

NEW VARIABLE STARS FROM TESS SECTOR 89

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Abstract: In this article we continued the search for new variable stars among the Transiting Exoplanet Survey Satellite (TESS) observations. The second iteration of the Star Hunters project was significantly more productive and efficient than the previous one. We managed to discover 326 variable stars from TESS sector 89. From those stars we classified 47, calculated periods and initial epochs for 62 and estimated amplitudes of variability for all 326 stars.

Key words: variable stars – TESS – light curves – time-domain astronomy – period analysis – citizen science

1 Introduction

After the prototype project called TESS-UA-2024 (Dzygunenko et al., 2026) and the first iteration of Star Hunters, we decided to continue the search for new variable stars in order to involve more people in citizen science (Percy John R., 2006). The plan remains largely the same, with some minor improvements based on the experience of previous projects. First, all the students who do not have previous experience in this subject completed the course called Variable Stars Lectures. It was developed by our team to provide them with the theoretical basis for the research and includes both video lectures and tests. Secondly, we downloaded the data from the Mikulski Archive for Space Telescopes (MAST, 2025) and distributed it among the students. At the third stage, we instructed them on how to apply previously received theoretical knowledge in practice. After several weeks of processing data in a semi-automated way, the students sent us the tables with presumably new variable stars and corresponding information about them. The fourth stage represents the most challenging part of the process, because mentors have to check each of hundreds

of stars and decide whether the provided information is correct. We chose the Transiting Exoplanet Survey Satellite (TESS) (Ricker et al., 2015) as our primary source of data because it continuously observes large quantities of stars. Each TESS sector is observed during 27.4 days and consists of 10-20 thousand individual objects, observed with 2-minute cadence. This space telescope is also constructed to make quite accurate measurements of flux intensity. On average the noise on the light curve does not exceed 0.001 magnitude, allowing us to find multiple previously undetected variable stars. The 89th sector was the most recent one published at the moment, thus becoming the primary focus of the Star Hunters-2 project.

2 Methods and analysis

The methods used in the research are described in detail in (Dzygunenko et al., 2026) and remained almost the same during this project. The overall procedure, followed by the students for each star, is:

1. Check if a star shows any signs of variability. If the signal-to-noise ratio is high enough and those changes are not TESS artifacts, add it to the list.
2. Check if a star has been discovered as variable by anyone before. We checked both the AAVSO VSX¹ and Simbad² databases, as well as searched for recently published articles in NASA ADS³. If it was mentioned as a variable in any of those sources, remove it from the list.
3. Check if the star shows some periodic pattern of variability, by which its brightness repeatedly changes over time. If yes, the star is periodic.
 - a. If the star is periodic, then calculate the period and initial epoch.
 - b. Estimate visually if computed values align with changes visible on the light curve. If they don't deviate noticeably, add to the table; otherwise, ask any mentor for help.
4. Estimate the amplitude of the variability in magnitudes. This calculation is conducted for all stars that have reached this stage.
5. Classification. Some types of variable stars have similar light curves, which are hard to distinguish without additional observations, which in the vast majority of cases are not available. Thus, only 52% of the discovered stars have been classified with any reasonable accuracy. We classified binary systems according to their light curve morphology (Prša et al., 2022) and identified pulsating stars by their position within the relevant regions of the Hertzsprung-Russell (H-R) diagram. Locations of the new pulsating variable stars are illustrated in Fig.1. The source of this figure ⁴.

¹<https://vsx.aavso.org/>

²<https://simbad.u-strasbg.fr/simbad/sim-basic>

³<https://ui.adsabs.harvard.edu/>

⁴https://commons.wikimedia.org/wiki/File:MS_and_RGB_isochrones.png

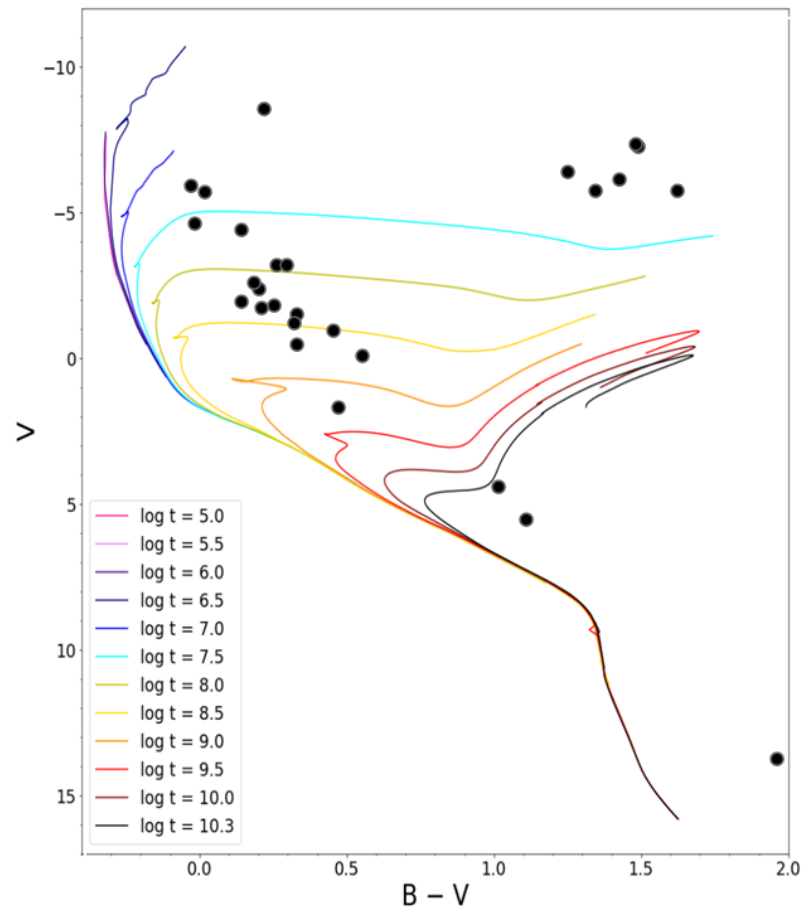


Figure 1: Location of new pulsating variable stars on the colour-magnitude diagram. The solid lines represent isochrones for various stellar ages, where $\log t$ is the decimal logarithm of age in years.

The automation for students is quite low; most of the actions are conducted manually. Only the computation parts are being automated. Despite decreasing overall efficiency, we decided to maintain this approach because the students must learn the process and the science behind it rather than simply executing automated commands. However, if anyone has sufficient knowledge to partially automate the process for oneself, in such instances automation is encouraged. Mentors have a much higher percentage of automated processes because they have to check hundreds of stars in a limited time span.

3 Results and discussion

As the main result, we compiled a table with information about 326 newly discovered variable stars. Each of those stars has not been discovered before and shows noticeable brightness changes. We provided the TIC ID, classification, amplitude, period, and initial epoch where applicable (see Table 1 in Appendix A).

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References

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4 Appendix A

Table 1: List of 326 newly discovered variable stars. Stellar classification is written as a standard abbreviation. Stars that we could not classify with any reasonable accuracy have been denominated by an asterisk (*) in the “variability type” column. The corresponding light curves are displayed in the Appendix B

TIC ID	Var. Type	A (mmag)	P (days)	T_0 (JD)	T (K)	M
71494380	DSCT	8,3	0,03307	2457000,02	7300	2,19
408351779	DSCT	7,4	0,03688	2457000,01	8100	1,68
385224945	DSCT	9,2	0,05738	2457000,02	7900	2,01
307214209	DSCT	4,4	0,05743	2456999,98	8000	1,16
186367921	DSCT	9,7	0,05881	2457000,01	7400	2,39
22222900	DSCT	15,0	0,07354	2457000,03	8000	2,07
28658119	DSCT	7,9	0,07451	2457000,01	-	-2,10
272187783	DSCT	10,0	0,10433	2456999,98	9600	1,54
5296800	DSCT*	75,0	0,11407	2456999,99	-	-
434484010	DSCT	7,3	0,13901	2457000,04	7300	1,17
55746843	EW	22,0	0,15528	2457000,01	-	-
89615401	UV Ceti*	53,0	0,24853	2457000,01	3100	-
133566240	unknown	1,7	0,25180	2456999,92	-	-
356838394	UV Ceti*	31,0	0,26187	2457000,12	3100	-
357484817	DSCT	8,4	0,28297	2456999,98	7300	2,84
35977125	DSCT	3,2	0,29215	2456999,95	9200	0,44
306825086	UV Ceti*	56,0	0,29696	2456999,99	3000	-
81210526	unknown	14,0	0,29943	2456999,93	-	-
122326071	Beta Cephei	3,6	0,33456	2457000,09	12300	-0,36
432752288	Beta Cephei	4,0	0,57155	2457000,11	8800	1,92
177353450	UV Ceti	40,0	0,58312	2457000,08	3400	11,23
47350268	unknown	32,0	0,74414	2457000,26	-	-
300935162	unknown	1,9	0,79137	2456999,91	-	-
181428113	EW+	105,0	0,81442	2456999,80	4500	5,81
267466707	ELL	15,0	0,85475	2457000,12	-	-
264767454	UV Ceti*	41,0	0,85986	2456999,99	3200	-
167656243	unknown	7,5	1,20525	2456999,91	-	-
300444683	ELL	14,0	1,52411	2456999,28	-	-
77550985	unknown	3,5	1,59979	2457000,53	-	-
362808488	ELL	22,0	1,60928	2457000,26	-	-
308396947	EA	2,4	1,70448	2457000,58	-	-
271693722	UV Ceti	49,0	1,92040	2457000,06	3300	11,51
48013854	unknown	1,9	2,19892	2457000,21	-	-
349765098	ELL	32,0	2,21582	2456999,68	-	-
276859959	T Tauri	8,1	2,23299	2457000,88	5800	3,07
93389192	unknown	9,5	2,25043	2457000,54	-	-
300710088	unknown	11,0	2,34195	2457001,05	-	-
55758485	unknown	6,5	2,48322	2456999,78	-	-
89708510	unknown	66,0	2,59511	2456999,89	-	-
25094115	ELL	6,0	2,64272	2456998,79	-	-

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TIC ID	Var. Type	A (mmag)	P (days)	T_0 (JD)	T (K)	M
350841061	unknown	10,0	2,71746	2456999,25	-	-
46746210	ROT	2,5	2,79205	2457001,06	7100	2,10
425056845	unknown	7,6	2,96966	2456999,25	-	-
276666216	unknown	7,6	3,20060	2456999,14	-	-
149275235	unknown	14,0	3,23654	2456999,26	-	-
124598686	ROT	2,7	4,07860	2456999,27	6300	2,53
149305070	unknown	2,8	4,29931	2457000,79	-	-
141271216	ROT*	30,0	4,43165	2456998,60	3200	-
286347420	unknown	53,0	4,64605	2456998,83	-	-
59532876	unknown	12,0	4,72213	2456999,96	-	-
40520168	unknown	34,0	4,80093	2456998,52	-	-
350862394	unknown	26,0	5,23729	2456998,98	-	-
77616716	T Tauri	6,6	5,47112	2457001,76	6200	4,14
384360078	unknown	13,0	5,64821	2456998,63	-	-
413373047	unknown	17,0	6,07544	2456999,52	-	-
355938791	unknown	5,8	6,26217	2457001,50	-	-
373918302	unknown	47,0	6,40124	2457000,17	-	-
453079788	unknown	16,0	6,69905	2457000,62	-	-
41229199	ROT	8,8	7,20141	2457003,15	5000	6,48
272233708	unknown	15,0	8,72913	2457003,37	-	-
150427790	unknown	8,6	10,66873	2457003,61	-	-
344085174	M	104,0	28,80511	2457004,57	3300	-0,38
238491701	Beta Cephei	6,7	-	-	13800	0,31
442754320	unknown	167,0	-	-	-	-
349830679	ELL	12,0	-	-	-	-
295578002	ELL	26,0	-	-	-	-
441530251	ELL	56,0	-	-	-	-
150274487	DCEP*	3,6	-	-	7000	-
340005947	unknown	3,2	-	-	-	-
44573029	EW	15,0	-	-	-	-
182888697	unknown	2,1	-	-	-	-
62683976	unknown	3,5	-	-	-	-
70443179	M	11,0	-	-	3500	-0,40
93552494	unknown	8,2	-	-	-	-
95993405	unknown	15,0	-	-	-	-
141796057	unknown	3,0	-	-	-	-
148612197	unknown	26,0	-	-	-	-
182880367	unknown	18,0	-	-	-	-
350654140	unknown	3,2	-	-	-	-
384471898	unknown	11,0	-	-	-	-
432162869	unknown	5,2	-	-	-	-
410322559	unknown	4,5	-	-	-	-
220477045	unknown	9,0	-	-	-	-

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TIC ID	Var. Type	A (mmag)	P (days)	T_0 (JD)	T (K)	M
181750099	unknown	2,5	-	-	-	-
169250438	unknown	4,9	-	-	-	-
139746149	unknown	3,8	-	-	-	-
77560387	unknown	6,7	-	-	-	-
45046261	M	99,0	-	-	3600	-0,77
7978592	unknown	6,0	-	-	-	-
296738596	M	5,2	-	-	3700	-1,30
286854355	unknown	7,2	-	-	-	-
279510954	unknown	9,0	-	-	-	-
101365484	unknown	8,0	-	-	-	-
2350053	unknown	4,7	-	-	-	-
7978123	unknown	7,2	-	-	-	-
25450219	unknown	4,8	-	-	-	-
37688556	unknown	2,9	-	-	-	-
48166598	unknown	23,0	-	-	-	-
101136248	unknown	5,1	-	-	-	-
101136679	unknown	12,0	-	-	-	-
175344943	unknown	6,9	-	-	-	-
182659932	unknown	2,6	-	-	-	-
185370567	unknown	4,9	-	-	-	-
192484767	unknown	11,0	-	-	-	-
255784686	unknown	6,5	-	-	-	-
277173662	unknown	155,0	-	-	-	-
284070255	unknown	6,3	-	-	-	-
285996570	unknown	13,0	-	-	-	-
305539512	unknown	6,2	-	-	-	-
342004233	unknown	8,9	-	-	-	-
344999162	unknown	11,0	-	-	-	-
350585323	unknown	5,9	-	-	-	-
401027524	unknown	3,3	-	-	-	-
36722312	unknown	3,6	-	-	-	-
75214196	unknown	4,1	-	-	-	-
77240114	unknown	7,9	-	-	-	-
143403118	unknown	9,7	-	-	-	-
348881873	unknown	15,0	-	-	-	-
425068761	unknown	34,0	-	-	-	-
3849122	unknown	7,1	-	-	-	-
82215211	unknown	5,0	-	-	-	-
123568460	unknown	17,0	-	-	-	-
374209678	unknown	3,2	-	-	-	-
36809148	unknown	4,3	-	-	-	-
62650185	unknown	4,1	-	-	-	-
145923906	unknown	4,7	-	-	-	-

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TIC ID	Var. Type	A (mmag)	P (days)	T_0 (JD)	T (K)	M
189619748	M	11,0	-	-	3600	-0,62
418100733	unknown	8,4	-	-	-	-
181219375	unknown	3,7	-	-	-	-
53576727	unknown	9,7	-	-	-	-
168141647	unknown	5,0	-	-	-	-
302131782	unknown	4,9	-	-	-	-
400136515	unknown	2,6	-	-	-	-
36721842	unknown	9,6	-	-	-	-
8003653	unknown	8,5	-	-	-	-
53208435	unknown	5,3	-	-	-	-
259910595	unknown	7,6	-	-	-	-
287401203	unknown	50,0	-	-	-	-
432183286	unknown	4,4	-	-	-	-
60905191	unknown	4,1	-	-	-	-
432106951	unknown	3,2	-	-	-	-
432168980	unknown	2,4	-	-	-	-
432101609	unknown	2,0	-	-	-	-
29781308	unknown	3,7	-	-	-	-
432190622	unknown	6,5	-	-	-	-
271595936	unknown	6,7	-	-	-	-
34984957	unknown	6,0	-	-	-	-
186154147	unknown	6,1	-	-	-	-
260075032	unknown	6,3	-	-	-	-
277300384	unknown	27,0	-	-	-	-
404852080	unknown	51,0	-	-	-	-
178782501	unknown	10,0	-	-	-	-
423364940	unknown	6,6	-	-	-	-
345073704	unknown	17,0	-	-	-	-
432131379	unknown	7,0	-	-	-	-
134645927	unknown	8,9	-	-	-	-
432083201	unknown	7,0	-	-	-	-
11466228	unknown	7,1	-	-	-	-
423246899	unknown	12,0	-	-	-	-
183903581	unknown	14,0	-	-	-	-
192932518	unknown	4,8	-	-	-	-
33770863	unknown	12,0	-	-	-	-
71093939	unknown	11,0	-	-	-	-
423248552	unknown	13,0	-	-	-	-
430553236	unknown	17,0	-	-	-	-
432186595	unknown	26,0	-	-	-	-
45637272	unknown	15,0	-	-	-	-
36835297	unknown	22,0	-	-	-	-
47005222	unknown	8,4	-	-	-	-

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TIC ID	Var. Type	A (mmag)	P (days)	T_0 (JD)	T (K)	M
144997260	unknown	4,1	-	-	-	-
257720280	unknown	6,0	-	-	-	-
3996132	unknown	4,9	-	-	-	-
71216609	unknown	7,8	-	-	-	-
123383643	unknown	5,2	-	-	-	-
132736769	unknown	5,8	-	-	-	-
143737679	unknown	4,9	-	-	-	-
269478149	unknown	6,2	-	-	-	-
385212956	unknown	16,0	-	-	-	-
34304135	unknown	2,0	-	-	-	-
193096221	unknown	4,5	-	-	-	-
285409835	unknown	5,0	-	-	-	-
334630157	unknown	11,0	-	-	-	-
360121992	unknown	5,1	-	-	-	-
410066548	unknown	5,3	-	-	-	-
18786687	unknown	6,4	-	-	-	-
32645011	unknown	2,9	-	-	-	-
92746150	unknown	3,9	-	-	-	-
141809220	unknown	12,0	-	-	-	-
422148645	unknown	4,1	-	-	-	-
82579115	unknown	3,9	-	-	-	-
408416845	unknown	4,1	-	-	-	-
55649312	unknown	7,9	-	-	-	-
11521786	unknown	4,5	-	-	-	-
40795915	unknown	73,0	-	-	-	-
238337815	unknown	5,3	-	-	-	-
262573254	unknown	14,0	-	-	-	-
373765872	unknown	61,0	-	-	-	-
376985587	unknown	7,0	-	-	-	-
422271542	unknown	29,0	-	-	-	-
287003811	unknown	14,0	-	-	-	-
45234567	unknown	7,9	-	-	-	-
384714697	unknown	5,3	-	-	-	-
306933992	unknown	19,0	-	-	-	-
141151953	unknown	8,0	-	-	-	-
75828290	unknown	12,0	-	-	-	-
60379352	unknown	6,2	-	-	-	-
37758544	unknown	3,4	-	-	-	-
281182515	unknown	3,7	-	-	-	-
279571361	unknown	4,9	-	-	-	-
101760788	unknown	38,0	-	-	-	-
410297323	unknown	7,1	-	-	-	-
409977271	unknown	6,8	-	-	-	-

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TIC ID	Var. Type	A (mmag)	P (days)	T_0 (JD)	T (K)	M
349964939	unknown	6,6	-	-	-	-
349153143	unknown	2,2	-	-	-	-
293605011	unknown	11,0	-	-	-	-
285412836	unknown	5,2	-	-	-	-
123150256	unknown	6,7	-	-	-	-
45877289	unknown	6,9	-	-	-	-
5546608	unknown	1,6	-	-	-	-
374312406	unknown	4,9	-	-	-	-
360009458	unknown	2,2	-	-	-	-
291471120	unknown	28,0	-	-	-	-
176683620	unknown	10,0	-	-	-	-
123105281	unknown	9,4	-	-	-	-
76493270	unknown	4,5	-	-	-	-
48335612	unknown	8,1	-	-	-	-
30185650	unknown	13,0	-	-	-	-
293626961	unknown	2,2	-	-	-	-
271644257	unknown	7,4	-	-	-	-
267457437	unknown	6,4	-	-	-	-
189570845	unknown	14,0	-	-	-	-
141121793	unknown	6,6	-	-	-	-
18556792	unknown	4,8	-	-	-	-
30041152	unknown	3,8	-	-	-	-
31961002	unknown	8,3	-	-	-	-
167087316	unknown	13,0	-	-	-	-
318185293	unknown	4,9	-	-	-	-
37761454	unknown	6,7	-	-	-	-
73080557	unknown	4,5	-	-	-	-
149347805	unknown	15,0	-	-	-	-
51947301	unknown	7,2	-	-	-	-
70444448	unknown	14,0	-	-	-	-
122907424	unknown	5,6	-	-	-	-
306736346	unknown	2,1	-	-	-	-
5909560	unknown	11,0	-	-	-	-
56665695	unknown	17,0	-	-	-	-
78175364	unknown	12,0	-	-	-	-
95962150	unknown	3,7	-	-	-	-
118913380	unknown	2,3	-	-	-	-
283994290	unknown	6,3	-	-	-	-
430502428	unknown	4,3	-	-	-	-
260352227	unknown	7,1	-	-	-	-
359569731	unknown	8,4	-	-	-	-
45044984	unknown	10,0	-	-	-	-
60415858	unknown	5,0	-	-	-	-

(continued on next page)

Table 1: Continued.

(continued from previous page)

TIC ID	Var. Type	A (mmag)	P (days)	T_0 (JD)	T (K)	M
178781720	unknown	2,7	-	-	-	-
183658624	unknown	3,3	-	-	-	-
260131310	unknown	12,0	-	-	-	-
260472262	unknown	6,2	-	-	-	-
285626080	unknown	20,0	-	-	-	-
298456269	unknown	4,5	-	-	-	-
46114128	unknown	11,0	-	-	-	-
179575202	unknown	67,0	-	-	-	-
300043830	unknown	11,0	-	-	-	-
349372072	unknown	5,8	-	-	-	-
55093477	unknown	3,7	-	-	-	-
167904450	unknown	7,9	-	-	-	-
261061538	unknown	11,0	-	-	-	-
182094771	unknown	5,9	-	-	-	-
4734401	unknown	9,4	-	-	-	-
453049832	unknown	3,7	-	-	-	-
461605205	unknown	6,0	-	-	-	-
455269688	unknown	6,3	-	-	-	-
455274154	unknown	10,0	-	-	-	-
299943301	unknown	10,0	-	-	-	-
386751445	unknown	8,7	-	-	-	-
334653999	unknown	2,4	-	-	-	-
237937112	unknown	2,1	-	-	-	-
361060107	unknown	1,8	-	-	-	-
198036035	unknown	8,7	-	-	-	-
26172055	unknown	7,4	-	-	-	-
38954454	unknown	9,2	-	-	-	-
1731678	unknown	6,6	-	-	-	-
238018529	unknown	4,0	-	-	-	-
332510406	unknown	10,0	-	-	-	-
434478160	unknown	7,8	-	-	-	-
437278711	unknown	4,4	-	-	-	-
437371303	unknown	4,1	-	-	-	-
437865646	unknown	19,0	-	-	-	-
438376282	unknown	2,8	-	-	-	-
439040577	unknown	4,7	-	-	-	-
439331136	unknown	6,3	-	-	-	-
441850019	unknown	3,5	-	-	-	-
442239738	unknown	5,7	-	-	-	-
445324999	unknown	5,8	-	-	-	-
31065297	unknown	2,9	-	-	-	-
183407026	unknown	2,1	-	-	-	-
380502855	unknown	18,0	-	-	-	-

(continued on next page)

Table 1: Continued.

(continued from previous page)

TIC ID	Var. Type	A (mmag)	P (days)	T_0 (JD)	T (K)	M
33281417	unknown	7,4	-	-	-	-
37685634	unknown	11,0	-	-	-	-
74972873	unknown	4,7	-	-	-	-
143405538	unknown	8,6	-	-	-	-
2251147	unknown	2,2	-	-	-	-
38457604	unknown	5,9	-	-	-	-
53109404	unknown	7,5	-	-	-	-
193221062	unknown	6,4	-	-	-	-
307210868	unknown	5,7	-	-	-	-
309066741	unknown	13,0	-	-	-	-
33152712	unknown	3,9	-	-	-	-
45889555	Beta Cephei	2,9	-	-	12700	-0,50
242078926	unknown	7,5	-	-	-	-
319258493	unknown	11,0	-	-	-	-
1680927	unknown	3,7	-	-	-	-
3054883	unknown	2,8	-	-	-	-
34987098	unknown	6,7	-	-	-	-
45659093	unknown	2,9	-	-	-	-
46955439	unknown	3,7	-	-	-	-
48430763	unknown	7,1	-	-	-	-
53575889	unknown	38,0	-	-	-	-
93269689	unknown	2,3	-	-	-	-
101172135	M	53,0	-	-	3700	-1,35
148560541	unknown	4,9	-	-	-	-
268344691	unknown	7,0	-	-	-	-
272089457	unknown	8,6	-	-	-	-
275185063	unknown	3,8	-	-	-	-
285024852	unknown	5,5	-	-	-	-

5 Appendix B

All TESS light curves for the 326 newly identified variable stars are shown below. Each figure presents a grid of 24 light curves (8×3), labeled with TIC IDs above each panel. The numbers in the captions indicate the object index range corresponding to Table 1 (see Appendix A).

