Revista Mexicana de Astronomía y Astrofísica, Volumen 1, Abril de 1976.

PHOTOMETRIC OBSERVATIONS OF OI AND Hα FOR THE HYADES STARS

Eugenio E. Mendoza V.

Instituto de Astronomía
Universidad Nacional Autónoma de México
Received 1976 February 17

RESUMEN

En este trabajo se presenta la fotometría α y λ de cuarenta y cuatro estrellas pertenecientes al cúmulo de las Hyadas, todas las estrellas desde A3 hasta F4. Los resultados, actuales y anteriores, confirman que este sistema fotométrico es muy apropiado para distinguir fácilmente dos grupos de estrellas: las de alta luminosidad y las metálicas (Am).

ABSTRACT

This paper presents α and λ photometry of 44 members of the Hyades open cluster, all the stars from A3 to F4. Present and previous results confirm that the α and λ photometric systems are suitable to distinguish very easily two groups of objects: the high luminosity and the metallic-line (Am) stars.

Key words: METALLIC-LINE STARS — NARROW BAND PHOTOMETRY — OPEN CLUSTERS.

I. INTRODUCTION

It is well known that the Hyades is an excellent choice for a standard open cluster with which other stellar aggregates and field stars can be compared.

We have shown (Mendoza 1971, 1975 and 1976) that the λ-index (neutral oxygen triplet at λ7774Å) separates very well high luminosity stars from other luminosity classes in the spectral range A-G. However, for main-sequence stars the scatter is larger than the observational errors. We have observed the Hyades cluster to study this characteristic in more detail.

We have added an α-index since the Hα line photometry is preferable to Hβ measurements in a number of cases, such as highly reddened stars and emission-line objects. Moreover, the α-index can be obtained with the same detector as the λ-index.

II. THE OBSERVATIONS

The filters used in this paper to define the α and λ indices have been already described (Mendoza 1975). The detector has been an RCA C-31034-A. The observations were carried out with the 40-inch telescope at Tonantzintla in February, November and December, 1975.

The results are summarized in Table 1 for 44 members of the Hyades open cluster, all the stars from A3 to F4. The first column of this table contains the BS number (Hoffleit 1964). The second, the name of the star; third, the MK-type, when available. The source of spectral type is given in the fourth column in order of preference. Columns fifth and sixth contain the Hα (α) and OI (λ)-line photometry. Column seventh, the number of different nights during which each star has been ob-

TABLE 1

NARROW BAND PHOTOMETRY OF THE HYADES

BS	Name	MK	S	α (mag)	λ (mag)	n	V	B-V	U-B
1201		(dF1)	5	0.154	0.024	4	5.97	0.34	0.00
1238		(A9n)	5	0.162	0.027	4	5.89	0.32	0.04
1254		(dF2)	5	0.134	0.016	4	5.46	0.36	0.00
1279		F3 V	1	0.134	0.010	4	6.01	0.40	0.02
1292	45 Tau	(dF4)	5	0.151	0.022	4	5.73	0.36	−0.01
1319	48 Tau	F3 V	2	0.139	0.011	5	6.32	0.40	0.02
1331	51 Tau	F0 V	3	0.186	0.026	4	5.65	0.28	0.08
1351	57 Tau	F0 IV	1	0.184	0.025	5	5.59	0.28	0.08
1354		F2 V	2	0.144	0.021	4	6.11	0.37	0.03
1356	58 Tau	A9 V	2	0.209	0.028	4	5.26	0.22	0.10
1368	60 Tau	A3m	3	0.182	0.008	5	5.72	0.32	0.10
1376	63 Tau	A1m	3	0.197	0.006	5	5.64	0.30	0.14
1380	64 Tau	A7.5 V	2	0.240	0.030	16	4.80	0.15	0.12
1385		F4 Vn	2	0.134	0.025	4	5.97	0.37	0.05
1387	κ Tau	A7 V	2	0.244	0.038	5	4.22	0.13	0.14
1388	67 Tau	(A5n)	5	0.196	0.028	5	5.28	0.25	0.10
1389	68 Tau	A3 V	2	0.261	0.031	4	4.28	0.04	0.08
1392	υ Tau	A8 Vn	2	0.178	0.028	5	4.28	0.26	0.15
1394	71 Tau	A8 Vn	3	0.185	0.026	5	4.50	0.25	0.14
1403		A3m	3	0.198	0.013	4	5.72	0.27	0.10
1408	76 Tau	F0 V	2	0.158	0.024	5	5.90	0.32	0.06
1412	θ^2 Tau	A7 III	1	0.220	0.036	25	3.39	0.18	0.12
1414	79 Tau	A5m:	3	0.228	0.020	5	5.03	0.23	0.12
1422	80 Tau	(A6n)	5	0.161	0.028	4	5.58	0.32	0.10
1427		A6 Vn	2	0.237	0.030	6	4.78	0.17	0.13
1428	81 Tau	A5m	3	0.216	0.013	4	5.48	0.26	0.10
1430	83 Tau	F0 Vn	2	0.201	0.029	4	5.41	0.26	0.10
1432	85 Tau	F2 Vn	2	0.159	0.022	4	6.02	0.34	0.04
1444	ρ Tau	A8 Vn	2	0.202	0.025	6	4.65	0.25	0.08
1458	88 Tau	A5m:	3	0.216	0.017	5	4.26	0.18	0.12
1459		F5 IV	4	0.141	0.013	4	6.02	0.38	0.02
1472	89 Tau	F0 V	2	0.168	0.030	4	5.79	0.31	0.06
1473	90 Tau	A6 Vn	2	0.250	0.034	5	4.27	0.12	0.13
1479	σ^2 Tau	A5 Vn	2	0.236	0.033	6	4.70	0.14	0.13
1480		A5m	4	0.209	0.016	4	5.39	0.25	0.12
1507		F0 V	3	0.192	0.028	4	5.40	0.25	0.08
1519		A2m	3	0.235	0.018	4	5.37	0.19	0.13
1547	97 Tau	(dA5)	5	0.207	0.030	4	5.11	0.21	0.12
1566		(dF0)	5	0.177	0.026	3	6.37	0.29	0.06
1620	ι Tau	A7 V	3	0.231	0.033	5	4.64	0.16	0.15
1670		A5m	3	0.198	0.010	4	5.94	0.28	0.05
1672	16 Ori	A2m	3	0.224	0.006	4	5.43	0.24	0.14
1905	122 Tau	F0 V	3	0.209	0.029	4	5.54	0.22	0.10
2124	μ Ori	A2m	3	0.226	0.017	6	4.13	0.16	0.11

Spectral type source for Table 1—Column 4.

1: Morgan and Keenan (1973)
2: Morgan and Hiltner (1965)
3: Cowley *et. al.* (1969)
4: Kennedy and Buscombe (1974)
5: Hoffleit (1964)

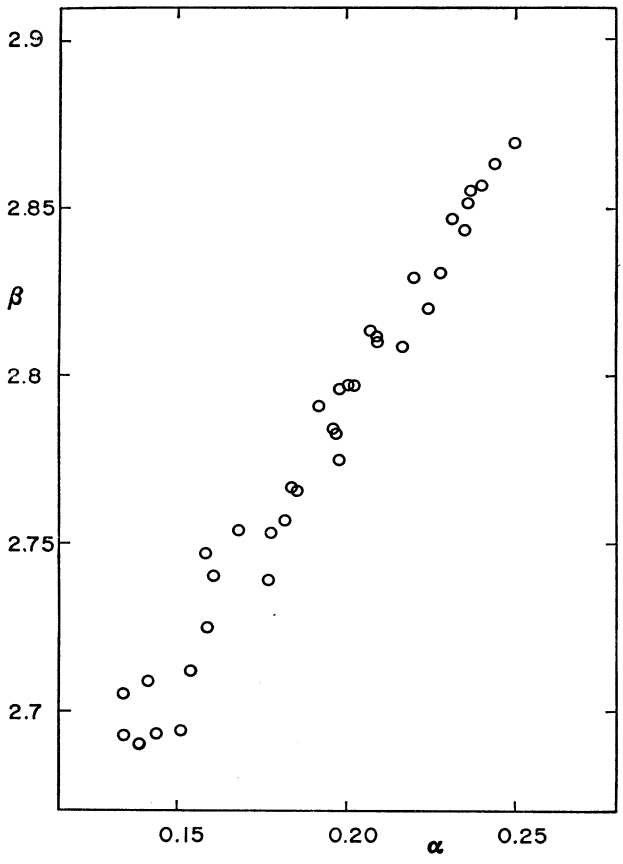

FIG. 1. The comparison between the Hα and Hβ line photometries. Only Hyades members.

served in this system; the last three columns list the UBV photometry taken from Mendoza (1967). The mean error of a single observation of α is ± 0.006 mag. and of λ, ± 0.008 mag.

The values given for 64 Tauri define the zero point of α and λ measurements given in Table 1. They differ slightly from previous observations. These were larger in α by 0.017 mag. and smaller in λ by 0.002 mag. (Mendoza 1975 and 1976).

III. DISCUSSION

The analysis of the photometry contained in Table 1 could include many comparisons of the several indices. We begin by plotting α *versus* β. The β-index has been taken from Crawford and Perry (1966). The correlation is satisfactory, and linear, in the covered spectral range.

The (B-V) *versus* α-array is illustrated in Figure 2. There is a small scatter in this diagram produced mainly by two kinds of stars: metallic-line stars (Am) and broad line stars (n). The first group has a tendency to lie above the *mean line* (defined by the "normal spectrum" stars). The n stars, on the average, may lie below this mean line. The same characteristics are shown in the α *versus* V array (see Fig. 3).

Next we plot λ *versus* α in Figure 4. This diagram shows a neat separation of the Am stars from the other spectral types. This separation is also present in λ *versus* m_1 (the m_1-index has been taken from Crawford and Perry 1966) as illustrated in Figure 5.

The U-B color index has been used as a measure of metallicity (see Mendoza 1963). Thus, we also have plotted λ *versus* U-B in Figure 6. The separation of the Am stars is also present in this diagram although not as neatly as that shown in Figures 4 and 5.

Finally, we show the graph λ *versus* V sin i (V sin i —the rotational velocity— has been taken from Bernacca and Perinotto 1970 and 1971) in Figure 7. Herein the Am stars are less separated from other stars than in the plots given in Figures 4-6.

IV. CONCLUSION

The α and λ photometric systems can be used to classify supergiant stars (Mendoza 1971, 1975 and 1976) and to classify metallic-line stars as shown in this paper (see Figures 4 and 5). Perhaps, also the n-stars can be classified in these systems (see Figures 2 and 7), though more data will be needed to investigate this point.

This work would not have been possible without the cordial support of the Organization of American States (OEA) who provided the detector used to measure the α and λ-indices.

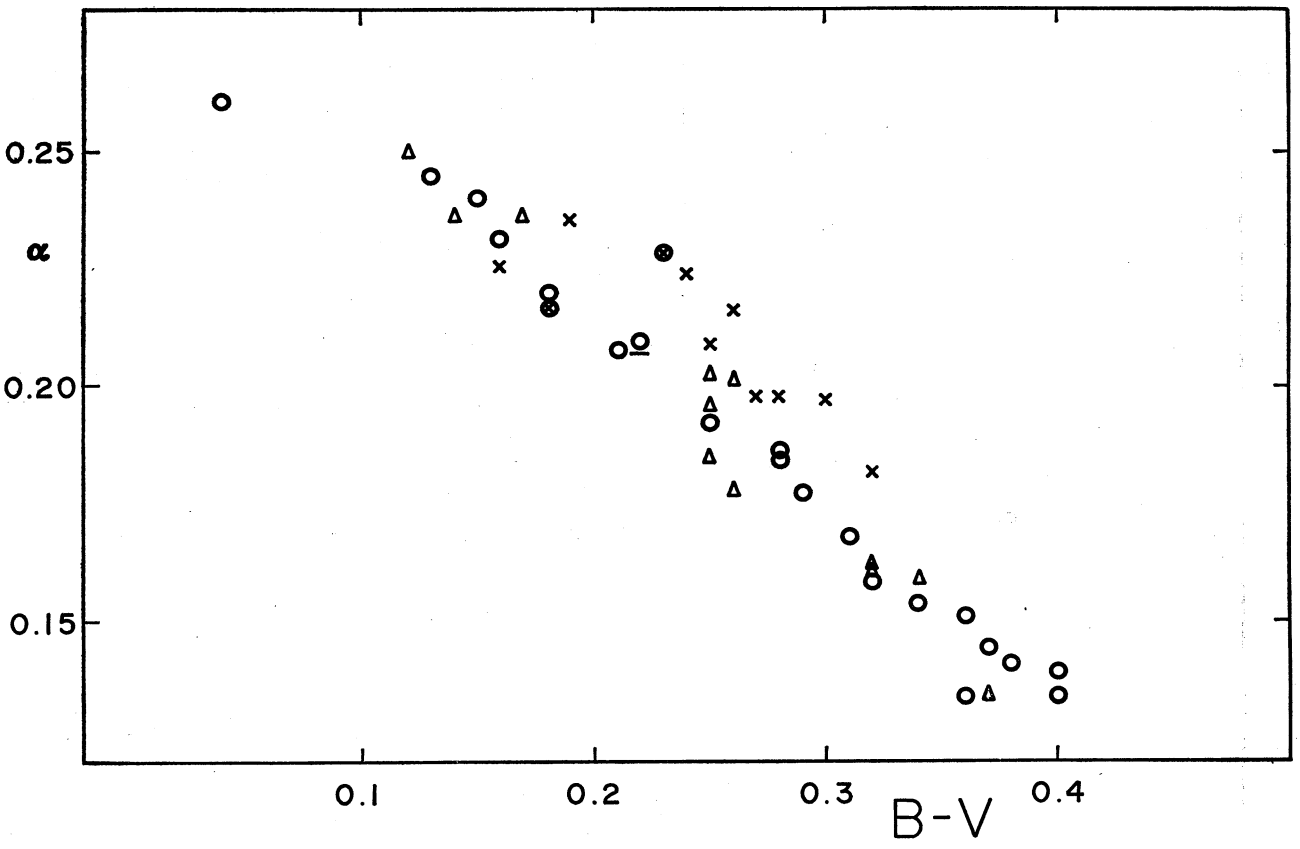

FIG. 2. The (B-V, α)-array for the Hyades stars. Open circles represent "normal spectral type"-stars. Crosses, metallic-line stars (Am); crossed circles, mild metallic-line stars (Am:). Triangles, n-stars.

REFERENCES

Bernacca, P. L., and Perinotto, M. 1970, *Contr. Osserv. Astrof. Univ. Padova, Asiago*, Nr. 239.

Bernacca, P. L., and Perinotto, M. 1971, *Contr. Osserv. Astrof. Univ. Padova, Asiago*, Nr. 250.

Cowley, A., Cowley, C., Jaschek, M., and Jaschek, C. 1969, *A. J.*, **74**, 375.

Crawford, D. L., and Perry, C. L. 1966, *A. J.*, **71**, 206.

Hoffleit, D. 1964, *Catalogue of Bright Stars*, Yale Univ. Obs.

Kennedy, P. M., and Buscombe, W. 1974, *MK Spectral Classifications*, Evanston.

Mendoza, E. E. 1963, *Bol. Obs. Tonantzintla y Tacubaya*, **3**, 137.

Mendoza, E. E. 1967, *Bol. Obs. Tonantzintla y Tacubaya*, **4**, 149.

Mendoza, E. E. 1971, *Bol. Obs. Tonantzintla y Tacubaya*, **6**, 137.

Mendoza, E. E. 1975, *Pub. A.S.P.*, **87**, 505.

Mendoza, E. E. 1976, *IAU Symposium 72*, in press.

Morgan, W. W., and Hiltner, W. A. 1965, *Ap. J.*, **141**, 177.

Morgan, W. W., and Keenan, P. C. 1973, *Ann. Rev. Astr. and Ap.* **11**, 29.

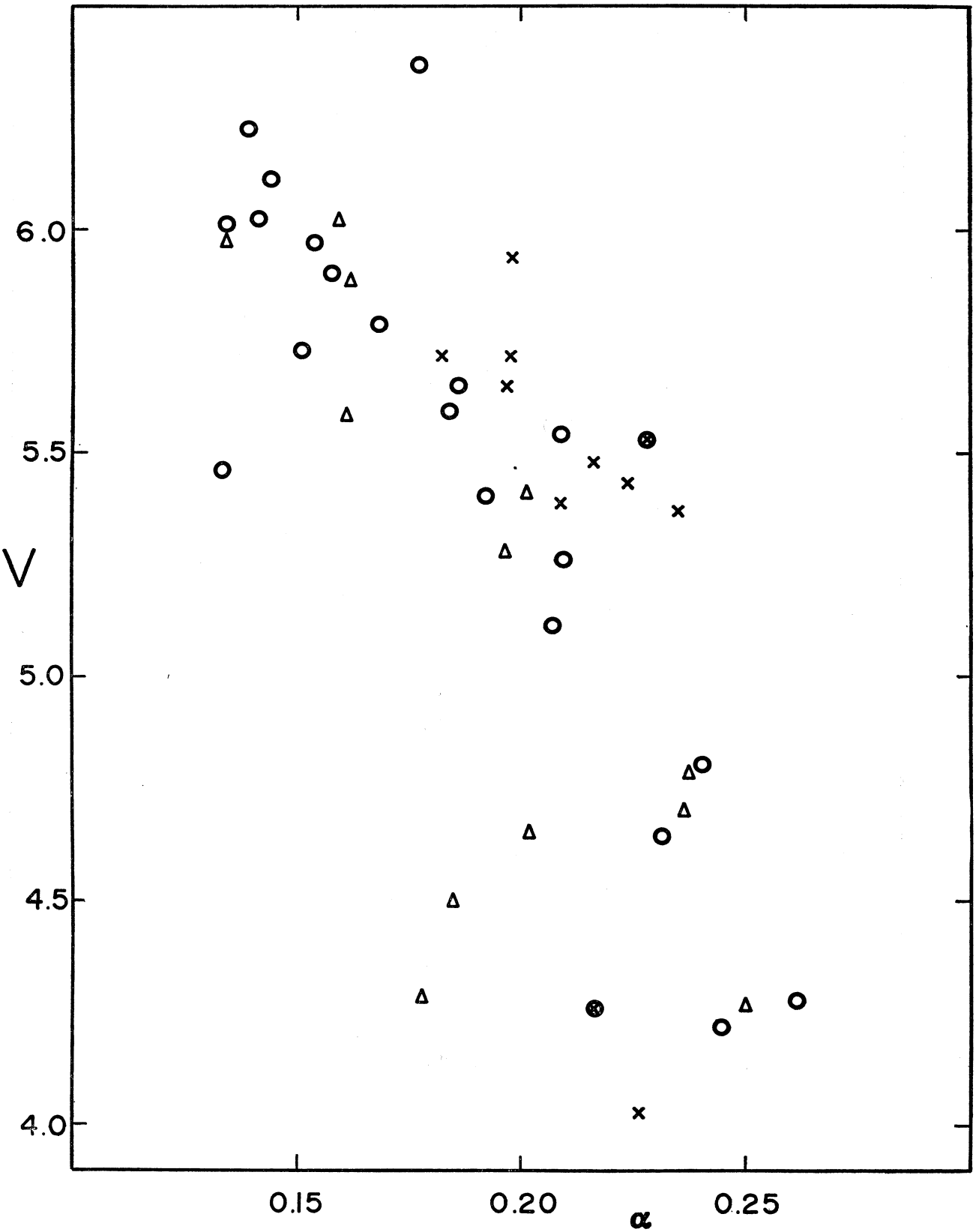

FIG. 3. The (α, V)-array for the Hyades stars. The symbols have the same meaning as in Fig. 2.

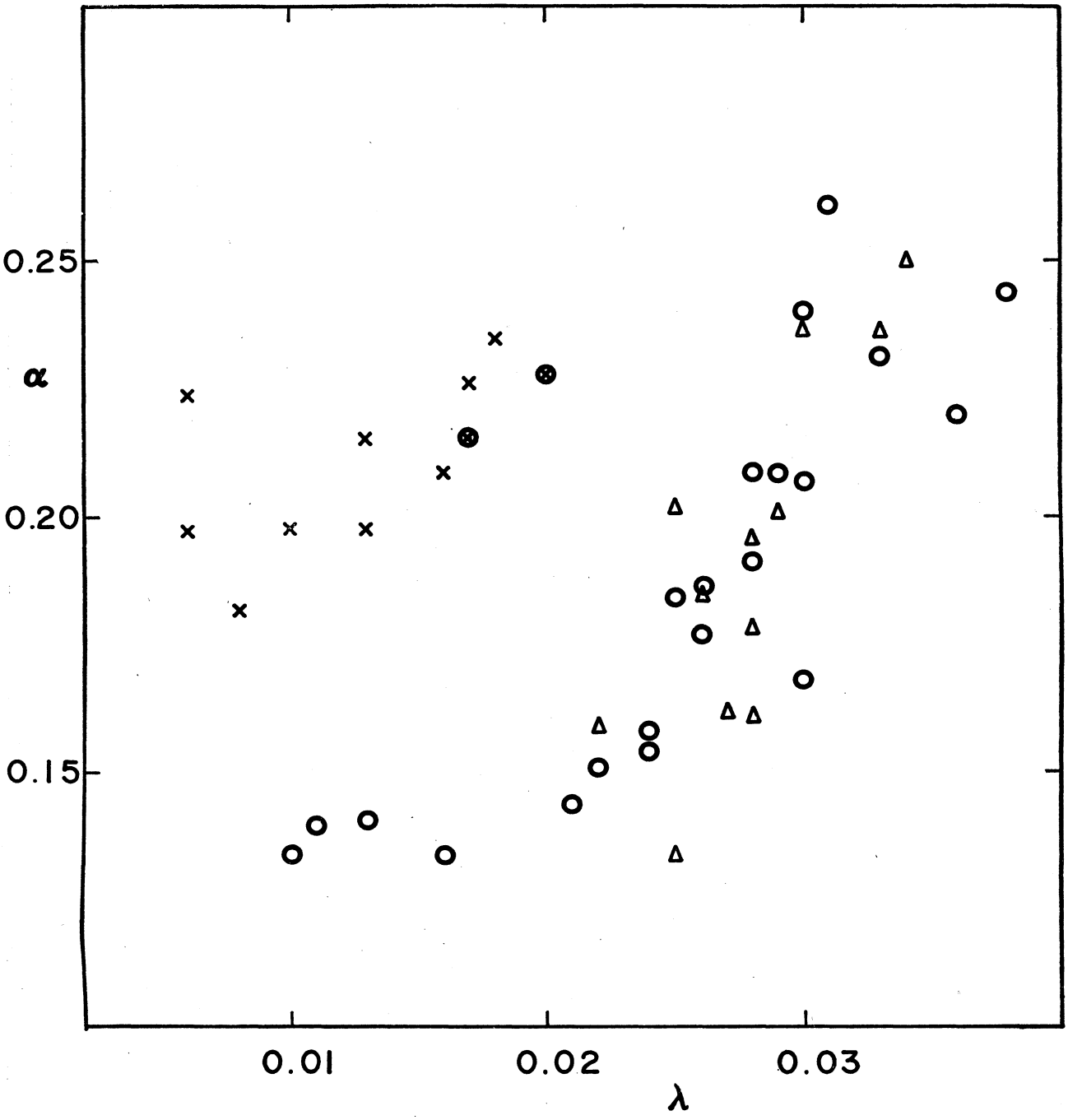

FIG. 4. The (λ, α)-array for the Hyades stars the symbols have the same meaning as in Fig. 2.

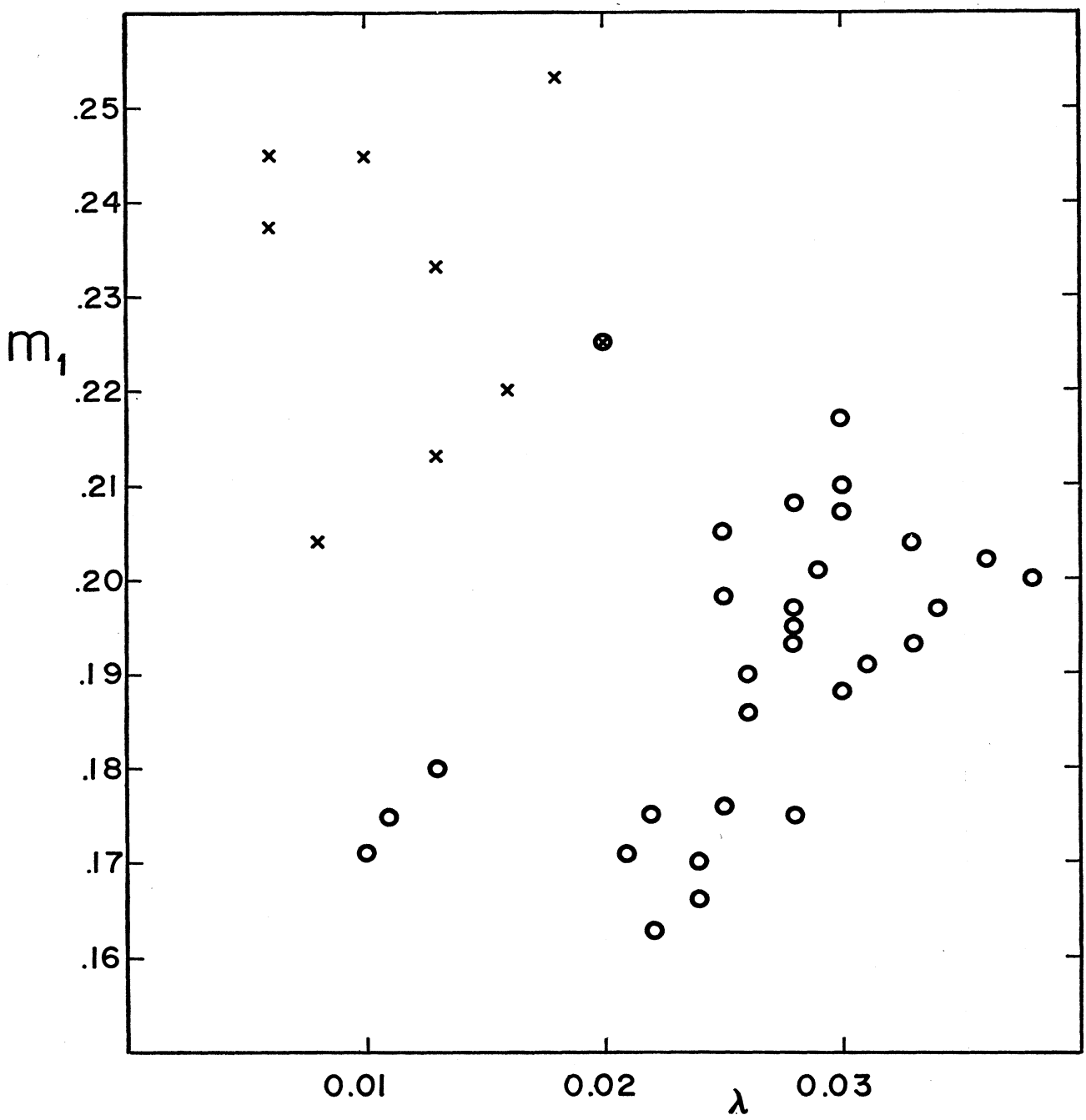

FIG. 5. The (λ, m_1)-array for the Hyades stars. The symbols have the same meaning as in Fig. 2.

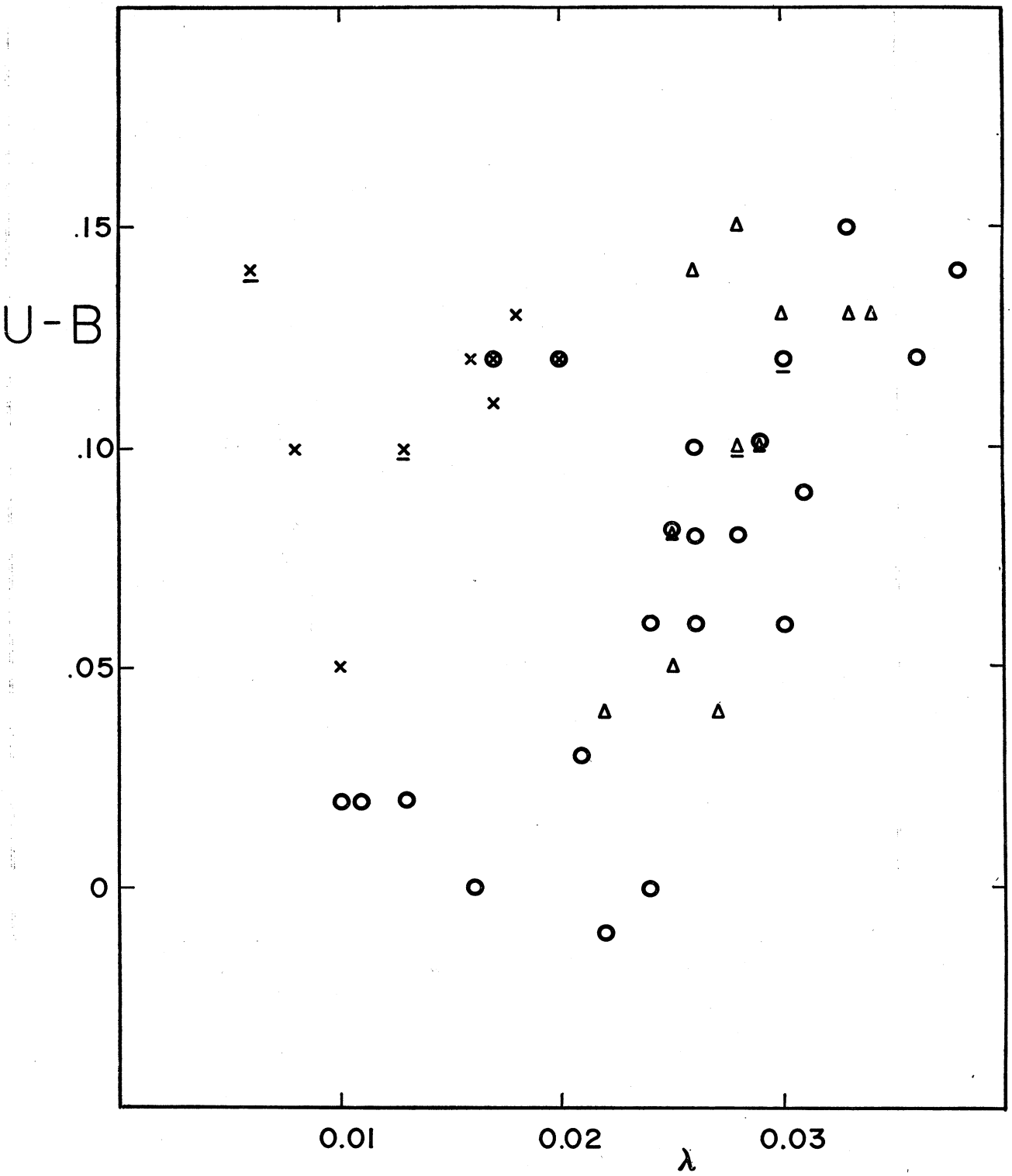

FIG. 6. The (λ, U-B)-array for the Hyades stars. The symbols have the same maning as in Fig. 2.

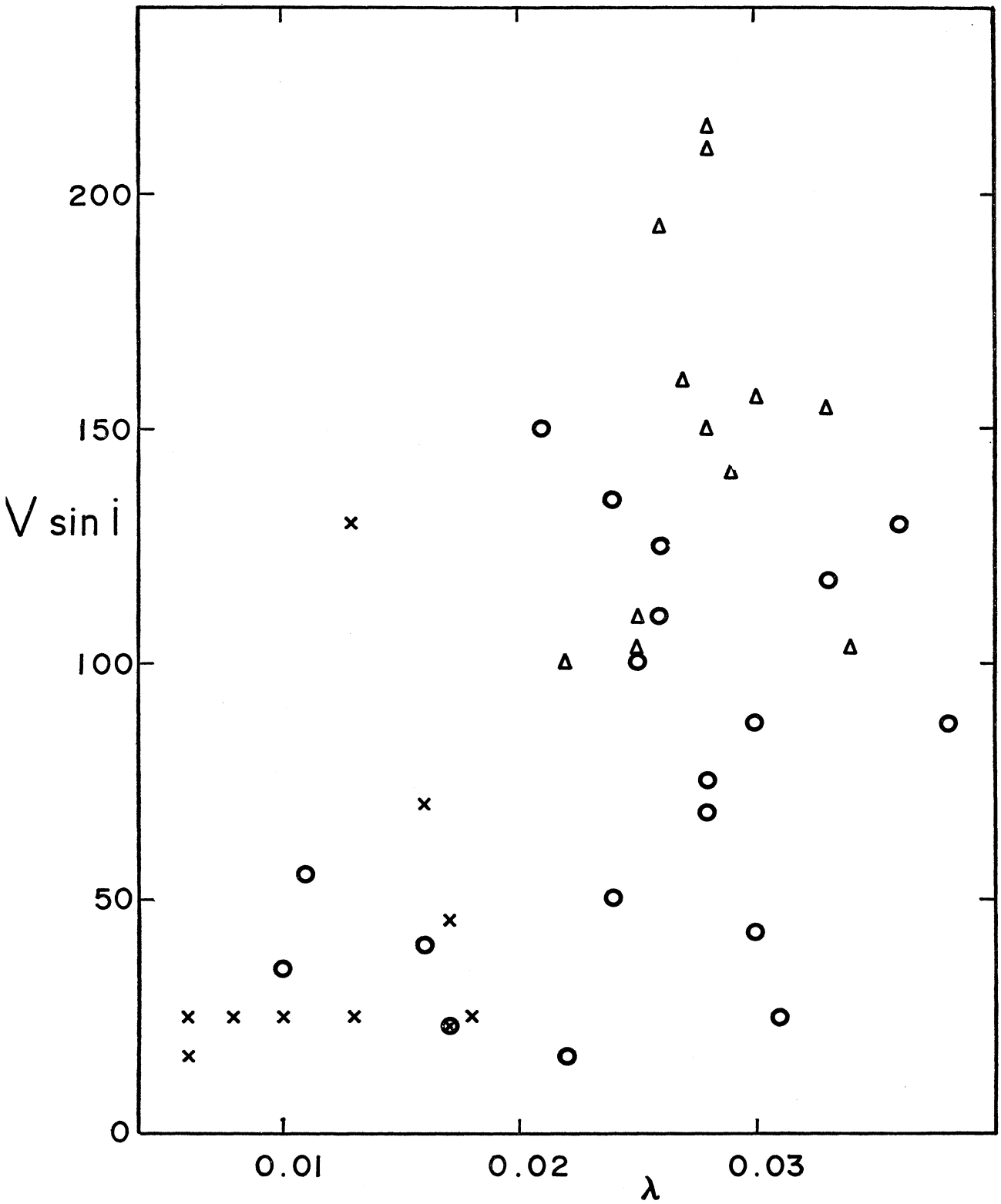

FIG. 7. The (λ, V sin i)-array for the Hyades stars. The symbols have the same meaning as in Fig. 2.