will protect from recombination the chromosome more efficiently than would any single inversion of comparable size. Van Valen (1961) studied a new inversion spontaneously appearing in a population of *D. pseudoobscura*. An increase in frequency was followed by a decrease. This was interpreted as indicating exchange of alleles between the new inversion and the common preexisting gene arrangement leading to shifts in karyotypic fitness. These laboratory experiments reveal that retention of inversion is dependent upon its combining abilities with other chromosomes in the population, that is, its ability to be heterotic with other gene arrangements.

It could be said that most often moderately sized inversions are favored due to trade-off between long and short inversions. Long inversions have a higher probability of capturing favorable sets of alleles solely because they capture more of the genome. However, they may loose their favorable content at a higher rate due to double cross overs. Shorter inversions have a low probability of capturing favorable combinations of alleles, but once they do they retain them more efficiently than do longer inversions (Krimbas and Powell, 1992). Also, the role of gene recombination could be important in two ways, one is the production of such gene combinations that are of rare permanent advantage to the species (three cosmopolitan inversions in *D. ananassae*). If the advantageous gene combinations are preserved due to inversion heterozygosity and become established in its genetic structure, then, the inversion heterozygotes prove to be an asset to the species. Second is the production of disadvantageous gene combinations as an insurance against the period when some of them might be needed for adaptation of the population.

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A study of P element and hybrid dysgenesis phenomena in some *Drosophila melanogaster* populations from Turkey.

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Mobile or transposable elements are DNA sequences that have the ability to integrate into the genome at a new site within their cell of origin (Kazazian, 2004). Over the last two decades a large

number of transposable elements have been identified in a wide variety of evolutionarily distant organisms, where they often represent a large fraction of the genome: 12% in *Drosophila*, 45% in humans, 50% in maize and up to 90% in some plants (Dimitri *et al*., 2003). There are more than 40 mobile elements in *Drosophila* genome (Rasmusson *et al*., 1993). P element is the most studied one among them (Dominguez and Albornoz, 1996; Dimitri *et al*., 2003). The number of P transposable elements in any natural population of *Drosophila melanogaster* can categorically be characterized within the dysgenesis system, P and M (Kidwell, 1983a; Kidwell,1986; Engels, 1996; Ozsoy, 2000). In the P-M system, three classes of strains P, Q, and M, have been described on the basis of their phenotypic properties (Kidwell, 1985). P strains have the P cytotype. These strains have the potential to produce variable degrees of P factor activity. M strains possess M cytotype and are divided into two subcategories, true M and M' (pseudo-M). True M strains completely lack any members of the P element family. M' strains carry a variable number of P elements, many and sometimes all of which may be defective. The M' type is common in strains recently derived from natural populations in Europe and Asia (Kidwell, 1986). Hybrids between P strain males and M strain females how significant frequencies of dysgenic traits, notably gonadal dysgenesis (GD sterility) and singed-weak mutability. Q strains are considered to be a subset of P strains; they do not show gonadal sterility in any strain combination, but can produce low frequencies of other dysgenic traits, such as singed-weak mutability and male recombination, in crosses with M-strain females (Kidwell, 1985). The P element-associated dysgenesis, hybrid dysgenesis, of an individual fly is thought to be determined by the very presence of genomic P elements in that fly, and the categories are constructed by the levels of dysgenesis measured by appropriate genetical tests (Kidwell, 1986; Engels, 1996). Geographical variation in P element numbers of natural *D. melanogaster* populations (corresponding to their P-M status) has been documented. Major continental differences in the genomic distribution of P elements are observed when present-day American and European populations are compared. Almost all American populations are of the P/Q type, but in European populations P strains are rare and M' strains are common. The level of P-element susceptibility varies widely across a gradient from west to east (Anxolabèhère *et al*., 1988).

In this study, 6 geographically different natural populations of *Drosophila melanogaster* from Turkey (Ankara, Kerpe and Giresun) were examined and their P-M statuses were determined by using Gonadal Dysgenesis (GD) Sterility Assay. Four Central Anatolian (Eryaman 1, Eryaman 2, Ayrancı, Beytepe; four local populations in Ankara) and two Northern Anatolian (Kerpe and Giresun) populations were collected during the summer. At each location the number of the flies collected exceeded 50 individuals per population. The GD sterility assay allows one to analyze the results of dysgenic crosses with marker strains, the visible changes in the overall morphology of gonads of the F1 female progenies caused by P mobility at developmental temperature above 25°C (exactly 29°C in this study), to determine P-M categories in an easy way (Ozsoy, 2000). Two types of mating, termed as "Cross A" and "Cross A*", were done to determine the P activities and cytotypes of tested natural populations. Cross A and A* were done as three replicas for every natural population (see Kidwell, 1986, for experimental setup and the marker strains used in these specific crosses). Parental hybrid matings were made in culture bottles that contained a standard *Drosophila* medium and immediately placed at 29°C until the eclosion of F_1 progeny. F_1 females were aged for three to five days after eclosion in order to allow any oocytes present to undergo full maturation. Ovaries were dissected into water. Observations were made with a stereodissection microscope at magnifications ranging from 10.5 to 45× (see picture in Kidwell, 1986). The frequency of ovarian dysgenesis was calculated as the number of dysgenic ovaries divided by the total number of ovaries examined, and cytotypes were determined according to the standard table given in Kidwell 1986 (Table 1).

Table 2 shows the percentage dysgenesis levels per population for the activity potentials and regulatory abilities. According to GD sterility assay, Ery-2, Beytepe and Giresun populations were defined as M' (pseudo-M); Ery-1, Ayrancı and Kerpe populations were determined as Q (weak-P). The highest P activity (58.3%) was obtained in Giresun population and the smallest (2.5%) in Kerpe population. %GD sterility of natural populations in Cross A and Cross A* is illustrated in Figures 1 and 2.

The populations were sampled from two ecologically distinct regions; Central Anatolian and Northern Anatolian parts of Turkey. The P-M status distribution of the populations determined by using the standard table of Kidwell (1986) resembles Eurasian strains which were mentioned Kidwell (1983b). The P-M category of Kerpe population collected from West Black Sea region was defined as Q strain (2.5% GD sterility), that of Giresun population collected from East Black Sea region was determined as M' strain (58.5% GD sterility). Therefore, it can be said that the strain type and the amount of %GD sterility in Black Sea region may change in an easterly direction. To justify this hypothesis, studies should be extended by raising the number of samplings from west to east, in other following cases. Moreover, it was found that Ery-1 and Ayrancı populations were Q strain; Ery-2 and Beytepe populations were M' strain. The finding of the four populations collected in Ankara is considered as a supporting proposal that fruit flies may have genetical varieties. So it is natural to expect more particular differences between two areas considering the fact that some GD sterility differences were gained even in districts of Ankara.

Table 1. Characteristic values for GD sterility in standard tests of various categories of strains (After Kidwell, 1986).

Strain type	%GD sterility	
	Cross A	**Cross A***
M (true)	0	100
M' (pseudo – M)	0 - ?	0 – 100
Q (weak P)	0 – 10	0 - 10
P (moderate)	11 – 80	0 - 10
P (strong)	81 - 100	0 - 10

The P-M status distribution of the different natural populations in Turkey has been investigated by some researchers (Konac and Bozcuk, 1990; Konac *et al*., 1995; Ozsoy and Bozcuk, 2000). But these results are not completely satisfactory to draw a general conclusion for Turkey concerning P-M status. The natural populations collected from different regions can be helpful in revealing a map of Turkey's P-M system.

Table 2. Percentages of gonad dysgenesis in the different natural populations of *Drosophila melanogaster*.

Natural Populations	**Temperature**	Cross Types						% GD sterility		Strain types
		2N		1N		**0N**				
		A	A*	A	A*	A	A*	A	A*	
Ery-1	29ºC	60	55	0	1	0	4	0	7.5	Q (weak-P)
Ery-2	29ºC	40	51	0	1	0	11	0	18.3	M'(pseudo-M)
Ayrancı	29ºC	60	56	0	0	0	6	0	9.7	Q (weak-P)
Beytepe	29ºC	57	36	3	2	0	22	2.5	38.3	M'(pseudo-M)
Kerpe	29ºC	60	57	0	3	0	0	0	2.5	Q (weak-P)
Giresun	29ºC	60	22	0	6	0	32	0	58.3	M'(pseudo-M)

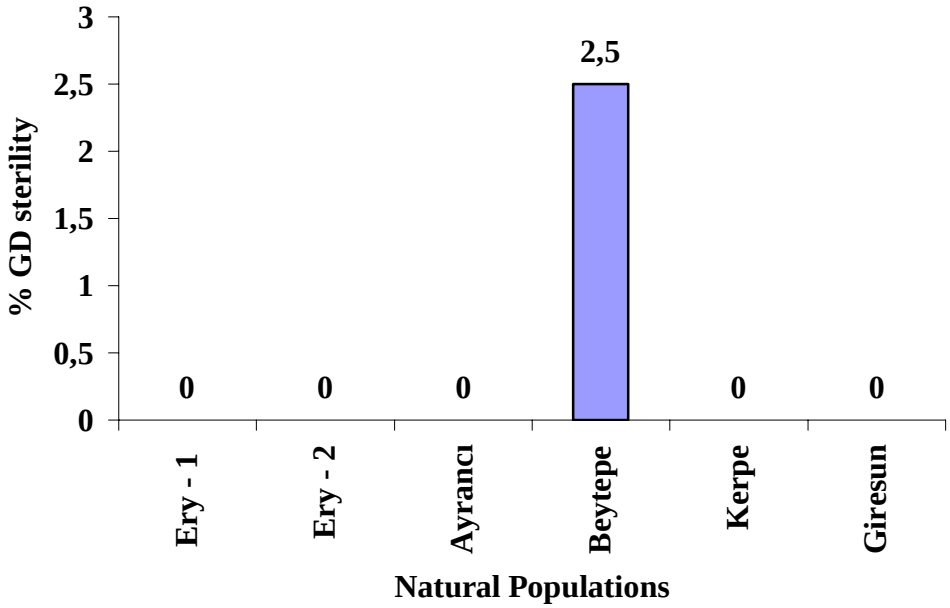

Figure 1. %GD sterility of natural populations of *Drosophila melanogaster* in Cross A.

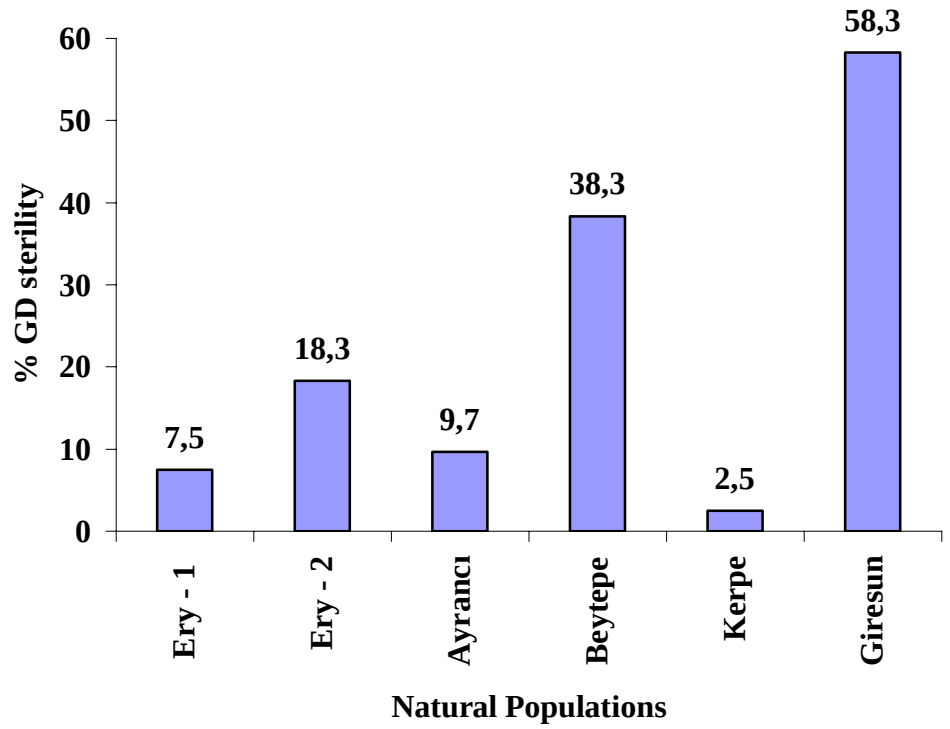

Figure 2. %GD sterility of natural populations of *Drosophila melanogaster* in Cross A*.

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A color and life-history polymorphism in *Drosophila sulfurigaster*.

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The species of the *nasuta* species subgroup (*immigrans* species group) are highly similar and are best identified using karyotyping (Wilson *et al.*, 1969), although three groups are distinguished based on the coloration of the frons (the area between the eyes). *D. kohkoa*, *D. kepulauana*, *D. nasuta, D. albomicans* and *D. niveifrons* have a white patch on the frons. The various subspecies of the *D. sulfurigaster* complex and *D. pulaua* have white orbits, while the remaining species—*D.* taxon F, *D.* taxon I, *D.* taxon J and *D. pallidifrons*—do not have white on the frons (Wilson *et al.*, 1969; Kitagawa *et al.*, 1982; Kitagawa, 1991; Yu *et al.*, 1999). The coloration is more pronounced in males, but under the right light conditions, this character is also visible in females of *D. sulfurigaster*, though less obvious. Despite many studies, the taxonomy of the group is still not fully known (see Yu *et al.*, 1999; Nagaraja *et al.*, 2004; Bachtrog, 2006), while the assignment of species and subspecies status varies between authors (see Yu *et al.*, 1999).

Three representatives of this group, *D. sulfurigaster* (white orbits), *D. kohkoa* and *D. kepulauana* (both entire white frons), are found in the Philippines; of these, only *D. sulfurigaster* has been recorded from the north of Luzon (Baltazar, 1991; Bächli, 1999-2007; Ruiz-Fiegalan, 2004). In October 1994, I collected *Drosophila* in the Sierra-Madre Mountains, near Cabagan, Isabela province in the northern Philippines. Individuals belonging to the *D. nasuta* subgroup were assigned to two groups based on the absence or presence of the whitish to silvery lines on the frons along the eyes. One group clearly resembles *D. sulfurigaster*, while the second group did not fit the known species of the Philippines ('Type A'). No individuals with a whitish to silvery sheen on the entire frons were found, confirming the absence of *D. kohkoa* and *D. kepulauana* from the north of Luzon (Baltazar, 1991; Bächli, 1999-2007; Ruiz-Fiegalan, 2004).

D. sulfurigaster is a generalist species, collected in three habitats (grassland, forest edge and secondary forest), while 'Type A' is only found in the secondary forest. The distance between the collection sides in the secondary forest and in the forest edge was less than one kilometer. Two life-history characteristics, development time and starvation resistance, were measured for both types using standardized methods in a common laboratory environment in the F_3 generation (for details, see van der Linde and Sevenster, 2006). The average values for development time and starvation