (-18°F. outside) would result in increased sorption of fumigant by the seed, with possible detrimental changes in germination and other qualitative properties.

Compressed CO₂ was released into the vault¹ through openings made in one of the vault doors, and through which gas sampling lines and power lines for electric fans were placed. Cages of mice and of adults of T. confusum Duv. were placed beforehand at various locations in the vault. Mean gas concentrations of approximately 10% CO₂ v/v in the vault air were attained. The vault was unsealed at 18 hours after application. All mice, including the native population, were dead. No mortality was observed among the Tribolium adults used, up to 7 days after their transfer from the cages into fresh flour.

References Cited

1. Berck, B. Use of CO₂ as a mouse eradicator for a seed storage warehouse. (Report to Dr. R. F. Peterson, CDS Research Station, Winnipeg, March 20, 1961.) (Abstracted for publication in Can. Dept. of Agric., Minister's Weekly Report, Sept. 29, 1961.)

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Ability of T. confusum adults to survive on potassium hydroxide pellets

For pilot tests of the biological effectiveness of various fumigants and fumigant mixtures, a culture of T. confusum in flour was maintained in our fumigant chemistry laboratory. Some adult insects had escaped, and had infested paper bag samples of bran and shorts respectively that were temporarily stored in a carton located near a 25-lb. slide-top carton of KOH pellets that was closed but that had been unsealed previously. The pellets were enclosed in a polyethylene bag tied with a plastic tie, and had not been used for several months.

During a laboratory clean-up and discard of surplus samples, it was observed that T. confusum adults travelled quite freely into and from the carton of pellets. On removing the carton top, some 500 adults were seen within the polyethylene bag, moving quite normally on the surface of the pellets. About 50 insects were dead. The adults were extra glossy and dark in color, and a large area of the upper layer of pellets was discolored with a light brown coloration. The "culture" was kept under observation for 7 days, after which the carton was sealed up with masking tape, whereupon the culture died. In a simulated experiment, KOH pellets enclosed in a loosely tied polyethylene bag were placed in the dark in a wide-mouth jar

that contained a 1-inch layer of flour infested with T. confusum adults. Observations made three days later showed that the insects had migrated into the bag. Adults previously fed on flour survived for 5 days on "dry" KOH pellets in a polyethylene bag that was stored in a jar without flour.

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Heterosis and maternal effect
in Tribolium castaneum*

Two inbred lines of Tribolium castaneum were crossed and heterosis observed. The lines had been produced by full-sib matings for 34 and 37 generations respectively. Heterosis was measured as the difference between the F_1 means (reciprocals) and the mid-parent value and expressed as a percentage of the mid-parent value.

The amount of heterosis for body weight (first-day pupal weight) was low, 5.0% and 3.7% for males and females, respectively. In contrast egg production measured 14 days post pupation for 48 hours exhibited a large amount of heterosis (279.3%).

Body weight of pupae differed significantly ($P < .01$) in F_1 males in the reciprocal crosses of the parent lines. F_1 males were heavier when their dams were from the heavier line. This effect was not observed in F_1 females. The data indicate that sex linkage of genes determining body weight could account for the observed maternal effect.

*(See also March, 1965 issue Canadian Journal of Genetics and Cytology.)

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A note on fringe populations

The thesis research by Muggli was conducted as a starting point of the investigations of harsh-environment ecology. The following statement on the importance of harsh-environment ecology may be quoted (Chiang, H. C., 1961. Fringe populations of the European corn borer, Pyrausta nubilalis, their characteristics and problems. Ann. Ent. Soc. Amer. 54: 378-387.)

"Fringe populations deserve special attention also from a basic ecological viewpoint. The relative importance of density-dependent factors and density-independent factors in the natural control of animal populations has been a much discussed, controversial question. Failure to recognize the existence of fringe populations, and the lack of information of the characteristics of such populations may lead to a wide difference in interpretation of results. Such a difference is bound to occur when results of a field population which happens to be in a fringe area are compared with those of a laboratory population, which seldom, if ever, shows fringe characteristics. In this connection, something might be learned in the laboratory regarding the characteristics of fringe populations by exposing the test animals to harsh and marginal conditions, in addition to the conventional optimal conditions."

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Morphological and systematic comments
on some reported Tribolium mutants

1. Microcephalic (T. castaneum: TIB 4, p. 16). The described form of the head in this mutant is suggestive of that found in the peculiar Tenebrionid group Cossyphodinae (family Cossyphodidae of many authors), which I believe may be allied to the Triboliini; it is also approached in some other Tenebrionidae (e.g. Hypselops) and in Pterogenius, representing a distinct family Pterogeniidae.
2. Tarsi irregular (T. castaneum: TIB 5, p. 13). A tarsal formula of 5-4-4 occurs very rarely in Heteromera, though quite common in the Anisotomidae (Staphylinidae); it is found, however, in the Cossyphodinae among Tenebrionidae. Evidence suggests that in phylogeny, reduction of the tarsal segments from 5 to 4 in Coleoptera usually occurs as a single step. Thus in the Cryptophagid genus Micrambe the males of some species have the tarsal formula 5-5-4, of others 5-5-5 as is the case in females of all species; no intermediate conditions have been reported. Reduction of the tarsal segments to 4 is also recorded as a single-factor mutant in Drosophila melanogaster ("four-jointed" mutants).†
3. Juvenile urogomphi (T. castaneum: TIB 6, p. 25). It would be interesting to study in some detail the structure of the end of the abdomen in individuals manifesting this mutation. In the Staphylinid subfamily Staphylininae, normal adults have long setiferous urogomphi-like structures at the end of the abdomen, apparently homologous with the paraprocts (regarded by me as pleural elements of segment 9) of other beetles. These structures appear to develop

in direct continuity with the pupal and larval urogomphi.‡

† See also note by Sokoloff on "Pleiotropic effects of the sex-influenced 'paddle' and 'serrate' genes in T. castaneum" below.

‡ See note by Sokoloff, "Further comments on mutants with juvenile-urogomphi-like appendages in the adult T. castaneum."

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*The white leg character in
Tribolium castaneum

It is not unusual, when censusing a large population of flour beetles, to observe one or more individuals with white legs, antennae or elytra. Such sporadic occurrences had previously, in this laboratory, been attributed to developmental abnormalities, injuries or cannibalism. In addition, the ethylquinones released by adults may result in white appendages in beetles which are exposed to these gases at certain critical juvenile stages. In November, 1960, two cultures were found which contained a rather high frequency of affected individuals. From the ensuing matings it soon became apparent that the inheritance pattern of this "character" was quite complex (Dawson, 1961, TIB 4:19). The studies to be reported here are confined to the expression of the white leg (WL) phenotype.

There is considerable variability in the expression of WL, both between and within affected individuals. The tibiae and tarsi are the most frequently affected segments, and the rear legs are more often lacking in pigmentation than the middle legs, which in turn are more often affected than the front legs. It is not unusual to observe beetles with one completely white leg and one or two legs with white tibiae. The white legs tend to be lost quite easily, either during the normal life of the beetles or during the process of sifting them from flour.

The original WL individuals were obtained from two matings involving the Sa-2 (Short antenna) gene. From the progeny of these matings, three crosses were made in which all parents had one white leg. The results of these matings, given in Table 1, show that of the total offspring, about 50 per cent were WL and 50 per cent normal. Most further work was limited to the offspring from WL-4.

Out crosses of WL beetles to the University of California synthetic stock yielded offspring as given in Table 2. The frequency of WL among the F₁ progeny was very low, and increased to only about 5 per cent in the F₂. Thus WL seems to act like a phenodeviant (Lerner, 1954). The

widespread occurrence of the WL phenotype is additional evidence in favor of this idea. It is, however, hard to explain the high frequency of WL in the early matings if this interpretation is correct.

By inbreeding and selection it was possible to increase the frequency of WL as high as 0.71 in one particular mating. However, a large reduction in fertility resulted from the inbreeding, and it was necessary to pool the lines in order to maintain the stock. The stock has been maintained for 5 generations by selecting the 20 to 25 most severely affected individuals, and the frequency of WL has remained quite constant (0.59, 0.59, 0.60, 0.62, 0.59 respectively).

Perhaps the most interesting observation is that the frequency of WL is different for the two sexes. In the offspring from WL-4 (Table 1), the frequencies are 0.63 and 0.46 for males and females respectively. The phenotypes of progeny from 17 matings where 50 or more offspring were classified, involving parents up to three generations removed from WL-4, are listed in Table 3. In 14 of the 17 matings the frequency of WL was higher in males.

Another interesting aspect of this work is the dependence of the frequency of WL in the offspring of a mating on the number of affected legs in the parents. Data from the 17 matings discussed above, presented in Table 4 in a slightly different manner, illustrate this point. The same phenomenon is observed with respect to numbers of affected legs in the offspring. There also is some evidence for a maternal effect on expression of WL.

Table 1
Original matings between WL individuals

Mating	Offspring Phenotypes					
	Males		Females		Total	
	WL	+	WL	+	WL	+
WL-1	5	29	23	25	28	54
WL-2	8	4	20	2	28	6
WL-3	27	16	18	21	45	37
TOTAL	40	49	61	48	101	97

Table 2
Results of outcrosses to the synthetic stock

Mating	No. of Matings	Offspring WL	Phenotypes +
WL × stock	6	2	448
F ₁ × F ₁	8	37	616

Table 3

Sex difference in offspring from matings involving WL

	<u>WL</u>	<u>+</u>	<u>Total</u>	<u>Frequency of WL</u>
Males	430	310	740	0.58
Females	357	391	748	0.48
Total*	806	714	1520	0.53

* Includes beetles not sexed

Table 4

Results of matings between WL beetles with
varying numbers of affected legs

<u>Total number of affected legs in parents</u>	<u>No. of matings</u>	<u>Frequency of WL offspring</u>		
		<u>Males</u>	<u>Females</u>	<u>Total</u>
0	4	0.51	0.37	0.44
1	1	0.41	0.40	0.41
2	4	0.62	0.39	0.50
3	5	0.63	0.55	0.59
4	3	0.63	0.63	0.63
Total	17	0.58	0.48	0.53

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*Linkage information on peach and ruby

In preliminary report on the eye mutants peach and ruby of T. castaneum, each was reported as an autosomal recessive (TIB 7, p. 32). However, further tests revealed that peach is sex linked and is allelic with the red and wine eye mutants. Peach will, therefore, be designated as r^{ph}.

Preliminary linkage tests indicate that ruby is located in the maroon region approximately 27 recombination units from jet.

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An improved dietary supplement for rearing *T. confusum*

In 1959 experiments were initiated comparing the commonly used brewer's dried yeast with dried Torula yeast (a primary grown product of the Red Star Yeast and Products Company) as a supplement to whole wheat flour. Gross observations indicated that Torula yeast produced greater numbers of *T. confusum* than the dried brewer's yeast and has been used in this laboratory since then. The increase of Torula yeast from 5% to 10% in whole wheat flour also increased reproduction and has been used for some time. Since Torula yeast is considerably cheaper than debittered dried brewer's yeast, a higher percentage of yeast can be used without increasing the cost of the rearing medium.

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*Malathion resistance in *Tribolium castaneum*

Resistance to malathion has occurred in *T. castaneum* in Nigeria. A culture derived therefrom now has a resistance factor of X200 after selection in the laboratory. Studies with synergists and the examination of malathion metabolites in the resistant and susceptible beetles show that the mechanism of resistance is one of enhanced carboxyesterase activity. Further studies of malathion synergists and the inheritance of the resistance are being made.

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*DDT resistance in *Tribolium castaneum*

A stock of *T. castaneum* from Pretoria has been cultured in flour containing DDT. The food contamination was increased in each generation according to the yield. After thirteen generations of selection cultures started in food containing 5, 10 and 20 ppm DDT have bred in media containing 100, 105 and 97.5 ppm respectively. A susceptible strain from Trinidad is able to breed in a similar medium containing 20 ppm DDT, but fails to produce progeny when the food contains 40 ppm. A substrain derived from some seventh generation adults from the culture started in 10 ppm has been selected by topical treatments of unmated adults in

subsequent generations. The thirteenth generation of this substrain when tested by a topical application method had a resistance factor of about X60. Studies of the inheritance of the resistance are underway.

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"Dose Ratio" of X-rays and fast neutrons

Similar relative biological efficiency (RBE) values for dominant or recessive lethals induced by radiations were found for mice and *Drosophila* and for induction of chromosomal aberrations for *Tradescantia* and *Drosophila*.

When dose response curves are of the "multi-hit" type for X-rays and "one-hit" type for other radiations, "dose ratio" rather than an RBE was recommended (1963, Health Physics 9:357). Dose-response curves for dominant lethals were of these kinds of curves in my experiments. Accordingly, dose ratios of 250 Kvp X-rays and 4.6 Mev fast neutrons for 50 per cent dominant lethals in flour beetles, *Tribolium castaneum* (Herbst) "Brazil CI," were determined during two weeks after exposure.

Dose ratio values were comparable regardless of sex exposed or temperature (25, 29 and 32°C). The mean dose ratio of 2.4 which represents the response of all meiotic stages at the time of irradiation was similar to that of 3.4 for *Drosophila* (1958, Alexander, M. L., Genetics 43:458). Radiation would be more hazardous to premeiotic or meiotic cells than to postmeiotic stages because the latter are of brief duration and consequently subjected to fewer chances for exposure.

In conclusion, 4.6 Mev fast neutrons were 2 to 3 times more effective in including 50 per cent dominant lethals in flour beetles than were 250 Kvp X-rays. The dose ratio for dominant lethals in flour beetles was similar to that found in other plants and animals.

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The abundance and distribution of animals are determined by the genetic constitution of the organism and its environment. *T. confusum* is more X-radiation sensitive than *T. castaneum* (Brazil CI) (1962, Erdman, H. E., Nature 195:1218 and 1963, Erdman, H. E., J. Exptl. Zool. 153:141). The response(s) of these organisms to insecticides and the modifications due

to radiations are of interest from economic, hazards, and theoretical stand-points.

Stock adults were tested for survival on various DDT concentrations in food at room conditions (27°C and 40 per cent relative humidity). These preliminary data (Table 1) show that T. confusum (Chicago Standard) has the best survival at high DDT concentrations; "Sooty" (T. castaneum) has the poorest. The greater resistance of T. confusum may be correlated with its greater lipid content. Further work will help clarify the lipid-DDT interaction.

Table 1

Per Cent Survival of Flour Beetles on Various Concentrations of DDT in the Food and Lipid Content of Flour Beetles

% DDT in diet	% adult survival, 18 days		
	<u>T. confusum</u> "Chicago Standard"	"Sooty" <u>T. castaneum</u>	"Brazil CI"
0	99	96	100
.00050	95	74	94
.00065	93	63	91
.0010	93	54	88
.0050	90	31	81
.0066	70	11	62
.01	53	3	45
mg lipid/g beetle	107 ± 2.2	97 ± 1.6	99 ± 0.2

In several experiments, progeny reared from egg to adult on the various concentrations of DDT food showed no departure from the expected 1 : 1 sex ratio. Developmental rate was retarded at 0.005 per cent DDT in food.

"Sooty" larvae placed on DDT contaminated food at different ages showed that older larvae had a better chance for survival than did younger larvae.

Two differences between T. confusum and T. castaneum (Brazil CI) were evident, namely, the former tolerated higher concentrations of DDT and was more radiation sensitive.

Future research will concern effects of combinations of DDT and radiations on populational abundance and distribution.

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*The susceptibility of the developmental stages of *Tribolium castaneum* to methyl bromide

Preadult stages of *Tribolium castaneum* were exposed to graded dosages of methyl bromide by exposing them for various periods to 10 mg per litre in a gastight chamber. Eggs were exposed in perspex cells with the openings covered by filter paper; and larva and pupae in short lengths of glass tubing closed at both ends by muslin. Fifty were exposed in every chamber and at least two replicates of each were exposed to seven dosage levels. The larvae were provided with flour. The insects were bred and fumigated at 25°C and 70 per cent R.H.

The eggs were split into 6 age groups, larvae into 24 and pupae into 10. The dosage required to kill 50 per cent varied from 10.3 mg hr late in the egg stage and early in the larval stage to 81 in the young pupa. The egg was least susceptible at 2-3 days old (50% kill at 30 mg hr) and most at 5 days, becoming less susceptible just prior to hatching. The larvae slowly became less susceptible as they grew but only become less susceptible than 2 day old eggs in the final fifth of this instar. Pupae were least susceptible when 2-4 days old and then became steadily more susceptible. When about to become adult their LD 50 was 30. It seems likely that larvae become more susceptible to fumigants around the time of moulting.

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Complete utilization of substrate by a beetle

Three per cent of more than 100 jars of cigarettes produced for smoking panel tests were accidentally infested with *Lasioderma serricornis* Fabr. One of these jars was given to me and kept as an unopened souvenir in my office. Live beetles persisted in the jar for seven years, and more than 50 generations have been postulated. Finally when no live adults had been seen for several months the jar was opened. The paper sheaths of the 65 cigarettes were completely empty but held upright in their tightly-packed vertical position. An accumulation of brown powder and beetle bodies filled the lower half inch of the jar. Microscopic examination of the brown powder identified it as beetle feces. No unchanged flakes of tobacco were evident. More than 1000 beetle bodies were counted and many more broken pieces were present. It appears that all original edible material has been converted either into beetles or into feces. The closed system comprised of a glass jar with a metal screw top and a tightly fitted waxed

cardboard disk suggests itself for extended studies such as prolonged bio-satellite flight. Are there equivalent examples featuring other beetles held for long periods in closed systems during which food conversion has gone to completion?

Yes. Cultures of Latheticus oryzae and Tribolium castaneum and T. confusum have been observed to convert flour until the only thing remaining were fecal pellets. Ed.

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A simple method for application of some insecticides against stored grain insects³

Dr. S. I. Bishara was discussing with us the best methods and times for controlling Bruchus rufimanus Boch., a common beetle in Egypt attacking some leguminous seeds, especially the broad bean Vicia faba. Instead of controlling the insect in the fields, for this usually needs considerable effort and amounts of insecticides, we thought of making an attempt to control the various stages of the insect in the seeds before planting.

A summary of the method follows:

The seeds were immersed in low concentrations of insecticides ranging from 0.3% down to 0.05% for periods of 3, 6, 12 and 24 hours before planting. The preliminary experiments using Malathion, Toxaphene and Dipterex gave very encouraging results. The percentage of insect mortality reached 100% without any effect on the seed germination.

It is hoped to publish a detailed report on this work very soon. We thought it worthy to make this note in hope it might draw the attention of investigators who are interested in the method, using other seeds and insects such as grain weevils, borers and other insects which pass a stage of their development inside grains.

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*Heat treatment of Tribolium confusum imagoes

Heat is widely used in work involving flour beetles. It is used for sterilization of flour, and for killing any discarded specimens. It can also be used for identification of phenotype and of sex in various crosses where beetles are not to be bred further. In order to determine the time of exposure to heat which least affects the phenotype, the following experiments were carried out with T. confusum.

1. Slow heat treatment. 50 male and 50 female two-month-old beetles derived from our synthetic laboratory strain were introduced into a plastic jar (6.0 × 3.6 cm.) with 8 grams of whole wheat flour (but glass vials 9.5 × 2.4 cm. also can be used for this purpose) and placed in a 65°C. Thelco laboratory electric oven for different periods of time. Five replicates were used for each period tested. The mortality of beetles following heat treatment was observed (Table 1). It was demonstrated that all beetles survived when immediately isolated from flour heated for 10 to 12 minutes at 65°C.; 92 per cent of the beetles survived exposure of 14 minutes; if heated to 15 - 16 minutes, all beetles were killed. These newly killed beetles can be isolated and kept for morphological studies without changing body color for several hours.
2. Quick heat treatment. Same age and same number of T. confusum imagoes as mentioned in method (1) were used for this test. Double-layer petri-dishes were used instead of plastic containers (the larger dish was used as the bottom layer). In this way the containers can be kept hot longer after removal from the oven than the single-layer dish at room temperature (about 25°C.). These dishes contained no flour and they were placed on the metal plate of the lower shelf of the oven at least 5 minutes before using. The beetles were introduced into the heated dishes as the dishes were taken out from the oven. The time required to kill them was 10 - 12 seconds. They were transferred to a cold dish for examination. A single-layer dish also can be used for quick killing purposes, but beetles in the dishes should be kept on the hot metal plate of the oven for 5 seconds to insure they are completely killed. It was noticed that if beetles receive too much heat, their body color may become darker and it may be difficult to squeeze out the sex organs with forceps for the purpose of determining the sex.

It is concluded that the quick heat treatment is more useful for sexing of adult and identification to phenotype.

Table 1

Per cent survival of T. confusum when exposed at different intervals of time at 65°C.

Slow heat treatment (plastic jar with flour)		Quick heat treatment (double-layer dishes without flour)	
<u>Time exposed to heat (minutes)</u>	<u>Survival (%)</u>	<u>Time exposed to heat (seconds)</u>	<u>Survival (%)</u>
10	100	4	100
12	100	6	75
14	92	8	22
15	0	10	0
16	0	12	0

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Premature eversion of the ovipositor in a pupa of
Tribolium confusum

Normal female pupae in Tribolium are characterized by the possession of prominent genital lobes anterior and medial to the urogomphi (Fig. 1A). A pupa has been found which differed from this normal appearance (Fig. 1B). The beetle had advanced in development to the point of having the compound eyes pigmented; the mandibles had a brownish appearance, and the tarsal segments and claws were visible through the pupal skin. It is judged that this individual was about a day short of completing its development. The pupa in question lacked urogomphi, but all the lateral irregular projections of the abdominal tergites were present. The posterior end was continued into a typical adult ovipositor and while the pupa was alive it was never seen retracted, but when touched it was seen to move from side to side. As can be seen from Fig. 1B, the various plates of the ovipositor were identifiable, including the valvifers and their plates. The styli were in their normal position (compare with Figs. 50, 51 of El Kifl, 1953, Bull. Soc. Fouad 1er Entom. 37:173-249). The female died before eclosion, so that it is not known whether the premature eversion of the ovipositor had any genetic basis. So far as is known this is the first such recorded case for T. confusum.

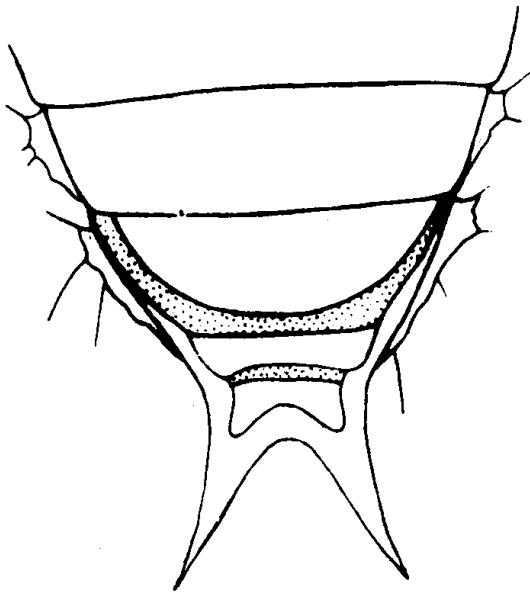


Fig. 1A

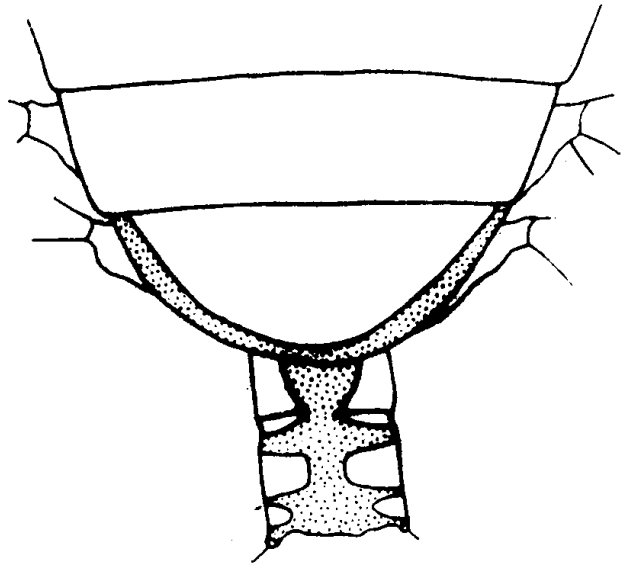


Fig. 1B

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Triphenyl tin compounds as insect reproduction inhibitors

Summary

Using the house fly as an indicator, a number of triphenyl tin derivatives were found to act as reproduction inhibitors. The more active compounds such as Dowco* 186 (triphenyl tin hydroxide), Dowco 187 (allyl triphenyl tin) and Dowco 188 (bis triphenyl tin sulfide) have three phenyl groups in common, plus a fairly labile fourth group attached to tin. The above compounds sterilize adult flies well below the lethal concentration. Females are sterilized at lower concentrations than males. Some derivatives produce easily reversible reproduction control; some do not. This property is somewhat dosage dependent in the house fly with all gradations ranging from nearly complete ovarian suppression to deposition of normal sized but sterile eggs. Triphenyl tins suppress or control reproduction in the German cockroach and the confused flour beetle. The triphenyl tin moiety would appear to have promise for the reproduction control of insects and related species from a number of orders of arthropods.

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* Trademark of The Dow Chemical Company

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*More on indeterminacy in competition

A previous paper by Lerner and Ho (1961) reported the results of competition experiments between Tribolium castaneum (CS) and T. confusum (CF). When 10 pairs of founders of each of the CS and CF were introduced in vials, CS eliminated CF in all replicates. When two inbred strains of CS, CS 2 and CS 12 and their hybrids (CS X) and two of CF (CF 9 and CF 11 and their hybrids, CF X) were placed in competition under the same conditions in every interspecies combination there were three types of results: (1) determinate with CS the winner; (2) determinate with CF the winner; and (3) indeterminate with CS superior on the average but with an occasional CF win.

The results differed from those of similar experiments reported by Park and collaborators (Park, 1948, 1954; Park and Lloyd, 1955) in which

the outcome of competition could not be predicted a priori and was said to be indeterminate. Lerner and Dempster (1962) suggested that much of the indeterminacy observed in competition experiments may be a reflection of random selection of the genotypes of founder populations. There were, however, some differences in experimental technique between the Park experiments and those of Lerner and Ho. In the former, competing cultures were initiated with two pairs each of the two species; in the latter, there were ten pairs of founders of each species. Furthermore, in Park's experiments the cultures were sifted and censused at monthly intervals and all the live stages introduced in fresh flour, whereas in those of Lerner and Ho, the adults were scored and discarded every month, the medium renewed, and the cultures continued with the pre-adult stages (with the exclusion of the egg-stage).

To rule out the possibility that the differences in results might lie in the difference in technique, a series of experiments using the same strains used in the previous study of Lerner and Ho was undertaken starting the competition vials with two pairs of adults, renewing the medium each month and censusing initially every three months, and later every month.

In view of the fact that a recent paper by Park, Leslie and Mertz (1964) give data to show that the use of inbred strains leads to a deterministic outcome of competition conforming with the findings of Lerner and Ho (1961), Lerner and Dempster (1962), and of Dawson and Lerner (1962), the results of our new experiments are merely being placed on record here in Tables 1-9. In brief, they conform with our previous findings, suggesting that the differences in technique do not matter in these studies of competition between flour beetles. It may be pointed out that wherever the results were indeterminate in this series of experiments (Tables 4, 5, and 9) in every case indeterminacy was observed (as in the previous experiments) only when CF line 11a was involved. This strain is being examined cytologically in order to determine whether an inversion or some other aberration accounts for this fact.

Table 1. Numbers of CF (numerator) and total CS + CF (denominator) adults in competition vials involving inbred strains CSI-2c and CFI-1b at a given transfer.

Vial #	Transfer #									
	0	1	2	5	8	11	12	15	17	
1	4/8	4/8	32/44	42/46	46/46	75/75	---	---	---	
2	4/8	4/8	77/88	49/53	41/41	89/89	---	---	---	
3	4/8	4/7	68/74	56/58	62/62	66/66	---	---	---	
4	4/8	4/8	43/60	34/38	83/84	65/65	27/27	72/72	---	
5	4/8	4/11	56/69	57/61	77/78	68/69	65/65	73/73	---	
6	4/8	4/8	47/63	54/63	81/84	74/74	64/64	85/85	---	
7	4/8	4/10	44/65	46/52	77/77	54/54	---	---	---	
8	4/8	4/8	64/81	45/52	61/63	67/68	67/67	58/58	---	
9	4/8	4/8	22/38	47/54	71/72	70/71	52/82	71/71	69/69	
10	4/8	4/8	50/66	52/54	51/51	63/63	---	---	---	

Table 2. Numbers of CF (numerator) and total CS + CF (denominator) adults in competition vials involving inbred strains CSI-12 and CFI-1b at a given transfer.

Vial #	Transfer #									
	0	1	2	5	8	11	12	15		
1	4/8	4/8	76/94	61/65	46/47	88/88	70/70	74/74		
2	4/8	4/7	77/92	70/78	60/60	74/74	---	---		
3	4/8	4/7	80/91	51/53	52/52	70/70	---	---		
4	4/8	4/7	76/90	53/58	54/54	44/44	---	---		
5	4/8	4/7	87/111	51/58	92/92	68/68	---	---		
6	4/8	4/7	95/120	68/80	60/61	84/84	86/86	84/84		
7	4/8	4/8	83/112	44/53	17/17	4/4	---	---		
8	4/8	4/8	76/93	52/55	54/54	80/80	---	---		
9	4/8	4/8	60/88	46/57	50/50	75/75	---	---		
10	4/8	4/7	65/72	54/55	51/51	60/60	---	---		

Table 3. Numbers of CF (numerator) and total CS + CF (denominator) adults in competition vials involving inbred strains CFI-1b and hybrid CSI-2c x I-12 at a given transfer.

Vial #	Transfer #																						
	0	1	2	5	7	8	9	11	12	15	15	12	11	10	11	11	10	11	12	13	14	15	
1	4/8	4/42	5/67	0/109	0/108	0/116	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
2	4/8	4/20	42/99	24/84	11/74	7/86	5/88	0/113	0/104	0/103	---	---	---	---	---	---	---	---	---	---	---	---	---
3	4/8	6/22	42/96	31/75	18/93	6/94	0/81	0/102	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
4	4/8	5/18	38/67	18/58	12/60	6/45	4/69	0/66	0/60	0/58	---	---	---	---	---	---	---	---	---	---	---	---	---
5	4/8	4/21	25/92	12/87	8/111	4/110	2/98	0/99	0/98	0/93	---	---	---	---	---	---	---	---	---	---	---	---	---
6	4/8	4/20	18/77	10/75	4/108	4/98	2/85	0/88	0/75	0/112	---	---	---	---	---	---	---	---	---	---	---	---	---
7	4/8	4/35	17/88	9/79	7/64	6/96	6/86	1/97	0/90	0/90	---	---	---	---	---	---	---	---	---	---	---	---	---
8	4/8	5/33	28/88	16/84	14/75	10/69	7/75	0/76	0/76	0/82	---	---	---	---	---	---	---	---	---	---	---	---	---
9	4/8	4/26	18/68	9/72	6/76	4/65	4/50	0/72	0/64	0/78	---	---	---	---	---	---	---	---	---	---	---	---	---
10	4/8	6/47	20/98	12/89	10/93	10/82	5/68	0/87	0/75	0/89	---	---	---	---	---	---	---	---	---	---	---	---	---

Table 4. Numbers of CF (numerator) and total CS + CF (denominator) adults in competition vials involving inbred strains CFI-11a and CSI-2c at a given transfer.

Vial #	Transfer #														
	0	1	2	5	6	7	8	9	10	11	12	13	14	15	
1	4/8	3/7	3/20	2/46	1/45	1/41	0/44	0/43*	0/30	---	---	---	---	---	
2	4/8	4/7	26/36	45/45	38/38	31/31	26/26	18/18	---	---	---	---	---	---	
3	4/8	4/10	11/36	10/50	10/45	9/42	6/35	4/30*	3/32	2/32	1/32	0/28	0/25	0/29	
4	4/8	4/7	26/32	62/66	65/65	54/54	46/46	---	---	---	---	---	---	---	
5	4/8	4/8	22/34	50/51	75/76	64/65	63/64	58/59	50/50	80/80	104/104	---	---	---	
6	4/8	4/9	25/46	39/59	36/43	34/35	59/59	84/84	119/119	---	---	---	---	---	
7	4/8	4/10	20/34	44/62	44/53	52/54	57/57	64/64	79/79	---	---	---	---	---	
8	4/8	4/8	25/31	57/59	71/71	66/66	57/57	---	---	---	---	---	---	---	
9	4/8	4/8	20/33	84/86	92/93	84/84	60/60	54/54	46/46	---	---	---	---	---	
10	4/8	4/9	27/43	71/72	109/109	180/180	166/166	---	---	---	---	---	---	---	

* parasitic infection ruled out.

Table 5. Numbers of CF (numerator) and total CS + CF (denominator) adults in competition vials involving inbred strains CFI-11a and CSI-12 at a given transfer.

Vial #	Transfer #													
	0	1	2	5	7	8	9	10	11	12	13	14		
1	4/8	4/7	12/41	17/39	13/33	9/20	9/24	8/25	8/27	6/36	5/31	4/49		
2	4/8	4/6	28/44	67/68	57/57	58/58	70/70	---	---	---	---	---		
3	4/8	3/6	14/53	28/41	56/59	72/73	119/120	114/115	123/123	123/123	116/116	---		
4	4/8	3/9	31/46	41/41	31/31	21/21	---	---	---	---	---	---		
5	4/8	5/9	40/66	36/37	40/46	57/57	67/67	---	---	---	---	---		
6	4/8	4/7	32/37	52/55	125/125	105/105	82/82	---	---	---	---	---		
7	4/8	4/7	20/43	34/35	66/67	79/79	85/85	77/77	80/80	---	---	---		
8	4/8	4/8	16/49	33/44	129/131	160/161	156/157	140/141	151/151	141/141	140/140	---		
9	4/8	4/8	14/38	48/48	36/36	33/33	---	---	---	---	---	---		
10	4/8	4/5	33/37	75/76	42/42	49/49	57/57	---	---	---	---	---		

Table 6. Numbers of CF (numerator) and total CS + CF (denominator) adults in competition vials involving inbred strain CFI-11a and hybrid CSI-2c x I-12 at a given transfer.

Vial #	Transfer #												
	0	1	2	5	8	11	12	13					
1	4/8	4/8	10/79	6/94	2/90	0/106	0/102	0/101					
2	4/8	4/16	7/58	6/98	2/111	2/34	*	---					
3	4/8	4/12	11/67	6/94	2/96	0/110	0/91*	---					
4	4/8	4/9	16/87	13/109	4/115	2/47	0/24*	---					
5	4/8	4/8	25/76	22/100	8/123	0/133	0/102	---					
6	4/8	3/7	16/93	14/80	8/117	2/97	2/68	0/51					
7	4/8	4/14	13/94	10/108	4/110	0/150	0/134	0/94*					
8	4/8	4/12	22/104	18/82	6/132	0/145	0/131	0/134					
9	4/8	4/8	18/73	17/92	6/130	2/112	*	---					
10	4/8	4/8	12/45	11/69	3/114	2/108	0/92	0/85*					

* Found infected with Nosema whitei.

Table 7. Numbers of CF (numerator) and total CS and CF (denominator) adults in competition vials involving hybrid CFI-lb x F-lla and inbred CSI-2c.

Vial #	Transfer #									
	0	1	2	5	8	11	12	15	16	
1	4/8	4/7	80/96	165/174	196/198	132/133	194/194	114/114	179/79	
2	4/8	4/8	97/115	132/141	149/150	129/129	118/118	229/229	---	
3	4/8	4/8	109/125	139/144	125/126	138/138	137/137	120/120	---	
4	4/8	4/8	93/101	150/150	112/112	---	---	---	---	
5	4/8	4/7	123/137	190/198	219/219	134/134	---	---	---	
6	4/8	4/9	145/158	153/158	159/159	123/123	---	---	---	
7	4/8	4/8	87/98	110/116	92/92	110/110	---	---	---	
8	4/8	4/8	88/103	151/160	150/152	159/159	136/136	161/161	---	
9	4/8	4/7	91/104	125/131	159/159	221/221	---	---	---	
10	4/8	4/8	101/115	131/134	104/104	141/141	---	---	---	

Table 8. Numbers of CF (numerator) and total CS and CF (denominator) adults in competition vials involving hybrid CFI-lb x F-lla and inbred CSI-12.

Vial #	Transfer #									
	0	1	2	5	8	11	12	15		
1	4/8	4/7	106/132	141/153	137/138	230/230	224/224	139/139	---	
2	4/8	3/7	104/129	130/141	175/175	125/125	---	---	---	
3	4/8	4/7	56/84	90/106	129/129	150/150	---	---	---	
4	4/8	4/7	86/101	109/117	112/113	76/76	---	---	---	
5	4/8	4/7	105/137	129/139	138/138	126/126	160/160	128/128	---	
6	4/8	4/6	127/137	65/68	181/181	83/83	---	---	---	
7	4/8	4/8	147/163	154/162	122/122	71/71	---	---	---	
8	4/8	4/7	121/131	169/172	166/166	166/166	---	---	---	
9	4/8	4/8	76/96	115/126	83/83	109/109	---	---	---	
10	4/8	4/6	100/132	130/149	122/122	160/160	---	---	---	

Table 9. Numbers of CF (numerator) and total CS and CF (denominator) adults in competition vials involving hybrid CFI-lb x I-11a and hybrid CSI-2c x I-12.

Vial #	Transfer #												
	0	1	2	5	6	7	8	9	10	11	12	13	
1	4/8	4/12	80/126	75/113	68/99	63/83	53/68	50/69	84/118	75/108	69/96	73/93	
2	4/8	4/11	68/107	70/119	57/81	54/70	46/55	35/58	29/48	24/65	24/74	17/57	
3	4/8	3/10	26/99	18/89	14/111	10/106	6/97	5/89	3/119	2/105	2/95	3/106	
4	4/8	4/8	84/141	72/105	66/82	56/62	53/62	84/95	74/87	74/94	67/86	61/79	
5	4/8	4/18	69/121	63/106	52/71	50/87	42/64	33/60	21/85	16/69	9/70	3/61	
6	4/8	4/9	30/79	39/91	22/101	20/99	17/83	14/81	13/91	8/70	7/72	3/93	
7	4/8	4/8	71/116	75/105	74/94	132/150	137/150	127/134	144/151	141/145	218/221	209/212	
8	4/8	4/10	76/114	73/94	59/91	53/75	47/65	40/62	38/64	26/49	18/46	15/66	
9	4/8	4/8	77/104	79/109	76/84	74/78	78/81	90/102	111/124	95/104	101/106	139/143	
10	4/8	4/9	83/124	105/132	119/140	107/124	103/113	127/135	139/142	133/136	141/142	125/126	

Vial #	Transfer #												
	14	15	16	17	18	19	20	21	22	23	24		
1	72/85	122/141	119/136	104/117	92/99	114/119	161/169	160/164	157/162	157/162	157/162	157/161	
2	16/103	13/87	8/71	7/109	3/111	0/116	0/122	0/102	---	---	---	---	
3	2/134	0/118	0/106	0/103	0/126	0/112	0/102	---	---	---	---	---	
4	57/83	48/74	37/153	32/69	23/56	19/75	15/70	9/67	6/97	1/91	0/80	---	
5	2/61	2/72	1/106	0/99	0/92	0/110	0/115	---	---	---	---	---	
6	3/102	3/99	1/112	1/111	1/116	0/122	0/126	0/111	---	---	---	---	
7	216/219	201/202	179/179	192/192	176/176	169/169	186/186	---	---	---	---	---	
8	11/64	7/60	6/97	3/96	2/92	2/107	0/107	0/93	0/108	---	---	---	
9	125/127	120/122	146/146	138/138	135/135	138/138	122/122	---	---	---	---	---	
10	176/177	156/156	173/173	152/152	130/130	131/131	132/132	---	---	---	---	---	

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*Selection of pyrethrum-resistant *Sitophilus granarius*

In 1954 the Laboratory received a field stock of *S. granarius*, with twice the resistance to pyrethrins, of our standard strain, as determined by a direct spray test.

Resistance has been steadily increased by breeding from the survivors of treatments designed to kill approximately 80% of beetles. Viscosity problems dictated changes in the selection technique; from direct spray, to topical dosage with micro capillary tubes, after 7 selections; and a further change to a micro-drop technique after 19 selections. Now, a resistance level 132 × that of the standard stock has been achieved after 30 selection tests during 44 generations. Reduced viability prevented treatment in each generation. During the course of selection, the resistant strain has gained 30% in weight over the standard strain; darkened in color, but not homogeneously; and become noticeably less active. There is some evidence to show that the factors for darkness and increased weight are sex limited to the resistant female. However, it is known that the dark form is not directly linked with resistance. Further work on the genetics of these insects is in progress.

When the resistance level had reached ×34 the cross tolerance to a wide range of different insecticides and environmental conditions was measured (Lloyd, C. J. and E. A. Parkin, *J. Sci. Fd Agric.* 1963, 14, 655-63). The resistance to allethrin, a synthetic pyrethroid, was equal to pyrethrum itself, but admixture with the activator piperonyl butoxide reduced resistance against both substances to a low level. Resistance to the other insecticides tested was of a low order with the notable exception of DDT (×15). Investigation of the cross tolerance to DDT, and the use of activators is being carried out.

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*Laboratory studies with confined cannibalistic populations of flour beetles (*Tribolium castaneum*) in a cold-dry environment. I. Data for 24 unmanipulated populations.

I completed a doctoral thesis some years ago, based upon laboratory populations of *Tribolium castaneum* Herbst, conducted in the laboratory of Professor Thomas Park at the University of Chicago. Up until now, no

written report of this work has been available, except for the thesis itself (Lloyd 1957) and the abstract of a talk given in London in 1958 (Lloyd 1959). I set out to study the phenomenon of population extinction in an unfavorable habitat. The fundamental character of this problem had to be changed after the work was well under way, because a genetic change had occurred in our laboratory strain. The beetle populations did not become extinct in the same incubator where they had invariably done so two and one-half years earlier (Park 1954). From the point of view of presentation, this poses a dilemma: if I describe the work chronologically, the reader may be "led astray" in the same way that I was; if I reorganize the material in a way that makes sense to me now, the reader may get a false impression of how the (modified) problem developed. I have decided to "seize both horns," that is, to report the work both ways in different papers.

The present paper will describe the population experiments in the context in which they were originally planned and report the data in full for some of the populations. Later papers will present the remaining population histories and discuss present ideas of what the data show, much modified by the extensive work that has subsequently been carried out in Professor Park's laboratory and elsewhere (see Park, Leslie and Mertz 1964 and earlier papers). Primarily, this paper is intended for the reader interested in exploring his own method of analysis. There seem to be as many different ways of analyzing Tribolium population histories as there are people interested in doing it, yet every independent analysis requires the full data, not merely the statistical summaries which are the only form practical for publication in most journals.

Indeed, statistical summaries may actually be misleading. There are cycles in the numbers of larvae, brought about primarily by the well-known cannibalism of larvae on eggs and younger larvae, that are slightly out of phase in different replicates. The plot of average numbers against time smooths out these cycles, and so differs in a qualitative way from the population histories that it would purport to represent.

One must census the population at frequent intervals in order to reveal the details of these cycles. They are well illustrated by the present data, based on weekly censuses. Similar patterns are evident in the unpublished thesis work of Strawbridge (1953), based on 4-gram populations of T. castaneum in a temperate-wet incubator (29°C., 70% relative humidity) censused at 3-day intervals. Strawbridge's cycles are much more rapid than mine, as would be expected from the much faster rate of development at 29°C. than at 24°C. (Park and Frank 1948, Lloyd 1957). The only published population history from Strawbridge's work is a figure used by Landahl (1955) to compare with a mathematical model. Cycles in the numbers of larvae were shown somewhat imperfectly by Chapman (1933), using Adelina-infected populations of T. confusum censused at 5-day intervals. Most of the later work has been based on 30-day censuses, which are too infrequent to reveal details.

Experimental design.--My interest in Tribolium castaneum was first stimulated by Park's (1954) discovery that his populations of this species

could not maintain themselves in a "cold-dry" incubator environment (24°C., 30% relative humidity). Each of Park's 15 replicate populations were started off with only four pairs of adults in 8 grams of flour medium. These beetles were able to reproduce themselves all right, but the ensuing populations eventually died out in every case. As it happened, the adults used to start these populations had been reared under different incubator conditions (29°C., 70% relative humidity), which were much more favorable, suggesting the hypothesis ". . . that adult beetles not raised in these [cold-dry] conditions produce new generations, but their progeny cannot" (Park 1954, p. 188)--in other words, that developing in the cold-dry conditions had some sterilizing effect on the beetles.

I decided to test this hypothesis by initiating 12 populations (designated A-1, A-2, . . . , A-12) entirely with individuals (larvae, adults) that had been reared in the cold-dry incubator, from eggs also laid in that incubator, by parent beetles that had been reared under more favorable conditions. These were the "unmanipulated control" populations of "strain A". Each week they were sifted free from the 8 grams of flour medium and all stages counted, including the eggs. The living stages were then returned to a fresh vial of medium which had been kept in the cold-dry incubator for several days previously.

Hoping to get populations that would persist, I started a similar series of unmanipulated control populations (B-1, B-2, . . . , B-12) with a different laboratory strain of beetles--"strain B"--which seemed, judging by the gross appearance of stock cultures, to have a higher intrinsic rate of increase under a variety of temperatures and humidities. In addition, there were four complicated series of manipulated populations, involving one or the other strain, in which the pupae were isolated and allowed to complete their metamorphosis (and develop their gonads) either in a more favorable "cold-wet" environment (24°C., 70% relative humidity, i.e., the "manipulated experimentals," A"-1, A"-2, etc., and B"-1, B"-2, etc.) or in the same cold-dry environment (A'-1, A'-2, etc., and B'-1, B'-2, etc.) Each experimental series consisted of 12 replicate populations and each population had a flour change every week.

On the hunch that this much census disturbance might somehow be harmful to the beetles, I established another series (C-1, C-2, etc.) with strain A, consisting of 300 "conditioned-flour" populations, which were never to have a flour change or be sifted free of the flour up to the time of census, and be sacrificed in groups of 12 every four weeks. (These populations showed that census disturbance does indeed affect population size, a point that will be documented fully in a later paper.) Finally, I thought that extinction might be avoided by starting populations with high densities, so I established 12 populations of strain A (D-1, D-2, etc.) with 20 times the initial numbers that were used for the A-series, but otherwise cultured in the same way, with weekly flour changes.

Even before this program was well under way, it became apparent that I was not going to be able to reproduce Park's results. While doing preliminary work, I had initiated a pilot series of populations in exactly the

same way as Park had done, using the same incubator, the same census techniques and census interval, starting each population with four pairs of newly-eclosed adults which had been reared in the temperate-wet incubator, and using what we believed to be genetically the same strain, i.e., "strain A". There were eleven of these populations and all of them quickly reached levels immensely in excess of anything that Park had observed for Tribolium castaneum in the cold-dry incubator, giving every indication that they were going to persist indefinitely. Obviously, Park's laboratory strain had become altered genetically in some way which affected its ecological performance in the cold-dry environment, and this happened in the short period between the times when we each withdrew beetles from the stock cultures to start our respective experiments, viz., between December 1950 and May 1953.

The most likely cause of this genetic change, I think, is that Park's inbred laboratory strain "A" was invaded by beetles from some other strain, probably "B". There is no proof that this is what happened, but there is enough circumstantial evidence to make the presumption plausible. The stock jars for several different strains were then normally kept together in the laboratory and at that time each jar was covered only by cotton gauze. I have since demonstrated that beetles are able to work their way through this gauze and drop to the flour inside, and it is well known that individual T. castaneum sometimes do fly (Park 1934). In fact, on one occasion I actually found several individuals of T. castaneum in a stock jar of the black mutant "ebony" of T. confusum, where their color made the intruders (or perhaps the progeny of a single intruder) conspicuous.

The strain in question, strain A, is the standard laboratory culture of Tribolium castaneum (sometimes designated "Chicago") then maintained by Professor Park, upon which a great deal of research had already been concentrated (Park 1948, 1954, 1957). In 1953 this strain had been cultured in the laboratory for about 20 years, or maybe even longer. A seeding was initially received in 1934 from Dr. N. E. Good of the United States Department of Agriculture, where the stock had been maintained for an unknown period. Strain B (sometimes called "Brazil") was originally obtained from Professor A. de Costa Lima of the Escola Nacional de Agronomia, Rio de Janeiro, in 1946; its history before that time is not known. The problem of the extinction of Park's populations in the cold-dry incubator has been commented on by Howe (1956). Howe notes that "very few F_2 can have succeeded in completing development" in these populations, and yet he gives data showing that his independent British strain of T. castaneum could be reared in a relative humidity of 30% at a temperature as low as 22.5°C.

Assuming that foreign beetles did get into strain A in Park's laboratory, there would have been excellent opportunities for a rapid change in the genetic constitution of the strain, stemming from the biological characteristics of Tribolium itself, in combination with the method which was used at that time to maintain stocks in the laboratory. This was to transfer several hundred adults or less to a large jar of fresh medium every two or three months. The (greatly expanded) next generation of adults appears in about a month's time and may perhaps destroy all but a small number of the pupae which appear during the next month or two. In view of the cannibalistic

habits of Tribolium, one can see how a fast developmental rate might be of enormous selective advantage in a culture which starts with all individuals of the same age. The largest larvae not only eat eggs and smaller larvae, but also are the first to become adults, whereupon they destroy many of the pupae which subsequently appear. Strain B, the presumed source of exogenous genotypes, was shown (Lloyd 1957) to complete its larval development in the cold-dry incubator about 3 to 6 days faster than strain A, as the latter was constituted in 1953. Since that time, Park, Leslie, and Mertz (1964) have developed (by inbreeding and selection, using material from various sources) four different genetic strains of both Tribolium castaneum and T. confusum--strains especially tailored for the study of interspecies competition, and maintained throughout in such a way as to insure their genetic isolation from one another.

My discovery in 1953 that strain A could now live in the cold-dry incubator meant, of course, that the "manipulated experimental" series (A"-1, A"-2, etc., and B"-1, B"-2, etc.) were quite pointless. These were discontinued after 7 weeks, their histories up to that time being essentially identical with the controls (A'-1, A'-2, etc., and B'-1, B'-2, etc.). The latter proved to be worth pursuing for quite a different reason than that originally intended, namely, the manipulations provided a means of keeping track of the number of pupae that were being cannibalized. The comparison between strains also proved interesting in this context. I will report on these manipulated populations, and on the other series (C-1, C-2, etc., and D-1, D-2, etc.) in subsequent papers. The purpose here is to present the data in full for the unmanipulated series (A-1, A-2, etc., and B-1, B-2, etc.)

Culture and census techniques--The minutiae of laboratory techniques for husbanding Tribolium populations hold no interest for the general reader. I believe, however, that one cannot hope to understand these populations without taking full cognizance of such minutiae, and that what may be valid for one imposed set of conditions, or one genetic strain, may be quite wrong for another. For this reason, I have felt free in this section to include everything that I think may be relevant.

The cold-dry incubator is a domestic refrigerator, six cubic feet in capacity, equipped with a thermostat, a small circulating fan, and a heating element. The relative humidity was kept around 30% by means of open trays of dehydrated silica gel. Condensed moisture on the cooling unit was periodically wiped dry with absorbent paper. The interior remained in darkness except when the door was opened, once to several times a day, to withdraw or replace beetles or to check conditions. Temperature and humidity records over the whole period averaged $24.0 \pm 0.6^{\circ}\text{C}$. and 31 ± 5 per cent, with standard deviations as shown. The culture medium was 95% fine whole wheat flour homogenized with 5% dry brewers' yeast, brought into equilibrium with the incubator conditions by remaining there several days prior to use.

The animals used to initiate the populations were all raised under cold-dry conditions at controlled densities. The flour in these culture jars was renewed every week, the new medium being quickly strewn on a piece

of construction paper and the larvae thoroughly dispersed in it (with the handle of a brush) before being returned to the jar. From previous findings it was predicted that 76% of the eggs for strain B, but only 33% of those for A, would survive to become large larvae. On this basis, a number of eggs was counted out for each culture jar such that the anticipated density of survivors would be about 10 per gram. After 28 days, the actual densities of larvae in these cultures ranged from 6.1 to 18.0 per gram. There was a striking negative correlation between survivorship and the amount of flour medium used in each container (mostly baby food jars), which ranged from 25 grams to 153 grams. This suggests to me that tamping down of the flour can be an important source of mortality for the larvae-- a situation I had not previously suspected. The largest culture was one in which I tamped down the flour a great deal in order to get more into the jar than it would conveniently hold. Survival was only 4% in that culture, so I discarded it altogether and was careful never to tamp down the flour in population vials.

The standard container for a Tribolium population, in this and a great deal of previous and subsequent work in Professor Park's laboratory, is an 8-dram glass shell vial. It measures 25 mm. in diameter by 95 mm. high, holding 8 grams of medium. This fills it less than half-way. The beetles, which spend much time on the flour surface, are unable to crawl up on the glass. The top is covered with coarse bolting cloth (29 meshes per inch) held with a rubber band.

The populations that I studied were first established in April, 1954. Room conditions during the following summer months in Chicago were of course warm and moist. It was necessary to carry out the census operations under room conditions, which meant exposing the weekly-censused populations for 2 or 3 hours each week to temperatures and humidities quite unlike those of the "cold-dry" incubator. In order to insure that this exposure should have no lasting effects on the beetles' habitat, i.e., in order to reduce the amount of moisture which the vial of fresh medium might absorb from room air while sitting on the laboratory table, each vial was covered with a special dehydrator cap containing silica gel. During the winter months, room conditions were much more like the incubator, and dehydrator caps were not used.

Census techniques for Tribolium have been standardized and briefly described by Park (1948, p. 268). The bolting silk used for sifting is stretched in a brass hoop, 12 cm. in diameter, from which it is removed, cleaned in 95% alcohol, and heat-sterilized in a drying oven between each census. Instead of brushing the animals from the bolting silk as Park describes, I removed them by inverting the hoop over a saucer and gently tapping on the stretched fabric. The larvae and adults clinging to the central portion immediately lose their footing and drop (about 5 cm.) into the dish; those on the perimeter are dislodged by poking at them through the fabric with a brush.

The contents of the saucer are gently shaken and blown upon. This removes the cast exuviae and many of the dried-up carcasses of partially

eaten pupae, which are collected on a piece of black construction paper. Any small larvae that blow out of the saucer are easily recovered because they cling to the paper when the other objects roll off (Saunders and Krueger 1957). The adults are unable to crawl up the smooth sides of the saucer, but each one tries to move up the nearest incline, so they soon arrange themselves in a ring around the perimeter of the saucer, leaving the larvae and pupae behind in the center. From this position the adults are brushed, a few at a time, into vertical sided glass dishes (finger bowls) for counting. The larvae and pupae are sorted and counted in the same way.

The sifted medium still contains the eggs and a few small larvae, so it is sifted again through a piece of fine bolting silk, which also retains a small amount of "frass"--empty egg shells, bits of exuviae, fecal pellets, and extra-large particles of flour. The larvae are removed by letting them cling to construction paper, and the eggs and frass arranged on a small plate of glass (about 11 cm. square) in a long continuous line turning back on itself in hairpin curves. This is done by bending the construction paper into a tilted U-shaped trough and gently rolling out the contents while moving the end of the trough back and forth over the glass plate. Since the eggs roll more readily than the frass, the latter becomes concentrated at the end of the line, whence it is easily brushed away. The eggs are counted under a dissecting microscope, following along the line, using transmitted light.

I found that magnification and transmitted light are necessary in order to distinguish egg shells and the yellowed, slightly shrivelled inviable eggs from the translucent, fully rounded living ones. It is imperative to make this distinction in order to avoid counting the same egg twice on successive weeks. Legitimately, almost no eggs should be counted more than once, because the normal hatching time at this temperature is about 7 days (Park and Frank 1948, Howe 1956). Despite my precautions, however, it is probable that some of the infertile eggs could remain healthy-looking for long enough to be counted twice or even three times. Therefore, low fertility (per cent hatch) inherently produces an upward bias in the egg count, and this makes the data on egg densities difficult to interpret. On the other hand, the studies of Rich (1956) and Sonleitner (1961) with marked eggs suggest that cannibalism rates (by adults alone--they did not study egg cannibalism by larvae) may be so high that an infertile egg has very little chance of remaining uneaten for a period longer than would be required for a fertile egg to hatch.

An earlier study with isolated pairs (Lloyd 1957) showed that eggs of strain A are considerably less fertile than those of strain B (per cent hatch below 80% for all pairs of strain A, above 80% for most pairs of strain B) and that fecundity is lower in strain A (a mean of 14.3 eggs per pair per 3-day period in A, 18.1 in B). To my surprise, the egg counts--the column marked "E" in the population histories to follow--tended to be higher in populations of strain A. The best indication of larval birthrate that I can give for populations of either strain is the count of first-instar larvae, in the column marked "(F)".

The census being completed, all living stages are placed into a new vial of fresh acclimatized medium. The exact manner of doing this is likely to be important, because it determines the spatial distribution of pupae and eggs within the vial, and this, in turn, undoubtedly affects the likelihood that they will be cannibalized. My method of placing the animals into the new vial was to drop all stages on top of the medium, tilt the vial about 45 degrees, and rotate it vigorously. This mixed the beetles into the top third or so of the flour.

I believed that this procedure would mimic the previous distribution of the various stages more closely than any other workable method that I could devise. This conviction was later confirmed by Ghent (1963) for large larvae, pupae, and adults, but not for eggs. Eggs are more numerous towards the bottom of the vial in undisturbed populations. Both adults and large larvae are voracious egg eaters, and both congregate towards the top of the vial.

At the beginning of the study there were 72 weekly-censused populations. the 12 replicates of each series were divided into three groups of four. Each group was to be censused on a fixed day of the week, groups of different strains on alternate days. The vials were assembled in a rack of wire mesh, their positions in the incubator being the same as the order of census (and numbering), i.e., each series was interdigitated with the others but not randomized. Owing to the pressure of time and the mounting numbers of things to count, the censuses tended to lag farther and farther behind schedule until, by the 14th week, I was forced to delete the count of eggs in order to catch up. In the population histories to follow, the "Age" is given in decimal fractions of a week, and is the actual age of each population when it was counted. Since fresh flour enhances fecundity (Park and Woollcott 1937, Sonleitner 1961), one would expect a somewhat higher egg count on a census coming after an interval of less than one whole week, and conversely.

Symbols.--The symbols used to head the columns are as follows:

- E Eggs
- (F) First-instar larvae. (Parentheses indicate that this count is included in S.)
- S Small larvae
- M Medium larvae
- L Large larvae
- P Pupae
- A Adults

The distinction between small and medium larvae was a subjective one. No measurements were taken, although preserved larvae covering the size ranges in each category were established as criteria. The large larvae were intended to comprise only the last instar; they were classified under a dissecting microscope by the relative size of the head capsule. Most large larvae were quiescent "prepupae." Photographs of these larval categories are given in the unpublished thesis (Lloyd 1957).

Weekly counts of dead stages are also given for these populations, coded by subscripted symbols, as follows:

- L_c Large larvae which had been partially cannibalized. They evidently do not become vulnerable until just prior to pupation; partially eaten medium larvae were never found.
- P_c Pupae, cannibalized. This count is inevitably biased downwards, because many of the carcasses were more than half eaten. Heads and tails were assembled to give a minimum estimate.
- Y_c Young adults, partially cannibalized. All were callow; fully-pigmented adults apparently suffer no predation. Callow adults are almost never more than half destroyed in one week, under these conditions.
- Y_{cf} Young adults, partially cannibalized, which also failed to eclose perfectly. Significantly too many of these tend to occur (judged by contingency, relative to the other categories), suggesting either that pupae having difficulty in eclosing become preferred objects for attack or else that slightly injured pupae go on living but cannot free themselves of the pupal exuviae, or both.
- Y_f Young adults which died in the process of eclosion, but without evident marks of injury.
- Y_d Young adults, dead from unknown causes. They were perfectly eclosed and bore no external marks of injury, but might have been injured in some other way (cf. Lloyd and Park 1962).
- A_d Adults, dead, but fully pigmented and bearing no marks of injury. Undoubtedly, many of them were relatively young; there were all shades of color represented, and the criterion "fully pigmented" is highly subjective.

Death of pupae owing to failure to eclose perfectly appears to be a frequent phenomenon at this temperature and humidity, and is related to mechanical disturbance, whether by the investigator or by adult beetles or larvae. Pupae by themselves, even at high density, can usually eclose properly if not disturbed, even at 24°C. and 30% relative humidity, in my experience.

Two other symbols are used in the population histories: the dash, indicating that no count was made for that particular category, and the

asterisk. One or two asterisks may appear next to the counts under M, L, or P, denoting one or two dead larvae or pupae (not included in the count) which bore no marks of cannibalism. Sometimes a "pupa" will acquire the full hardness and pigmentation of an adult, with no progress at all towards eclosion, and die in this condition. Such an individual was classified under Y_p , not as an asterisk in the P column.

Remarkably few dead larvae were found, which suggests that these cultures were not infected with sporozoan parasites (Park 1948). The dead larvae that did occur did not present the characteristic dark appearance of larvae killed by Adelina infection, except for a few, and microscopical examination of these carcasses never revealed any sporozoans during the 36-week period. These populations were kept going up until the 76th week, with much less frequent flour changes. By that time, a severe infection had appeared in populations A-9 and A-11, and also low-level infections in A-8, A-12, and B-2. The kinds of sporozoans involved were schizogregarines microsporidians, presumably Triboliocystis and Nosema respectively. The eugregarine, Adelina, was never seen.

The usual method of initiating laboratory populations of Tribolium has been with a small seeding of adults. This leads to a relatively high initial peak in adult numbers, followed by long-term oscillations about a somewhat lower average. In the present study, the populations were started differently, with larvae present as well. There were 23 S, 8 M, 7 L, and 8 A. Of the S, 13 were very small (4 to 5 days since hatching) and 10 were larger (13 to 14 days). Of the 8 A, 4 were callow (0 to 1 day after eclosion) and 4 were older (9 to 10 days), with sexes of each in equal numbers. This modification was intended to damp the initial peak by providing more crowded conditions at the time the first cohort of progeny appear, and to damp oscillations by assuring a fairly broad range in the age distribution of adults. Ideally, it was intended that the adult number should rise more or less linearly to its equilibrium level and then maintain that level without further oscillations. This result was achieved moderately well.

Minor errors in counting or classifying larval stages undoubtedly took place, and sometimes are reflected as internal inconsistencies in the counts. For example, in population A-7, the 10 M and 6 L recorded on the 3rd week should probably have been 9 M and 7 L, because 7 P appeared on the 4th week, and the 4 P present on the 3rd week are completely accounted for by 2 carcasses and 2 new adults. (The pupal period in both strains is about 200 hours under these conditions.) I have presented the data exactly as they appear in the notebook; anyone could make a posteriori corrections himself and, as it is, the internal inconsistencies may provide a rough estimate of reliability.

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POPULATION A-1

Age	E	(F)	S	M	L	P	A	L _c	P _c	Y _c	Y _{of}	Y _f	Y _d	A _d
0.000	0	0	23	8	7	0	8	0	0	0	0	0	0	0
1.000	47	0	22	3	6	6	8	0	1	0	0	0	0	0
2.000	106	7	26	9	8	1	13	0	0	1	0	0	0	0
3.000	105	17	47	18	2	8	14	0	0	0	0	0	0	0
4.000	95	16	58	9	13	3	19	0	1	1	0	0	0	0
5.036	130	21	58	16	7	11	19	0	0	0	0	0	0	1
6.125	152	13	62	18	11	8	24	0	3	0	0	1	0	0
7.048	59	4	46	15	19	5	29	-	-	-	-	-	0	0
8.280	153	6	66	22	14	17	30	0	2	0	1	0	0	0
9.161	169	14	76	18	16	16	35	0	1	1	1	1	0	0
10.280	112	23	79	34	19	16	40	0	2	0	0	0	1	1
11.262	144	15	65	32	22	22	46	0	3	0	0	1	1	0
12.262	135	12	67	29	24	22	50	0	5	0	1	0	1	1
13.286	113	8	50	29	28	19	57	0	6	1	0	1	0	1
14.476	-	-	-	35	19	27	55	0	11	1	0	0	2	1
15.149	206	10	51	27	27	25	56	0	2	0	1	4	0	0
16.131	200	30	75	24	23	19	59	0	6	1	1	2	1	0
17.006	170	16	85	15	19	20	62	0	9	1	0	1	0	0
18.101	185	23	85	32	10	25*	65	0	4	1	1	3	0	0
19.006	169	6	70	32	19	12	64	0	9	2	2	1	1	0
20.018	220	13	71	41	17	11	65	0	5	1	1	1	0	1
21.018	216	18	68	40	25	12	66	0	6	1	0	0	0	0
22.024	189	20	65	26	39	15	65	0	5	1	0	3	1	0
23.006	203	18	60	22	36	20*	66	0	6	1	2	1	0	0
24.018	254	11	52	24	25	28	65	0	12	2	0	0	0	0
24.958	286	17	51	22	21	25*	67	0	9	2	2	2	1	0
26.113	253	30	66	22	16	19	67	0	7	2	1	2	0	1
27.119	252	35	78	23	12	16	71	0	6	1	0	2	0	0
28.149	379	31	94	16	15	16	68	0	4	1	0	3	2	1
29.018	329	43	116	18	10	17	68	1	3	1	0	2	0	1
30.036	309	32	126	27	9	13	69	0	5	0	3	0	0	0
30.976	305	22	114	37	11	8	69	-	-	-	-	-	-	-
32.006	259	20	106	56	12	13	69	-	-	-	-	-	-	-
32.970	-	8	89	60	25	9	68	-	-	-	-	-	-	-
33.964	-	11	59	59	30	22	66	-	-	-	-	-	-	-
35.012	-	10	43	55	36	24	67	-	-	-	-	-	1	1
36.018	196	28	69	43	32	29	69	-	-	-	-	-	0	0

POPULATION A-2

Age	E	(F)	S	M	L	P	A	L _o	P _c	Y _o	Y _{of}	Y _f	Y _d	A _d
0.000	0	0	23	8	7	0	8	0	0	0	0	0	0	0
1.000	37	0	23	1	9	6	8	0	0	0	0	0	0	0
2.000	112	10	32	7	7	3	14	0	0	0	0	0	0	0
3.000	96	12	52	13	8	6	17	0	0	0	0	0	0	0
4.000	109	13	70	19	10	6	22	0	0	1	0	0	0	1
5.036	206	7	70	17	11	8	22	0	0	0	0	0	0	0
6.125	176	18	80	27	11	9	27	0	1	0	0	0	0	0
7.048	85	6	65	34	14	6*	26	0	2	0	0	1	0	2
8.280	121	7	52	27	30	14	30	0	2	0	0	1	0	0
9.161	200	14	51	13	32	28	28	0	3	0	0	0	0	1
10.280	163	15	65	19	18	26	34	0	13	1	1	0	0	0
11.262	212	27	84	14	16	19	43	0	5	1	0	3	0	2
12.262	238	19	86	21	8*	14	47	0	8	1	0	0	1	3
13.286	244	20	94	30	12	13	47	0	2	1	0	2	0	0
14.476	-	-	-	49	15	10	51	0	4	2	0	1	0	0
15.149	253	8	70	39	25	10	50	0	0	0	0	3	0	1
16.131	230	20	63	37	37	14	48	0	7	2	0	0	1	1
17.006	160	21	48	44	22	24	50	0	6	0	0	1	0	0
18.101	179	20	68	28	27	25	53	0	10	1	1	3	1	0
19.006	200	20	74	22	27	21	55	0	5	3	0	4	0	1
20.018	266	8	56	22	16	26	55	0	6	0	2	1	0	1
21.018	200	26	76	23	19	15	56	0	6	3	1	5	0	1
22.024	197	14	61	26	21	12	55	0	5	1	2	1	3	0
23.006	190	16	55	22	22	13	56	0	4	1	1	1	0	1
24.018	161	7	44	17	20	17	53	0	6	1	0	1	0	3
24.958	182	10	40	18	20	16	53	0	7	0	0	4	0	1
26.113	264	22	59	15	8	13	54	0	3	1	1	3	1	0
27.119	197	24	71	17	11	4	56	0	3	1	1	2	0	0
28.149	141	8	62	9	16	6	55	0	1	0	0	1	0	2
29.018	117	11	63	17	15	9	54	0	2	0	0	0	0	1
30.036	122	7	38	26	9	11	51	0	3	1	0	0	1	4
30.976	113	14	37	27	10	8	50	-	-	1	-	-	-	-
32.006	69	6	34	25	18	4	47	-	-	-	-	-	-	-
32.970	-	3	30	19	11	13	46	-	-	-	-	-	-	-
33.964	-	6	33	15	13	15	47	-	-	-	-	1	0	1
35.012	-	5	42	19	11	14	50	-	-	-	-	-	0	1
36.018	27	4	44	15	10	10	48	-	-	-	-	-	2	3

POPULATION A-3

Age	E	(F)	S	M	L	P	A	L _c	P _c	Y _c	Y _{cf}	Y _f	Y _d	A _d
0.000	0	0	23	8	7	0	8	0	0	0	0	0	0	0
1.000	57	0	20	0	8	7	8	0	0	0	0	0	0	0
2.000	110	7	26	8	7	3	13	0	0	1	0	0	0	0
3.000	129	15	43	11	8	6	15	0	0	0	0	0	0	0
4.000	129	16	70	11	9	4	17	0	2	0	0	0	0	2
5.036	149	12	68	14	8	9	19	0	0	0	0	0	0	0
6.125	115	19	79	17	10	8	23	0	1	0	0	1	1	0
7.048	113	5	56	19	16	5	25	0	1	2	0	0	0	1
8.280	120	10	56	26	25	11	25	1	2	0	1	0	0	1
9.161	147	15	77	16	26	18	26	0	2	0	0	1	0	1
10.280	87	16	85	23	17	27	30	0	2	2	1	3	0	0
11.262	155	9	74	31	18	28	34	0	7	1	1	0	0	1
12.262	157	12	59	34	27	21	40	0	3	2	1	4	1	0
13.286	209	15	52	38	20	21	47	0	5	3	0	0	0	0
14.476	-	-	-	33	22	25	53	0	7	0	0	1	0	0
15.149	215	4	35	29	26	19	53	0	7	1	0	3	2	0
16.131	328	18	40	21	22	22	57	0	8	2	0	1	0	0
17.006	342	30	78	16	17	20	60	0	7	1	0	2	0	0
18.101	336	29	103	12	14	14*	63	0	10	0	0	0	0	0
19.006	408	40	134	8	12	12*	63	0	5	0	1	2	1	0
20.018	476	35	130	32	4	14	65	0	5	0	0	1	0	0
21.018	289	27	127	43	13	5	67	0	4	1	0	1	0	0
22.024	202	12	95	34	29	4	68	0	2	0	0	2	0	0
23.006	214	6	65	41	38	12	68	1	3	0	0	1	0	0
24.018	227	15	47	58	31	32	66	0	4	0	0	0	0	2
24.958	217	26	53	39	45	30	66	0	8	0	2	3	0	0
26.113	171	13	52	22	60	26	68	0	13	1	3	1	1	1
27.119	214	17	57	15	40	37	68	0	11	0	1	3	1	1
28.149	343	13	56	19	17	42	69	0	20	0	2	3	0	1
29.018	346	37	74	32	10	29	72	0	13	0	2	3	1	1
30.036	299	25	71	25	12	10	71	0	12	4	3	3	3	2
30.976	278	21	73	21*	19	3	71	0	7	2	0	0	0	3
32.006	304	24	70	28	18	12	68	-	-	-	-	-	-	-
32.970	-	10	78	27	9	16	65	-	-	-	-	-	-	-
33.964	-	6	62	36	15	7	63	-	-	-	-	-	0	3
35.012	-	10	65	30	21	9	63	-	-	-	-	-	0	3
36.018	213	12	53	35	21	18	59	-	-	-	-	-	1	3

POPULATION A-4

Age	E	(F)	S	M	L	P	A	L _c	P _c	Y _c	Y _{cf}	Y _f	Y _d	A _d
0.000	0	0	23	8	7	0	8	0	0	0	0	0	0	0
1.000	61	0	20	1	7	7	8	0	0	0	0	0	0	0
2.000	133	3	17	10	3	5	12	0	1	2	0	0	0	0
3.000	139	17	45	11	8	5	14	0	0	0	0	0	0	0
4.000	163	18	61	5	12	5	14	0	2	1	0	0	0	2
5.036	176	15	77	7	4	14	14	0	1	0	0	0	0	0
6.125	186	28	103	17	7	3	22	0	6	0	1	1	0	0
7.048	124	17	86	21	9	4	23	0	0	0	0	0	0	1
8.280	145	16	83	33	21	11	23	0	0	0	1	0	0	2
9.161	131	21	92	33	26	19	26	0	0	0	2	0	0	0
10.280	110	11	81	34*	24	27	30	0	4	0	0	1	1	1
11.262	191	19	78	35	30	21	40	0	8	2	1	1	0	0
12.262	212	18	72	40	26	33	46	0	5	2	3	1	0	1
13.286	248	16	70	37	32	22	57	0	6	2	1	1	1	0
14.476	-	-	-	37	31	29	64	0	3	3	1	0	0	0
15.149	225	14	56	32	27	28	66	0	9	0	0	3	0	2
16.131	253	9	43	29	22	27	67	0	10	1	1	0	1	3
17.006	258	13	45	23	25	21	67	0	8	1	0	2	2	0
18.101	306	36	76	19	14*	25	67	0	10	1	1	0	1	1
19.006	459	22	88	19	10	21	68	0	6	1	2	0	0	1
20.018	386	29	104	22	14	9	68	0	7	1	0	5	0	1
21.018	385	18	83	30	14	10	68	0	5	0	1	0	0	1
22.024	304	12	80	32	16	9	69	0	3	0	0	1	0	1
23.006	284	17	68	34	28	11	66	0	3	2	0	0	1	2
24.018	308	15	59	41	22	10	66	0	5	0	0	2	0	0
24.958	295	23	46	25	27	29*	66	1	1	0	2	1	0	0
26.113	397	26	63	17	22	29	74	0	5	0	1	2	0	1
27.119	362	32	78	17	23	19	75	0	5	3	2	3	2	0
28.149	444	37	89	18	12	18	77	0	4	0	4	0	1	1
29.018	374	43	95	21	7	18	75	0	6	0	0	1	1	1
30.036	372	31	85	25	15	7	75	0	9	1	0	1	1	2
30.976	400	17	68	25	15	8	73	-	-	-	-	-	-	-
32.006	323	19	73	33	11	11	72	-	-	-	-	-	-	-
32.970	-	24	68	35	11	15	69	-	-	-	-	-	-	-
33.964	-	21	49	34	19	17	70	-	-	-	-	2	0	1
35.012	-	10	49	21	26	15	71	-	-	-	-	-	0	1
36.018	370	27	63	23	21	21	69	-	-	-	-	-	0	4

POPULATION A-5

Age	E	(F)	S	M	L	P	A	L _o	P _o	Y _o	Y _{of}	Y _f	Y _d	A _d
0.000	0	0	23	8	7	0	8	0	0	0	0	0	0	0
1.000	46	-	18	3	8	7	8	0	0	0	0	0	0	0
2.000	119	11	26	6	8	5	11	0	3	0	0	0	0	0
3.000	140	16	55	8	7	9*	11	0	0	0	0	1	0	0
4.000	193	13	80	6	10	6	16	0	0	0	0	0	0	0
5.060	185	11	88	13	7	7	20	0	0	0	0	0	0	0
6.149	202	41	169	49	6	7	22	0	1	0	0	1	1	0
7.113	105	8	60	35	24	3	23	0	1	0	0	2	0	0
8.464	117	2	43	34	26	21	24	0	0	0	0	1	0	1
9.393	176	19	54	34	22	32	25	0	2	0	0	0	0	0
10.280	173	18	74	22	22	24	39	0	6	0	2	3	0	0
11.286	218	19	122	16	14	34*	48	0	3	0	0	0	0	0
12.328	282	26	118	33	8	22	56	0	7	2	0	2	1	0
13.554	244	13	95	54	18	11	57	0	8	1	1	4	2	1
14.560	-	-	-	66	30	12	55	0	5	0	1	0	2	1
15.256	198	9	50	56	34	27	54	0	3	0	0	0	0	0
16.452	163	7	44	47	47	18	57	0	8	2	0	3	0	0
17.018	252	8	42	32	35	40*	60	0	1	2	1	1	0	1
18.030	295	17	51	22	27	42	63	0	16	0	0	1	0	0
19.000	325	28	91	21	20*	25	68	0	16	1	1	2	3	2
20.030	296	23	87	17	18	26	71	0	3	1	0	3	0	1
21.119	394	25	86	18	16	17	72	0	8	1	0	2	1	4
21.976	257	23	80	26	13	12	71	0	5	3	0	1	0	1
22.982	292	14	66	26	19	15	69	0	4	1	1	0	0	2
23.970	250	11	49	24	25	10	69	0	12	0	0	0	1	0
25.012	284	12	40	24	24	14	68	0	4	0	0	2	0	1
25.988	357	16	35	25	22	16	70	1	4	0	0	1	0	0
27.125	352	30	62	21	17	14	68	0	7	1	2	0	0	2
28.304	273	26	86	7	23	12	66	0	3	0	2	0	0	2
29.143	336	14	84	6	16	17	65	0	3	0	0	2	0	1
30.119	359	23	95	17	5	21	63	0	6	0	0	2	0	2
30.982	358	33	104	29	6	9	65	-	-	-	-	-	-	-
32.006	246	4	83	39	9	6	62	-	-	1	-	-	-	-
33.042	-	10	75	46	21	8	62	-	-	-	-	-	-	-
34.018	-	13	72	53	26	15	59	-	-	-	-	-	-	-
35.125	-	5	51	48	30	25	59	-	-	-	1	-	0	1
36.042	146	8	44	47	29	19	54	-	-	-	-	-	1	4

POPULATION A-6

Age	E	(F)	S	M	L	P	A	L _c	P _c	Y _c	Y _{cf}	Y _f	Y _d	A _d
0.000	0	0	23	8	7	0	8	0	0	0	0	0	0	0
1.000	46	-	17	3	7	7	8	0	0	0	0	0	0	0
2.000	131	6	19	8	5	4	15	0	1	0	0	0	0	0
3.000	126	11	40	8	7	7	16	0	1	0	0	0	0	1
4.000	176	24	58	1	10	7	18	0	1	0	0	0	1	0
5.060	149	21	78	4	2	12	20	0	0	0	0	0	0	0
6.149	194	25	79	12	2	6*	22	0	1	0	1	3	0	1
7.113	160	16	93	17	7	1	22	0	2	0	0	2	0	0
8.464	107	5	74	26	16	5	23	0	0	0	0	0	0	0
9.393	120	14	80	20	21	10	23	0	1	1	0	0	0	1
10.280	92	6	51	32	27	11	25	0	3	1	1	0	0	1
11.286	119	16	60	35	20	27	27	0	5	0	1	3	0	2
12.328	139	15	67	22	32	20	34	0	6	1	0	2	0	0
13.554	178	26	86	23	19	31	40	0	4	0	0	4	0	1
14.560	-	-	-	26	19	23	42	0	12	3	0	0	0	0
15.256	199	7	42	38	25	9	46	0	9	1	1	2	0	0
16.452	205	13	48	36	26	18	49	0	6	1	0	0	0	1
17.018	174	13	49	40	22	16	54	0	2	0	0	2	0	0
18.030	188	12	49	23	30	22	55	0	5	2	0	2	1	0
19.000	261	14	55	23	19	25	56	0	4	0	0	0	1	4
20.030	261	15	52	19	15	23*	57	1	8	0	0	2	2	0
21.119	254	25	80	18	8	13*	61	0	7	0	1	4	0	0
21.976	257	15	71	13	14	10	63	0	3	0	3	1	0	0
22.982	302	17	78	10	13	12	61	0	5	1	1	1	1	1
23.970	243	24	77	22	11	10	62	0	1	1	1	1	1	0
25.012	192	14	55	33	14	8	60	0	4	0	0	1	1	2
25.988	231	10	41	29	22	11	60	0	1	2	0	0	0	0
27.125	253	13	48	26	24	13	60	0	7	0	0	0	0	0
28.304	301	16	57	12	22	20	59	0	8	1	2	0	1	1
29.143	266	20	68	12	17	19	62	0	6	0	0	0	0	1
30.119	257	14	60	20	14	14	60	0	8	0	1	2	1	3
30.982	284	23	79	26	9	12	58	-	-	1	-	-	-	-
32.006	212	12	86	26	15	8	58	-	-	-	-	-	-	-
33.042	-	16	74	38	14	17	55	-	-	-	-	-	-	-
34.018	-	12	62	50	18	13	54	-	-	-	-	-	-	-
35.125	-	11	72	49	28	11	58	-	-	-	-	-	0	3
36.042	159	10	48	35	31	19	54	-	-	-	-	1	0	4

POPULATION A-7

Age	E	(F)	S	M	L	P	A	L _c	P _c	Y _c	Y _{cf}	Y _f	Y _d	A _d
0.000	0	0	23	8	7	0	8	0	0	0	0	0	0	0
1.000	57	-	17	3	7	7	8	0	0	0	0	0	0	0
2.000	161	17	29	9	4	5	12	0	3	0	0	0	0	0
3.000	141	11	34	10	6	4	14	0	2	0	0	0	0	0
4.000	166	24	64	5	10	7	17	0	0	0	0	0	0	1
5.060	163	18	64	9	4	6	16	0	3	0	0	0	2	0
6.149	165	28	71	14	4	7	19	0	1	0	0	1	0	0
7.113	157	15	65	21	8	6	20	0	1	0	0	0	2	0
8.464	131	7	58	19	14	11	23	0	0	0	0	1	0	1
9.393	142	9	49	22	16	15	23	0	5	0	0	0	0	0
10.280	152	8	50	16	21	14	25	0	5	1	1	1	0	0
11.286	119	14	53	22	20	19	28	0	1	1	0	0	1	1
12.328	179	13	54	19	17	23	32	0	3	4	0	0	0	0
13.554	187	11	46	21	18	16	42	0	3	1	0	2	0	0
14.560	-	-	-	26	14	17	46	0	1	0	1	0	0	0
15.256	227	15	54	26	19	16	47	0	2	0	1	0	2	0
16.452	245	25	66	25	16	16	48	0	5	0	0	0	1	2
17.018	241	15	66	18	20*	14	49	0	3	0	1	3	0	0
18.030	265	28	82	22	12	13	51	1	8	0	0	1	0	0
19.000	286	16	83	26	11	12*	53	0	5	0	0	2	1	0
20.030	280	27	84	32	20	9	54	0	8	0	0	0	0	1
21.119	253	21	78	32	30*	14	52	0	5	5	0	0	0	2
21.976	221	16	67	36	27	17	51	0	4	1	0	1	0	1
22.982	233	4	50	23	24	26	52	0	4	1	2	0	0	0
23.970	270	19	47	30	18	26	53	0	10	0	4	4	0	0
25.012	282	14	63	25	17	18	59	0	8	0	1	2	1	0
25.988	367	18	57	25	21	13	56	0	7	3	0	2	1	1
27.125	354	23	70	26	15	18	55	0	2	0	4	2	1	0
28.304	332	21	76	27	15	16	54	0	7	1	1	5	1	2
29.143	364	24	69	21	23	11	52	0	2	1	2	1	1	1
30.119	352	25	73	20	20	17	51	0	3	2	1	1	0	1
30.982	314	23	62	23	19	17	51	-	-	1	-	-	-	-
32.006	379	27	78	25	9	20	53	-	-	-	-	-	-	-
33.042	-	15	82	30	15	10	55	-	-	-	-	-	-	-
34.018	-	11	96	29	14	13	54	-	-	-	-	-	-	-
35.125	-	15	87	33	20	14	54	-	-	-	-	-	0	3
36.042	201	15	85	45	17	9	50	-	-	-	-	-	0	4

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POPULATION A-8

Age	E	(F)	S	M	L	P	A	L _c	P _c	Y _c	Y _{of}	Y _f	Y _d	A _d
0.000	0	0	23	8	7	0	8	0	0	0	0	0	0	0
1.000	51	-	24	1	7	7	8	0	0	0	0	0	0	0
2.000	114	5	33	5	8	3	12	0	1	1	0	0	0	0
3.000	115	13	71	13	4	9	12	0	1	0	0	0	0	1
4.000	106	18	72	10	12	7	14	0	0	0	0	0	0	1
5.060	110	12	87	19	10	9	18	0	1	0	0	1	1	0
6.149	118	19	80	36	8	10	26	0	0	0	0	0	0	0
7.113	104	6	73	39	19	5	31	0	3	0	0	0	1	0
8.464	118	7	64	26	23	28	31	0	3	0	0	0	0	0
9.393	134	18	71	29	20	36	38	0	5	0	0	0	0	1
10.280	189	26	77	31	20	21	52	0	9	0	0	0	0	0
11.286	224	9	81	27	23	22	60	0	4	0	0	0	1	1
12.328	231	10	59	46	17	25	64	0	8	2	2	0	0	0
13.554	211	6	60	40	20	23	68	0	12	0	1	2	1	0
14.560	-	-	-	44	28	16	66	0	10	2	2	1	1	1
15.256	233	14	49	32	31	22	69	0	4	1	1	2	0	0
16.452	308	14	58	31	22	21	71	0	13	0	0	1	0	0
17.018	354	25	70	27	19	27	73	0	2	0	0	4	0	0
18.030	310	29	89	31	18	17	73	0	15	2	0	4	0	1
19.000	302	18	92	24	25	13	76	0	3	1	0	1	0	0
20.030	298	11	76	30	25	14	75	0	7	0	0	0	1	0
21.119	295	12	63	36	26	18	75	0	12	1	0	1	0	0
21.976	263	16	56	37	24	16	74	0	8	1	0	1	0	0
22.982	278	30	79	28	31	24	76	0	5	1	0	1	0	2
23.970	326	29	92	22	24	25	78	0	9	0	4	1	0	0
25.012	278	17	78	23	22	22	78	0	8	2	3	0	0	1
25.988	398	22	71	22	21	21	78	0	7	0	1	3	0	0
27.125	339	25	74	30	25	15*	78	0	8	1	3	1	0	0
28.304	316	36	102	30	22	15	77	0	5	0	4	1	0	0
29.143	260	19	85	24	26	16	75	0	7	0	0	1	0	3
30.119	272	19	86	28	18	22	70	0	3	1	0	4	0	1
30.982	300	17	88	29	15	20	66	-	-	1	-	-	-	6
32.006	224	21	83	41	13	16	64	-	-	-	-	-	-	-
33.042	-	14	85	38	17	15	62	-	-	-	-	-	-	-
34.018	-	8	73	42	14	24	59	-	-	-	-	-	-	-
35.125	-	11	56	43	28	23	55	-	-	-	-	-	0	-
36.042	168	12	62	43	20	33	54	-	-	-	-	1	5	3

POPULATION A-9

Age	E	(F)	S	M	L	P	A	L _c	P _c	Y _c	Y _{of}	Y _f	Y _d	A _d
0.000	0	0	23	8	7	0	8	0	0	0	0	0	0	0
1.000	65	0	11	7	8	7	8	0	0	0	0	0	0	0
2.000	74	11	22	7	10	0	13	0	1	0	0	0	0	2
3.000	134	9	45	8	4	12	12	0	0	0	0	0	0	1
4.000	168	20	66	6	2	6	18	0	0	0	0	1	0	1
5.125	165	13	64	14	7	3	21	0	1	0	0	1	0	0
6.220	125	21	75	23	7	7	22	0	0	0	0	0	0	0
7.125	126	3	71	17	15	1	22	0	3	0	0	0	1	2
8.744	136	11	62	29	16	18	22	0	2	0	0	0	0	1
9.387	159	11	54	31	23	20	24	0	0	0	0	1	0	0
10.387	114	9	50	21	24	21	35	0	5	1	1	1	1	0
11.304	180	15	59	12	26	24	40	0	5	0	1	0	0	0
12.351	268	22	68	20	14	19	51	0	11	1	0	0	0	0
13.589	247	24	65	29	22	11	56	0	6	2	2	2	1	1
14.732	-	-	-	28	16	12	60	0	2	0	0	1	0	1
15.310	290	13	64	25	17	14	63	0	1	0	0	0	0	0
16.143	348	28	62	25	19	20	63	0	5	0	0	0	0	2
16.976	271	24	75	22	24	15	66	0	6	1	1	1	0	0
18.006	317	22	97	19	16	16	68	0	4	1	0	4	1	1
19.161	322	9	60	26	17	14	66	0	5	4	0	0	0	2
20.280	386	11	55	27	13	15*	65	0	5	1	0	1	0	1
21.161	339	24	61	39	13	12	66	0	4	0	0	4	0	1
22.030	233	7	52	27	23	9	64	0	1	0	0	0	0	0
23.167	295	15	48	11	28	14	61	0	4	1	0	2	0	2
24.137	303	20	53	10	18	24	62	0	4	0	2	1	0	0
25.149	308	42	88	8	12	17	67	0	8	2	0	3	0	1
26.030	373	39	83	18	8	13	65	0	4	2	1	2	0	2
27.435	317	-	75	23	10*	5	63	0	3	1	4	2	0	2
28.036	357	15	72	20	8	7	62	0	2	0	0	0	0	1
29.137	336	31	91	22	14	7	61	0	2	0	0	2	0	1
29.899	352	25	83	27	15	11	60	0	0	1	0	0	0	1
31.006	315	39	96	30	15	13	58	-	-	-	-	-	-	-
32.012	268	20	84	35	15	10	59	0	3	2	1	2	-	-
33.244	-	26	72	33	10	18	59	-	-	-	-	-	0	1
34.173	-	12	63	31	22	13	60	-	-	-	-	-	-	-
35.173	-	8	60	30	17	15	61	-	-	-	-	-	0	2
36.030	176	14	64	19	22	19	60	-	-	-	-	-	0	3

POPULATION A-10

Age	E	(F)	S	M	L	P	A	L _c	P _c	Y _c	Y _{cf}	Y _f	Y _d	A _d
0.000	0	0	23	8	7	0	8	0	0	0	0	0	0	0
1.000	66	0	9	6	8	7	8	0	0	0	0	0	0	0
2.000	126	9	12	4	11	1	14	0	0	0	0	0	0	1
3.000	191	6	45	2	8	8	15	0	1	0	0	0	0	0
4.000	209	17	71	2	2	7	15	0	4	0	0	1	0	1
5.125	174	19	80	17	2	4	16	0	4	0	0	0	0	0
6.220	197	8	61	18	10	3	16	0	3	0	0	2	0	1
7.125	93	9	52	28	21	2	17	0	0	0	0	0	0	0
8.744	88	7	43	17	22	21	19	0	2	0	0	0	0	0
9.387	204	12	43	23	18	18	26	0	0	0	0	1	1	0
10.387	158	20	65	22	18	19	34	0	7	0	0	1	0	0
11.304	184	9	55	13	17	15	37	0	7	1	0	2	0	1
12.351	260	6	42	22	13	18	40	0	4	2	0	1	0	0
13.589	216	32	74	27	13	15	48	0	4	0	0	0	1	0
14.732	-	-	-	20	18	10	48	0	8	0	0	1	0	2
15.310	246	6	71	14	21	13	49	0	2	0	0	0	0	0
16.143	255	9	47	36	14	20	48	0	4	0	0	0	1	2
16.976	300	20	54	38	10	19	53	0	6	0	0	1	0	0
18.006	156	24	66	30	28	8	55	0	6	1	0	2	3	0
19.161	165	5	48	13	30	26	56	0	1	0	1	0	1	0
20.280	249	8	46	16	18	36*	54	0	4	0	1	2	0	2
21.161	272	16	62	24	8	23*	57	0	13	2	2	3	0	0
22.030	235	21	57	30	13	13	55	0	10	1	1	0	1	3
23.167	188	16	53	19	21	9	55	0	4	0	1	2	0	1
24.137	234	16	42	12	21	13	53	0	5	1	0	0	1	1
25.149	278	10	34	13	9	25	53	0	7	0	0	0	0	1
26.030	341	19	46	13	11	18	54	0	5	3	1	0	0	0
27.435	256	38	87	15	10	8*	58	0	5	0	4	0	1	1
28.036	261	15	75	13	9	8	57	0	4	0	1	0	1	1
29.173	278	16	68	17	12	8	57	0	2	1	0	0	0	1
29.899	290	19	59	32	8	10	59	0	2	0	0	1	0	0
31.006	315	22	72	35	10	8	59	-	-	-	-	-	-	-
32.012	195	23	56	27	24	6	56	-	-	-	-	-	-	-
33.244	-	9	67	12	26	13	53	-	-	-	-	-	0	3
34.173	-	11	57	24	11	26	53	-	-	-	-	-	-	-
35.173	-	15	53	32	11	15	53	-	-	-	-	-	0	4
36.030	161	15	50	27	16	10	52	-	-	-	-	-	1	2

POPULATION A-11

Age	E	(F)	S	M	L	P	A	L _c	P _c	Y _c	Y _{cf}	Y _f	Y _d	A _d
0.000	0	0	23	8	7	0	8	0	0	0	0	0	0	0
1.000	60	1	9	8	7	7	7	0	0	0	0	0	0	1
2.000	135	16	41	6	8	4*	11	0	0	0	0	0	1	0
3.000	152	15	88	3	4	10	14	0	0	0	0	0	0	0
4.000	147	14	116	11	3	9	17	0	0	0	1	0	0	0
5.125	154	1	67	56	4	4	20	0	4	0	0	1	0	1
6.220	128	7	62	49	15	0	21	0	0	0	0	0	0	0
7.125	85	7	65	48	34	9	21	0	1	0	0	0	0	0
8.744	100	3	52	26	43	37	25	0	4	0	1	1	0	0
9.387	167	11	52	33	26	47	28	0	4	1	1	0	0	0
10.387	186	13	53	27	25	24	41	0	23	1	2	4	2	0
11.304	197	18	76	16	29	23	47	0	8	3	1	0	2	0
12.351	314	8	65	26	19	18	53	0	10	0	1	1	2	0
13.589	249	6	48	27	19	25	52	0	4	0	0	1	2	0
14.732	-	-	-	37	17	14	55	0	4	0	0	1	0	0
15.310	381	17	57	40	14	15	57	0	4	0	0	1	0	0
16.143	363	39	96	27	26	17*	54	0	5	1	0	0	1	1
16.976	214	22	111	22	23	18*	55	0	6	0	1	0	0	1
18.006	357	26	127	20	15	20	55	1	12	2	0	1	1	0
19.161	319	15	115	36	15	21	56	0	4	1	0	3	1	0
20.280	278	16	81	63	24	9*	53	0	9	0	1	1	0	5
21.161	241	8	74	58	31	11*	53	0	3	0	0	0	0	1
22.030	228	10	59	46	49	18	53	0	2	0	0	0	0	0
23.167	243	12	36	29	51	39	52	0	6	0	1	0	0	2
24.137	305	14	33	27	32	37	52	0	16	0	3	2	1	0
25.149	291	33	66	11	30	31	56	0	15	0	0	2	0	1
26.030	398	33	83	9	20	24	55	0	10	1	0	7	0	0
27.435	401	45	131	6	9	19	52	0	9	1	2	4	1	3
28.036	459	25	127	18	7	15	53	0	5	0	2	1	0	0
29.173	447	43	161	24	6	5	55	0	7	1	0	3	0	1
29.899	318	30	146	43	11	4	57	1	1	0	0	1	0	0
31.006	200	11	106	51	22	5	53	-	-	-	-	-	-	-
32.012	149	12	56	68	28	13	50	-	-	-	-	-	-	-
33.244	-	13	45	42	46	22	46	-	-	-	-	-	0	4
34.173	-	9	36	41	27	45	44	-	-	-	-	-	-	-
35.173	-	13	47	24	26	31	48	-	-	-	-	-	0	3
36.030	217	12	46	25	15	30	51	-	-	-	-	-	2	4

POPULATION A-12

Age	E	(F)	S	M	L	P	A	L _c	P _c	Y _c	Y _{of}	Y _f	Y _d	A _d
0.000	0	0	23	8	7	0	8	0	0	0	0	0	0	0
1.000	68	3	12	4	7	7	7	0	0	0	0	0	0	1
2.000	133	13	27	5	10	2	13	0	0	0	0	0	1	0
3.000	117	15	55	5	4	10	14	0	0	0	0	0	0	1
4.000	175	11	64	7	3	6	17	0	1	0	0	1	0	0
5.125	171	16	75	12	3*	5	16	0	1	0	2	1	0	1
6.220	149	16	82	22	6	3	20	0	0	0	0	0	0	0
7.125	118	10	66	22	12	2	20	0	1	0	0	0	0	0
8.744	132	15	62	24	18	11	19	0	4	0	0	0	0	1
9.387	175	13	62	27	10	23	21	1	0	0	0	0	0	0
10.387	134	11	63	29	26	11	29	0	7	1	0	0	2	1
11.304	196	17	78	20	24	21*	34	1	5	1	0	2	0	1
12.351	309	18	90	28	18	18	39	0	8	2	0	0	0	1
13.589	220	13	73	44	14	22	44	0	3	1	2	1	0	0
14.732	-	-	-	37	19	15	51	0	10	1	0	1	0	0
15.310	286	10	63	33	32	13	51	0	4	0	1	1	0	1
16.143	226	23	78	33	24	25	52	0	2	1	0	0	1	0
16.976	286	22	81	31*	16	32	53	0	8	1	2	0	1	1
18.006	244	40	102	26	25	18**	55	0	10	1	0	3	1	1
19.161	290	13	90	30	24	21	54	0	7	0	0	2	1	2
20.280	332	26	99	24	24	23	58	0	6	1	1	2	0	0
21.161	294	10	81	29	21	19*	62	0	4	0	0	1	1	0
22.030	294	30	91	31	21	17*	62	0	8	0	3	0	1	0
23.167	285	15	69	29	36	15	60	0	9	1	0	0	0	3
24.137	286	18	66	31	30	16	58	0	6	1	0	1	0	0
25.149	374	30	75	18	22	28	59	0	7	0	0	1	0	1
26.030	369	32	88	22	20	25	60	0	7	0	1	1	0	0
27.435	368	25	102	31	14	21	60	0	10	0	1	3	3	3
28.036	307	21	90	28	15	18	60	0	6	0	1	0	1	1
29.173	301	17	83	27	16	14	57	0	7	0	1	4	1	4
29.899	287	15	75	41	17	11*	56	0	6	1	0	1	0	0
31.006	294	20	81	43*	14	20	55	-	-	-	-	-	-	-
32.012	200	20	110	39	24	14	56	-	-	-	-	-	-	-
33.244	-	6	71	47	27	24	53	-	-	-	-	-	1	6
34.173	-	6	50	67	20	29	50	-	-	-	-	-	-	-
35.173	-	9	48	50	36	23	52	-	-	-	-	-	1	6
36.030	92	6	36	41	39	25	50	-	-	-	-	-	1	2

POPULATION B-1

Age	E	(F)	S	M	L	P	A	L _c	P _c	Y _c	Y _{cf}	Y _f	Y _d	A _d
0.000	0	0	23	8	7	0	8	0	0	0	0	0	0	0
1.000	63	0	11	8	10	7	8	0	0	0	0	0	0	0
2.000	142	22	59	5	16	2	15	0	0	0	0	0	0	0
3.000	143	-	94	9	6	13	17	0	0	0	0	0	0	0
4.000	122	15	98	31	9	7	24	0	2	0	0	0	0	0
5.000	93	16	91	49	10	8	26	0	1	0	0	0	1	0
6.006	59	16	82	43	41	4	31	0	0	0	0	2	0	0
7.066	69	5	73	43	38	19	32	0	2	1	0	0	0	0
8.018	89	10	53	35	54	16	32	0	8	0	0	0	0	0
9.125	136	17	63	29	38	36	36	2	6	0	0	3	1	0
10.256	107	14	71	32	27	20	45	0	19	0	2	5	0	0
11.268	113	6	56	22*	34	16	47	0	15	0	0	2	2	0
12.244	198	7	55	32	23	20	49	4	12	0	1	0	0	0
13.304	156	6	35	40	27	11	53	1	11	1	0	1	0	1
14.471	-	-	-	39	25	6	54	2	7	1	0	2	0	0
15.054	206	14	41	34	32	11	55	0	1	0	0	0	0	0
16.119	191	10	50	22	34	14	56	1	7	1	1	0	0	0
16.994	238	9	34	24	29	17	56	1	9	1	0	0	0	0
18.048	198	18	54	23	21	14	58	0	10	0	0	4	0	0
19.046	247	19	64	24	20	14**	61	0	4	1	0	1	0	0
20.129	273	14	79	20	17	11	63	1	6	0	0	1	0	1
21.159	160	25	95	21	19	11	65	0	4	2	0	1	1	0
21.968	192	22	115	22	18	12	65	0	2	0	2	0	1	1
23.028	203	22	105	27	24	10	65	0	5	1	0	0	1	0
24.028	150	2	70	43	24	10	64	0	5	0	0	0	1	1
24.957	155	5	52	47	38	12	63	0	4	0	0	0	0	0
26.017	159	18	46	49	35	14	63	0	5	0	1	0	0	1
26.969	169	4	32	43	37	20	64	0	5	1	0	0	0	0
27.993	173	17	45	27	42	22	64	0	5	0	2	0	1	0
28.993	219	10	40	21	35*	18	66	1	7	0	4	2	0	1
30.106	249	20	63	17	18	24	67	3	9	1	1	1	0	0
30.957	306	18	68	22	12	14	70	-	-	1	-	-	-	-
31.957	228	16	72	28	13	9	72	-	-	-	-	-	-	-
33.017	-	11	62	33	14	6	75	-	-	-	-	-	-	-
34.035	-	11	58	33	19	7	73	-	-	-	-	-	1	2
35.053	-	6	41	37	26	12	68	-	-	-	-	-	0	5
36.035	157	14	40	45	18	17	66	-	-	-	-	-	0	2

POPULATION B-2

Age	E	(F)	S	M	L	P	A	L _c	P _c	Y _c	Y _{cf}	Y _f	Y _d	A _d
0.000	0	0	23	8	7	0	8	0	0	0	0	0	0	0
1.000	11	0	13	11	7	7	8	0	0	0	0	0	0	0
2.000	85	6	19	6	16	2	14	0	0	0	0	0	0	1
3.000	109	10	46	13	3	10	16	1	1	0	0	0	0	0
4.000	170	24	92	11	9	6	17	0	6	0	0	0	0	0
5.000	91	3	88	24	8	6	19	0	0	0	0	1	0	0
6.006	69	10	80	37	16	6	21	0	2	0	0	0	0	0
7.066	81	9	69	44	24	4	24	0	2	0	0	1	0	0
8.018	59	10	52	44	39	11	24	0	3	0	0	0	0	0
9.125	93	6	45	31	48	26	28	0	1	0	0	1	0	0
10.256	81	6	34	33	39	28	33	0	11	0	1	2	1	1
11.268	108	11	28	20	31	33	40	0	11	2	1	1	1	1
12.244	131	18	43	13	35	22	48	0	12	1	2	1	0	1
13.304	158	20	62	5	26	25	53	1	2	1	1	0	1	1
14.471	-	-	-	20	12	16	56	1	17	1	1	1	1	1
15.054	241	23	85	28	8	16	57	1	2	0	0	0	0	0
16.119	146	4	75	37	14	8	57	1	8	1	1	1	1	1
16.994	117	8	64	45	20	2	58	0	5	0	0	1	0	0
18.048	114	13	34	59	27	10	57	1	2	0	0	0	0	0
19.046	140	9	25	47	40	13	58	0	3	0	0	2	0	0
20.129	145	8	27	22	50	15	58	0	8	0	0	1	1	0
21.159	194	7	27	11	42*	26	57	0	6	0	0	1	0	1
21.968	243	16	49	14	23*	36*	59	0	4	0	0	2	0	0
23.028	234	39	86	10	17	21*	62	0	20	0	0	3	1	0
24.028	288	22	96	17	5	12	62	0	11	1	0	2	1	2
24.957	290	23	131	16	14	9	57	0	4	0	0	1	1	4
26.017	195	7	117	35	11	5	60	0	4	1	0	0	0	1
26.969	173	2	88	59	17	5	60	0	3	1	0	1	1	1
27.993	143	14	71	80	24	8	58	0	3	0	0	0	1	2
28.993	71	10	52	77	40	13	55	2	1	0	0	0	1	2
30.106	91	4	41	49	57	20	55	0	5	1	0	0	1	1
30.957	100	2	19	46	59	25	54	-	-	-	-	-	-	-
31.957	139	10	20	36	41	37	57	-	-	-	-	-	-	-
33.017	-	18	48	22	29	29	56	-	-	-	-	-	-	-
34.035	-	6	43	17	24	26	62	-	-	-	-	-	1	3
35.053	-	8	50	28	11	28	66	-	-	-	-	-	0	2
36.035	188	25	85	29	14	7	73	-	-	-	-	-	0	5

POPULATION B-3

Age	E	(F)	S	M	L	P	A	L _c	P _c	Y _c	Y _{cf}	Y _f	Y _d	A _d
0.000	0	0	23	8	7	0	8	0	0	0	0	0	0	0
1.000	57	0	12	7	11	7	8	0	0	0	0	0	0	0
2.000	140	11	24	6	15	2	12	0	1	0	0	0	0	3
3.000	100	28	89	8	5	10	12	0	0	0	0	0	0	1
4.000	141	18	107	19	6	6	15	0	5	0	0	0	0	0
5.000	99	6	94	39	10	6	17	0	1	0	0	1	1	0
6.006	68	15	79	42	24	5	18	0	4	0	0	1	0	0
7.066	57	8	46	52	45	5	19	0	4	0	0	0	0	0
8.018	72	7	45	40	43	23	20	0	2	0	0	0	0	0
9.125	68	1	33	23	44	22	23	0	5	0	2	1	1	0
10.256	140	15	40	26	14	52	28	0	4	0	1	1	1	2
11.268	123	17	75	13	24	25	49	1	6	1	0	5	1	0
12.244	174	4	73	16	20	13	66	2	1	3	0	0	2	0
13.304	186	15	73	26	17	8	70	0	8	1	0	0	0	0
14.471	-	-	-	46	21	10	67	0	5	0	0	1	1	2
15.054	155	15	56	46	16	13	67	0	2	0	0	0	0	0
16.119	173	19	35	41	26	7	67	0	3	0	1	2	0	0
16.994	166	6	31	48	27	14	67	0	0	1	0	2	0	0
18.048	185	5	57	36	34	21	70	0	7	1	0	2	0	0
19.046	224	8	49	34	32	18*	72	0	7	3	0	0	0	0
20.129	176	13	39	31	30	17	71	0	5	1	1	2	2	0
21.159	251	12	34	29	29	12	71	1	6	1	0	1	0	1
21.968	168	10	36	20	28	15	70	0	5	0	0	0	0	1
23.028	185	17	47	9	32	14	69	0	4	0	0	0	0	1
24.028	276	18	64	16	21	14	70	1	9	0	1	0	0	0
24.957	246	27	75	25	16	15	70	0	6	0	0	2	0	0
26.017	205	22	76	22	20	7	69	0	4	1	2	3	0	1
26.969	189	9	64	23	24	6	67	0	3	0	1	0	0	4
27.993	168	9	48	32	25	6*	66	1	3	1	1	0	0	0
28.993	128	10	49	32	25	9	63	2	4	0	0	0	0	3
30.106	155	4	37	31	24	9	62	1	3	1	0	1	0	1
30.957	141	7	37	26	24	11	62	-	-	-	-	-	-	-
31.957	141	14	52	20	24	11	59	-	-	-	-	-	-	-
33.017	-	13	66	22	20	12	56	-	-	-	-	-	-	-
34.035	-	7	53	13	20	13	50	-	-	-	-	-	0	6
35.053	-	6	49	15	21	5	51	-	-	-	-	-	0	1
36.035	143	14	59	20	8	11	51	-	-	-	-	-	1	0

POPULATION B-4

Age	E	(F)	S	M	L	P	A	L _c	P _c	Y _c	Y _{of}	Y _f	Y _d	A _d
0.000	0	0	23	8	7	0	8	0	0	0	0	0	0	0
1.000	36	-	13	10	7	7	8	0	0	0	0	0	0	0
2.000	124	13	39	6	15	3	14	0	0	0	0	0	0	0
3.000	100	8	52	15	8	5	17	0	2	0	0	0	0	0
4.000	132	20	66	16	8	5	19	0	3	0	0	0	0	1
5.000	91	5	73	26	6	7	21	0	2	0	0	0	0	0
6.006	53	11	71	24	13	6	21	0	3	0	0	1	1	0
7.066	83	3	61	28	25	6	23	0	0	0	1	0	0	0
8.018	121	15	55	37	26	14	25	0	3	0	0	0	0	0
9.125	135	14	62	14	38	11	26	1	8	0	1	1	1	1
10.256	99	6	57	23	31	11	28	0	9	0	0	0	0	0
11.268	126	7	36	18	22	26	30	1	6	0	2	0	1	0
12.244	135	13	51	22	26	16	37	0	6	3	0	1	2	0
13.304	148	5	34	22	28	12	43	0	4	1	2	1	1	0
14.471	-	-	-	20	28	10	45	0	6	2	0	1	1	1
15.054	196	7	34	27	27	12	44	0	1	0	1	0	1	1
16.119	182	17	57	23	18	19	47	0	4	1	0	0	0	1
16.994	187	15	60	19	18*	16	51	0	8	0	0	0	0	0
18.048	197	20	88	27	22	17	52	0	10	2	0	2	2	0
19.046	196	6	56	47	18	10**	53	0	8	3	0	1	0	0
20.129	171	3	36	38	34*	8	53	0	6	1	0	0	0	0
21.159	165	4	30	32	41	10	52	0	3	1	0	0	0	1
21.968	175	6	28	34	33	23	52	0	3	0	0	1	0	0
23.028	174	25	57	17	38	24	51	1	13	0	0	0	1	0
24.028	201	13	56	7	34	20	52	1	13	0	0	0	1	0
24.957	229	19	64	12	22	19	52	0	11	1	4	0	0	1
26.017	230	24	77	25	10	18	52	0	9	0	2	0	0	0
26.969	245	23	89	28	11	13	51	0	6	0	2	4	2	1
27.993	226	27	99	36	16	6	52	0	6	0	1	0	1	0
28.993	125	11	103	43	23	5	53	0	2	1	1	0	1	0
30.106	112	4	88	34	34	7	52	1	5	0	0	0	0	1
30.957	133	1	46	52	34	8	51	-	-	-	-	-	-	-
31.957	157	5	19	71	38	11	51	-	-	-	-	-	-	-
33.017	-	12	39	64	43	6	50	-	-	-	-	-	-	-
34.035	-	8	72	24	58	13	53	-	-	-	-	-	0	0
35.053	-	2	43	23	54	18	51	-	-	-	-	-	0	3
36.035	178	7	33	14	13	31	51	-	-	-	-	-	1	1

POPULATION B-5

Age	E	(F)	S	M	L	P	A	L _c	P _c	Y _c	Y _{of}	Y _f	Y _d	A _d
0.000	0	0	23	8	7	0	8	0	0	0	0	0	0	0
1.000	42	-	6	10	7	7	8	0	0	0	0	0	0	0
2.000	106	5	31	7	14	3	15	0	0	0	0	0	0	0
3.000	110	7	77	5	8	11	17	0	1	0	0	0	0	0
4.000	110	12	83	26	7	6	24	0	0	0	0	0	0	0
5.000	81	3	84	29	11	4	28	0	0	0	0	0	0	0
6.113	64	10	65	38	20	6	30	0	1	0	0	0	0	0
7.119	92	2	49	41	23	11	32	0	3	0	0	0	0	0
8.339	65	4	62	28	37	21	35	0	4	0	0	0	0	1
9.494	111	5	48	33	28	23	37	0	8	2	0	4	0	2
10.327	146	13	56	28	23	26	43	0	7	0	1	3	0	0
11.321	137	16	69	28	27	21	48	1	9	0	0	1	1	1
12.250	171	8	69	27	24*	20	52	0	8	2	0	0	0	0
13.417	156	8	64	25	26	10	57	1	8	0	0	4	1	0
14.452	-	-	-	49	21*	7*	57	2	7	1	0	0	0	2
15.196	143	9	36	57	23	10	56	0	6	0	0	0	0	1
16.196	144	6	37	45	27	12	57	0	4	0	0	0	0	0
17.054	163	11	35	30	44	10	57	0	8	0	2	0	0	0
18.036	250	33	50	46	28	24	57	0	3	0	1	2	0	0
19.042	228	16	54	23	24	23	59	0	13	0	1	0	0	0
20.018	121	13	50	23	23	15	62	0	10	0	0	0	0	0
21.012	227	11	64	19	21	15*	61	0	6	1	0	0	0	0
22.042	225	18	85	17	17	14	64	0	7	0	0	3	1	0
22.982	224	18	83	24	17	13	65	1	5	0	0	1	0	0
23.964	249	18	87	22	18	14	64	0	5	1	0	0	0	1
24.982	161	14	75	36	22	10	63	1	6	0	1	0	0	2
26.042	142	12	69	36	29	10	60	0	4	1	0	1	1	2
27.161	177	6	46	48	30	10	61	0	4	0	0	0	0	0
28.256	156	6	38	43	37	16	60	0	2	0	1	2	1	0
29.125	149	10	38	32	43	19	60	0	6	0	1	2	0	0
30.030	180	11	37	28	41	17	60	1	10	0	0	1	1	0
30.982	162	14	50	24	29	31	61	-	-	-	-	-	-	-
32.125	232	23	73	19	23	23	65	-	-	-	-	-	-	-
33.042	-	21	75	24	18	14	67	-	-	-	-	-	-	-
34.143	-	16	89	33	14	13	68	-	-	-	-	-	-	-
35.131	-	7	73	51	13	11	68	-	-	-	-	-	2	0
36.149	105	5	70	45	23	5	65	-	-	-	-	-	0	3

POPULATION B-6

Age	E	(F)	S	M	L	P	A	L _c	P _c	Y _c	Y _{cf}	Y _f	Y _d	A _d
0.000	0	0	23	8	7	0	8	0	0	0	0	0	0	0
1.000	38	-	15	7	7	7	8	0	0	0	0	0	0	0
2.000	78	6	25	10	9	6	15	0	0	0	0	0	0	0
3.000	144	7	43	9	7	11	16	0	0	0	0	0	0	0
4.000	103	17	74	16	5	9	23	0	1	1	0	0	0	0
5.000	94	4	60	22	8	10	25	0	0	0	0	0	0	0
6.113	50	16	80	28	10	8	28	0	1	1	0	2	0	0
7.119	72	4	67	35	13	6	29	0	2	0	0	1	0	0
8.339	74	15	77	38	22	18	30	0	3	0	0	1	0	0
9.494	56	6	61	35	42	8	36	0	6	1	1	1	0	0
10.327	106	3	57	30	41	14	41	0	2	0	0	1	0	0
11.321	106	18	59	24	36	32	42	0	8	0	0	1	1	0
12.250	139	5	42	40	34	11	42	0	19	2	0	4	1	0
13.417	127	12	63	24	33	18	45	1	6	1	0	0	0	0
14.452	-	-	-	34	30	11	44	0	16	1	0	1	0	0
15.196	226	20	65	34	30	16	45	0	2	0	0	3	0	0
16.196	161	23	82	39	24	14	45	1	17	0	2	0	0	0
17.054	201	7	65	34	26	21*	45	0	4	0	0	0	0	0
18.036	181	13	68	36	23	24	48	0	3	0	1	2	0	0
19.042	175	8	49	34	28*	17	53	0	3	4	1	1	0	0
20.018	176	6	34	38	28	19	52	0	5	1	1	2	1	2
21.012	208	11	46	20	36	17	51	0	12	1	0	1	1	0
22.042	212	17	66	13	35	18	54	0	6	0	0	2	0	0
22.982	226	17	62	18	24	21	55	1	10	0	0	0	0	0
23.964	274	19	72	18	23	15	56	0	16	0	0	0	0	0
24.982	158	20	69	22	20	10	58	0	8	0	0	2	0	2
26.042	216	10	56	34	18	17	57	0	3	1	0	0	2	1
27.161	224	8	56	35	22	13	57	1	4	1	0	1	1	2
28.256	212	9	54	36	32	9	57	0	6	0	0	1	1	1
29.125	178	13	52	30	35	12	58	0	2	0	0	0	0	0
30.030	181	9	60	34	21	21	58	0	7	0	0	1	0	1
30.982	178	13	51	32	21	16	58	-	-	-	-	-	-	-
32.125	220	11	53	38	22	11	60	-	-	-	-	-	-	-
33.042	-	18	67	28	32	10	59	-	-	-	-	-	-	-
34.143	-	11	75	33	19	16	61	-	-	-	-	-	-	-
35.131	-	15	78	31	25	11	64	-	-	-	-	-	1	0
36.149	160	7	60	45	31	9	64	-	-	-	-	-	0	2

POPULATION B-7

Age	E	(F)	S	M	L	P	A	L _c	P _c	Y _c	Y _{cf}	Y _f	Y _d	A _d
0.000	0	0	23	8	7	0	8	0	0	0	0	0	0	0
1.000	58	-	12	13	4	7	8	0	0	0	0	0	0	0
2.000	108	14	50	2	14	3	14	0	1	0	0	0	0	0
3.000	158	11	78	5	7	13	14	0	0	0	0	0	0	1
4.000	128	12	89	24	4	7	23	0	0	0	0	2	0	0
5.000	70	6	57	25	11	7	25	0	0	0	1	0	0	0
6.113	86	21	95	51	20	4	25	1	2	0	0	1	0	0
7.119	83	3	75	59	24	10	26	1	1	0	0	0	0	0
8.339	147	21	130	40	43	16	26	0	10	1	0	0	0	0
9.494	90	5	56	50	40	25	30	1	8	0	1	0	0	0
10.327	119	3	50	35	44	33	36	0	5	1	0	1	0	0
11.321	137	15	42	41	44	34	47	0	7	0	0	0	2	0
12.250	146	12	43	29	46	24	50	4	10	1	2	0	4	1
13.417	174	1	18	18	33	10	51	1	22	1	0	0	0	0
14.452	-	-	-	15	26	14	50	0	12	0	0	0	0	1
15.196	205	15	59	14	18	20	51	1	5	0	0	1	0	0
16.196	208	20	76	17	15	12	51	0	11	2	0	1	1	0
17.054	203	10	58	25	15	10	51	0	4	0	0	1	1	0
18.036	165	17	54	30	12	11	51	0	2	3	0	1	1	1
19.042	160	8	58	27	19	8	52	0	4	0	1	1	0	0
20.018	130	11	52	27	25	9	53	0	7	0	0	0	0	0
21.012	152	5	45	33	23	11*	53	0	7	0	0	0	0	0
22.042	150	3	45	26	22	14	54	1	4	0	2	0	0	0
22.982	138	19	63	21	27	19	53	0	3	0	0	0	1	1
23.964	157	12	55	24	22	12	55	0	9	0	0	2	0	0
24.982	103	12	68	22	22	18	52	0	7	1	2	0	0	3
26.042	123	7	51	24	25	13	50	0	4	0	0	4	1	2
27.161	175	4	30	32	23	9	50	1	7	1	3	0	0	0
28.256	144	16	40	39	15	21	48	0	1	1	0	2	0	1
29.125	116	3	28	32	21	13	49	0	4	0	0	2	0	1
30.030	133	15	40	24	22	14	50	1	5	0	0	1	0	0
30.982	166	7	42	13	26	13	48	-	-	-	-	-	-	-
32.125	159	14	50	14	16	17	51	-	-	-	-	-	-	-
33.042	-	13	71	18	10	10	46	-	-	-	-	-	-	-
34.143	-	7	79	17	11	7	44	-	-	-	-	-	-	-
35.131	-	6	68	29	14	8	42	-	-	-	-	-	0	3
36.149	61	7	53	44	16	6	42	-	-	-	-	-	0	2

POPULATION B-8

Age	E	(F)	S	M	L	P	A	L _c	P _c	Y _c	Y _{cf}	Y _f	Y _d	A _d
0.000	0	0	23	8	7	0	8	0	0	0	0	0	0	0
1.000	63	-	14	10	6	7	8	0	0	0	0	0	0	0
2.000	104	14	30	10	14	3	13	0	0	0	0	0	0	0
3.000	112	5	42	10	8	9	13	0	0	0	0	0	1	0
4.000	107	9	55	25	9	8	17	0	4	0	0	1	0	0
5.000	75	6	57	25	11	7	20	0	2	0	0	0	0	0
6.113	57	8	54	33	19	5	23	0	1	1	0	1	0	0
7.119	72	7	56	38	15	9	24	0	3	1	0	0	0	0
8.339	72	6	43	34	30	25	27	0	1	0	0	0	0	0
9.494	79	8	66	20	28	19	36	0	6	0	1	3	0	0
10.327	109	8	51	22	28	13	37	0	9	0	0	3	2	0
11.321	120	11	52	28	21	21	40	0	5	1	0	0	0	0
12.250	169	12	66	31	23	17	45	0	2	2	1	1	0	0
13.417	99	8	60	28	28	10	47	1	5	2	1	3	0	0
14.452	-	-	-	28	29	13	48	0	8	0	0	0	1	1
15.196	126	7	37	38	26	14	48	0	5	0	0	1	1	0
16.196	118	19	43	40	21	18	50	0	2	0	1	0	0	0
17.054	149	5	32	30	21	19	51	0	4	0	0	0	1	0
18.036	125	15	43	18	26	16	56	0	6	1	0	0	0	0
19.042	183	5	48	14	21	14	55	1	7	2	0	0	0	1
20.018	227	14	55	16	14	16	55	0	7	1	1	0	0	0
21.012	158	14	55	25	13	11	56	0	5	1	0	1	0	1
22.042	168	3	49	22	15	6	55	0	8	0	0	1	0	1
22.982	257	35	96	23	15	9	54	0	3	0	0	0	0	1
23.964	161	3	52	18	22	8	55	0	1	1	0	1	0	1
24.982	146	19	57	21	24	9	54	0	4	0	0	0	1	0
26.042	177	12	48	28	17	15	53	0	3	0	1	0	0	2
27.161	197	17	58	30	18	14	52	0	2	0	1	2	0	1
28.256	158	15	69	29	24	7	52	0	7	0	1	0	1	3
29.125	137	19	75	23	24	11	48	0	4	0	1	0	1	3
30.030	115	12	59	39	21	13	46	0	5	0	0	0	0	2
30.982	135	9	60	45	13	20	45	-	-	-	-	-	-	-
32.125	76	12	53	43	27	4	46	-	-	-	-	-	-	-
33.042	-	6	46	39	29	11	44	-	-	-	-	-	-	-
34.143	-	6	40	38	29	19	45	-	-	-	-	-	-	-
35.131	-	3	28	33	32	15	47	-	-	-	-	-	1	3
36.149	53	4	29	19	36	21	45	-	-	-	-	-	1	4

POPULATION B-9

Age	E	(F)	S	M	L	P	A	L _c	P _c	Y _c	Y _{cf}	Y _f	Y _d	A _d
0.000	0	0	23	8	7	0	8	0	0	0	0	0	0	0
1.000	42	-	14	6	8	7	8	0	0	0	0	0	0	0
2.000	79	7	28	8	9	5	14	0	0	0	0	0	1	0
3.000	117	9	74	7	10	9	14	0	1	1	0	0	0	0
4.137	90	18	96	11	10	7	18	0	0	1	0	1	0	0
5.149	70	3	47	45	12	10	20	0	1	0	0	2	0	0
6.202	55	10	66	49	22	2	26	0	1	0	0	1	0	0
7.208	39	17	45	43	42	10	25	0	0	0	0	0	0	1
8.613	63	4	46	22	40	32	27	0	7	0	0	1	0	0
9.387	119	13	43	24	28	35	38	0	11	0	0	0	0	0
10.339	99	12	61	20	26	21	46	0	9	3	0	3	4	0
11.304	128	7	67	14	21	19	48	0	11	0	1	5	2	0
12.411	178	6	43	33	20	14	50	0	6	0	0	1	2	1
13.619	135	22	60	40	22	6	49	0	10	1	0	0	2	0
14.577	-	-	-	43	21	13	48	1	1	1	0	0	1	0
15.398	127	1	46	32	31	8	48	0	11	0	0	0	0	0
16.339	117	12	43	23	33	17	48	0	7	0	0	1	0	1
17.024	166	3	35	25	24	29	48	0	3	1	0	0	0	0
18.071	153	14	42	27	20	21	54	0	10	1	0	1	2	0
19.042	168	16	49	22	19	15	57	1	4	0	1	1	1	1
20.018	185	10	48	21	23	7	59	0	6	0	0	0	2	2
21.024	242	17	55	20	19	10	57	0	7	0	0	0	2	1
22.000	193	24	75	19	15	15	57	0	4	0	0	0	0	0
22.976	214	7	69	17	20	11	56	0	5	0	1	0	0	1
24.006	185	27	74	24	21	10	57	0	6	1	0	0	0	0
25.018	156	5	65	33	15	14	55	0	9	0	0	1	0	2
26.125	208	10	59	25	26	9	54	0	5	0	1	1	0	2
27.167	160	12	52	31	33	7*	52	0	2	2	1	0	2	1
28.018	195	15	45	35	38	14	50	0	1	1	0	0	0	2
29.107	114	24	58	34	25	17	46	0	11	0	1	1	1	4
30.125	112	3	36	22	31	16	46	0	2	0	0	0	0	0
30.982	178	8	26	27	29	17	49	-	-	-	-	-	-	-
31.970	193	21	45	27	17	29	50	-	-	-	-	-	-	-
33.149	-	23	85	19	17	16	57	-	-	-	-	2	0	4
34.006	-	7	73	10	21	10	59	-	-	-	-	-	-	-
35.036	-	3	56	16	17	11	61	-	-	-	-	-	0	1
36.042	168	17	48	45	16	10	57	-	-	-	-	-	0	4

POPULATION B-10

Age	E	(F)	S	M	L	P	A	L _c	P _c	Y _c	Y _{cf}	Y _f	Y _d	A _d
0.000	0	0	23	8	7	0	8	0	0	0	0	0	0	0
1.000	50	-	15	9	6	7	8	0	0	0	0	0	0	0
2.000	82	15	47	6	15	1	14	0	0	0	0	0	0	0
3.000	117	10	82	10	7	11	15	0	0	0	0	0	0	0
4.137	150	-	91	25	6	11	18	0	1	0	0	0	1	0
5.149	91	11	84	42	10	6	26	0	1	0	0	1	0	0
6.202	57	8	78	49	22	2	28	0	1	0	0	0	0	0
7.208	50	14	60	38	48	7	28	0	0	0	0	0	0	0
8.613	78	2	53	39	35	23	28	0	12	0	0	0	0	0
9.387	104	12	51	38	34	32	30	0	11	0	0	0	0	0
10.339	109	15	62	30	40	30	37	0	5	1	0	0	3	0
11.304	111	5	60	27	36	26	41	2	12	2	3	2	1	1
12.411	146	7	39	36	33	18	43	0	14	2	0	2	0	0
13.619	146	11	43	36	29	19	45	0	10	1	0	2	0	0
14.577	-	-	-	35	25	19	44	0	10	0	2	0	1	1
15.398	175	6	54	19	35	16	46	0	4	1	0	0	1	0
16.339	135	6	58	26	22	18	49	0	10	1	0	0	0	0
17.024	212	6	45	29	26*	19	48	1	6	0	0	1	1	0
18.071	177	26	81	41	18	18*	52	2	4	1	0	1	1	0
19.042	180	5	70	33	26	7	55	0	11	1	0	0	0	0
20.018	162	9	65	24	34	7	51	1	4	0	0	0	3	1
21.024	213	4	48	24	33	12	50	0	5	0	0	0	0	0
22.000	132	9	37	33	23	14	50	2	12	0	0	0	0	1
22.976	158	10	47	23	38	9	48	0	6	0	1	1	0	2
24.006	144	11	37	23	32*	8	49	0	4	0	0	0	0	0
25.018	179	7	44	13	29	15	47	0	4	0	0	0	0	2
26.125	167	23	64	20	20	17	46	0	4	0	3	1	0	1
27.167	264	11	57	19	21	17	46	0	5	1	2	2	0	0
28.018	215	31	93	19	22	11	47	0	6	0	0	0	1	1
29.107	203	6	83	27	13	6	45	1	9	1	0	1	1	1
30.125	176	15	73	44	14*	13	43	0	4	0	0	0	0	2
30.982	187	9	54	53	20	5	44	-	-	-	-	-	-	-
31.970	153	14	62	53	26	10	44	-	-	-	-	-	-	-
33.149	-	6	46	53	32	13	39	-	-	-	-	-	1	6
34.006	-	4	41	33	42	17	37	-	-	-	-	-	-	-
35.036	-	12	34	21	55	16	33	-	-	-	-	-	0	3
36.042	167	12	39	26	30	33	31	-	-	-	-	-	0	4

POPULATION B-11

Age	E	(F)	S	M	L	P	A	L _o	P _o	Y _c	Y _{of}	Y _f	Y _d	A _d
0.000	0	0	23	8	7	0	8	0	0	0	0	0	0	0
1.000	29	-	17	7	7	7	8	0	0	0	0	0	0	0
2.000	106	6	21	9	8	6	14	0	0	0	0	0	0	1
3.000	112	7	48	12	9	6	18	0	1	0	0	0	0	0
4.137	139	16	86	17	8	10	21	0	0	0	0	0	0	0
5.149	141	13	85	30	8	11	24	0	1	0	0	0	0	0
6.202	114	16	109	26	16**	3	26	0	6	0	1	2	0	1
7.208	67	34	98	39	31	3	27	0	0	0	0	0	0	0
8.613	102	9	83	44	48	25	25	0	5	0	0	0	1	1
9.387	102	5	41	54	38	17	27	0	10	0	0	0	0	0
10.339	99	18	53	38*	47	26	30	0	8	1	0	0	2	0
11.304	146	10	53	16	45	29	37	0	11	3	0	0	0	0
12.411	188	13	58	18	36	27	42	0	9	0	0	0	1	0
13.619	225	15	56	33	15	33	50	0	4	1	1	3	2	0
14.577	-	-	-	21	26	12	57	0	13	2	0	1	0	0
15.398	247	11	71	25	28	8	60	0	7	0	1	1	0	0
16.339	228	16	60	40	17	19	58	0	3	0	0	0	0	3
17.024	263	9	50	38	20	18	59	0	8	2	0	0	0	0
18.071	188	12	53	37	26	12	60	1	7	0	0	1	0	0
19.042	190	7	48	25	41	9	62	0	6	1	0	1	0	0
20.018	141	10	47	24	27	27	60	0	5	0	0	0	1	1
21.024	276	3	39	26	29	19	59	1	12	3	0	3	0	1
22.000	211	16	40	29	26	12*	57	2	10	1	1	0	2	1
22.976	203	22	59	25	23	13	56	0	3	0	1	2	0	0
24.006	183	21	69	15	26	16	56	1	7	0	0	0	0	1
25.018	207	11	66	13	28	7	58	0	6	0	3	1	0	1
26.125	268	16	93	25	15	16	56	0	3	0	1	1	0	2
27.167	247	23	97	42	15	16	55	1	6	0	0	0	0	3
28.018	199	27	102	39	27	5	55	0	7	0	0	3	1	0
29.107	140	11	95	35	36	8	53	0	3	0	0	0	1	2
30.125	145	9	51	56	38	12	52	0	3	0	0	0	0	1
30.982	188	10	42	61	37	7	48	-	-	-	-	-	-	-
31.970	144	14	59	46	43	16	51	-	-	-	-	-	-	-
33.149	-	9	56	32	37	19	50	-	-	-	-	-	0	2
34.006	-	4	45	20	36	24	48	-	-	-	-	-	1	1
35.036	-	9	34	31	25	32	47	-	-	-	-	-	1	4
36.042	94	20	65	27	18	26	51	-	-	-	-	-	2	4

POPULATION B-12

Age	E	(F)	S	M	L	P	A	L _c	P _c	Y _c	Y _{cf}	Y _f	Y _d	A _d
0.000	0	0	23	8	7	0	8	0	0	0	0	0	0	0
1.000	50	-	8	7	11	6	8	0	1	0	0	0	0	0
2.000	97	9	37	3	17	1	14	0	0	0	0	0	0	0
3.000	117	6	64	10	6	13	14	0	1	1	0	0	0	0
4.137	140	18	78	19	7	7	20	0	1	1	0	1	0	0
5.149	133	18	76	56	11	9	23	0	2	0	0	0	0	0
6.202	69	21	106	38	24	5	24	0	0	0	0	0	0	0
7.208	37	15	66	33*	39	5	25	0	2	0	0	2	0	0
8.613	85	2	44	42	33	23	26	1	8	1	0	1	0	0
9.387	131	14	46	36	42	19	30	0	11	1	0	2	0	0
10.339	110	12	61	16	53	23	32	0	5	1	2	0	1	0
11.304	114	13	60	19	34	35	36	0	6	2	1	2	0	0
12.411	172	7	63	24	22	19	40	0	14	1	2	4	2	0
13.619	130	8	54	34	22	17	43	0	6	1	0	2	2	1
14.577	-	-	-	33	28	8	47	0	5	1	1	2	0	0
15.398	178	7	46	30	32	15	49	0	2	0	0	0	0	1
16.339	117	9	46	36	23	20	52	0	4	1	0	0	1	0
17.024	247	9	48	31	21	27	57	0	1	2	0	0	1	0
18.071	149	25	72	25	27	14	60	0	7	2	0	1	1	2
19.042	208	9	50	28	21	11	66	0	8	0	0	1	0	0
20.018	193	11	53	25	24	19	65	0	4	0	0	0	1	0
21.024	185	11	49	36	22	12*	64	0	7	0	0	1	0	2
22.000	183	9	41	31	29	9	63	0	9	0	1	1	1	0
22.976	198	10	51	21	29	16	64	0	2	1	0	0	0	0
24.006	181	12	50	19	30	16	63	0	8	0	0	0	1	0
25.018	213	13	52	17	20	24	61	0	8	0	1	0	1	1
26.125	249	18	63	23	15	17*	64	0	10	1	0	0	1	0
27.167	263	20	69	27	22	7	64	0	9	1	1	1	1	0
28.018	289	23	92	26	22	7	62	0	3	0	1	1	1	1
29.107	197	20	101	31	26	13	61	0	2	0	0	0	0	2
30.125	163	14	78	47	22	12	62	0	6	0	1	2	0	1
30.982	226	11	64	53	25	13	62	-	-	-	-	-	-	-
31.970	150	9	55	58	36	6	64	-	-	-	-	-	-	-
33.149	-	8	46	50	36	22	59	-	-	-	-	-	2	3
34.006	-	3	41	40	46	21	62	-	-	-	-	-	-	-
35.036	-	11	39	27	46	23	60	-	-	-	-	-	0	4
36.042	184	14	46	30	28	35	57	-	-	-	-	-	2	5