Astronomy & Astrophysics manuscript no. exor_plates_2
January 31, 2018

Towards a better classification of unclear eruptive variables: the cases of V2492 Cyg, V350 Cep, and ASASSN-15qi

R. Jurdana-Šepić[1], U. Munari[2], S. Antoniucci[3], T. Giannini[3], D. Lorenzetti[3]

[1] Physics Department, University of Rijeka, Radmile Matejčić, 51000 Rijeka, Croatia
[2] INAF - Osservatorio Astronomico di Padova - via dell'Osservatorio 8, Asiago (VI) 36012, Italy
[3] INAF - Osservatorio Astronomico di Roma - Via Frascati, 33 - Monte Porzio Catone 00078, Italy
[4]

Received date / Accepted date

ABSTRACT

Context. Eruptive variables are young stars that show episodic variations of brightness: EXors/FUors variations are commonly associated with enhanced accretion outbursts occurring at intermittent cadence of months/years (EXors) and decades/centuries (FUors). Variations that can be ascribed to a variable extinction along their line of sight are instead classified as UXors.
Aims. We aim at investigating the long-term photometric behaviour of three sources classified as eruptive variables. We present data from the archival plates of the Asiago Observatory relative to the fields where the targets are located. For the sake of completeness we have also analysed the Harvard plates of the same regions that cover a much longer historical period, albeit at a lower sensitivity, however we are only able to provide upper limits.
Methods. A total of 273 Asiago plates were investigated, providing a total of more than 200 magnitudes for the three stars, which cover a period of about 34 yr between 1958 and 1991. We have compared our data with more recently collected literature data.
Results. Our plates analysis of V2492 Cyg provides historical upper limits that seem not to be compatible with the level of the activity monitored during the last decade. Therefore, recently observed accretion phenomena could be associated with the outbursting episodes, more than repetitive obscuration. While a pure extinction does not seem the only mechanism responsible for the ASASSN-15qi fluctuations, it can account quite reasonably for the recent V350 Cep variations.

Key words. Stars: pre-main sequence – Stars: variables – Astronomical Data Bases: catalogues – Stars: individual: V2492 Cyg – Stars: individual: V350 Cep – Stars: individual: ASASSN-15qi

1. Introduction

The last phases of the matter accretion onto young stellar objects (YSOs) occur through intermittent bursts of the mass-accretion rate that consequently provoke a remarkable increase of brightness, mainly at optical and near-infrared (NIR) frequencies. A detailed description of the current knowledge of the accretion process onto young stars has recently been given by Hartmann, Herczeg, & Calvet (2016). According to a general consensus these eruptive events are classified into two major classes, FUors and EXors, which, at the moment, globally amount to only a few tens of objects (see also the review by Audard et al. 2014). FUors (Hartmann & Kenyon 1985) are characterized by bursts of long duration (tens of years) with accretion rates of the order of 10^{-4}-10^{-5} $M_\odot$ yr^{-1} and spectra dominated by absorption lines. EXors (Herbig 1989, Lorenzetti et al. 2012) show shorter outbursts (between months and one year) with a recurrence time of years, have accretion rates of the order of 10^{-6}-10^{-7} $M_\odot$ yr^{-1}, and are characterized by emission line spectra (e.g. Herbig 2008, Lorenzetti et al. 2009, Kóspál et al. 2011, Sicilia-Aguilar et al. 2012, Antoniucci et al. 2013, 2014, Giannini et al. 2016). Bursts of both classes are thought to be triggered by instabilities originating in the disk itself (Zhu et al. 2009, D'Angelo & Spruit 2010, 2012), in particular in the inner connection region between star and disk. To have a more complete account for the scenario of the young variables, UXors objects must also be considered (Grinin 1988), whose brightness variations are related to orbiting dust structures that move along the line of sight.

Observational activity is often oriented to obtain a quick classification by considering the mentioned properties as overstrict, whereas it is becoming increasingly clear that a large variety of different cases exists, for which it is difficult to discriminate between the three classes (see e.g. the case of V1647 Ori, whose variability is loosely defined - Aspin 2011, Kóspál et al. 2011; and, more recently, that of V346 Nor - Kraus et al. 2016, Kóspál et al. 2017). Sometimes even the origin of the observed variability is a matter of debate (see e.g. the case of GM Cep - Sicilia-Aguilar et al. 2008; Xiao et al. 2010). These dubious circumstances arise from observations that often rely on a single (or a few) event(s) and not on a long-lasting photometric and/or spectroscopic monitoring. Remarkably, a single outburst does not allow us to ascertain if the object will remain or not in its higher state; analogously, from a single fading, we cannot determine whether we are looking at a typically bright object subject to repetitive obscuration or, conversely, at a quiescent object that undergoes recurrent outbursts.

One method to ameliorate the classification process involves investigating (whenever it is possible) the past history of the objects. A long-lasting (up to half century or more) monitoring can be obtained by digging into the plate archives, which allow us to build up light curves in the optical bands, where the eruptive variables present their largest fluctuations. This method has

Send offprint requests to: Rajka Jurdana-Šepić, e-mail: jurdana@phy.uniri.hr

proven to be very efficient for studying the eruptive variables, as recently demonstrated for the FUor V960 Mon (Jurdana–Šepić & Munari, 2016) and for the EXors GM Cep (Xiao et al. 2010) and V1118 Ori (Jurdana–Šepić et al. 2017).

In the following, we examine deep *BVRI* plates taken between 1958 and 1993 with the Asiago Schmidt telescopes, of three young variables classified as eruptive objects, namely V2492 Cyg, V350 Cep, and ASASSN-15qi, which for different reasons deserve a more in-depth analysis in order to ascertain their nature. We aim at improving the characterization of their quiescent phase, which will represent a useful reference for studies analysing future outbursts and the physical changes induced by these events.

To expand our search to a more distant past (up to ∼1890), we have also examined all the deepest plates covering our three program stars that we have been able to locate in the plate stack of the Harvard College Observatory (HCO). None of them, unfortunately, turned out to be as deep as the Asiago plates, their limiting recorded brightness being typically several magnitudes brighter.

The paper is organised as follows: our sample is presented in Sect. 2; the adopted method and the obtained *BVRI* photometry are presented in Sects. 3 and 4. Section 5 gives the analysis and discussion of the obtained results, while our concluding remarks are given in Sect. 6.

2. The investigated sample

2.1. V2492 Cyg

The object V2492 Cyg (α_{2000} = $20^h51^m26.23^s$, δ_{2000} $+44°05'23.9''$) is located in the North American-Pelican Nebula at an estimated distance of 550 pc (Bally & Reipurth 2003). Its first outburst on 2010 August 23 was discovered by Itagaki & Yamaoka (2010) and the brightness increase of ∼5 mag lasted about 10 months. Covey et al. (2011) independently discovered the V2492 Cyg outburst: their optical and near-IR spectroscopy revealed a rich emission-line spectrum that allowed them to derive a mass-accretion rate of 2.5 10^{-7} $M_\odot$ yr^{-1}. Blue-shifted absorption at several hundred km $s^{-1}$and the presence of typical tracers of shocked gas (such as H_2, [SII] and [FeII]) both indicate a substantial amount of outflowing matter. The same spectroscopic evidence was confirmed by Aspin (2011), who also considered archival data (2009-2010) to investigate the pre-outburst nature of V2492 Cyg. His conclusions favour an EXor classification for V2492 Cyg, although the source appears to be significantly younger than other members typical of the class. After its fading, the source underwent additional episodes of brightening followed by dimming events; all these phases were extensively sampled by Hillenbrand et al. (2013), who detected neutral and singly ionized atomic species likely formed in an accretion flow, but also identified a behaviour attributable to rotating circumstellar disk material that causes the semi-periodic dimming. Therefore they concluded that V2492 Cyg simultaneously displays accretion-driven and extinction-driven fluctuations. Kóspál et al. (2013), observing the source between 0.55 μm and 160 μm, regard V2492 Cyg as an UXor-type system. The most recent (Nov. 2016 - Mar. 2017) peak of brightness, at a level never reached before, has been announced by Ibryamov & Semkov (2017) and spectroscopically studied at high resolution by Munari et al. (2017) and Giannini et al. (2017), who confirm the great deal of emission lines as presented by Aspin (2011), but with absorptions that are now far stronger.

2.2. V350 Cep

Herbig (2008) provides a summary of the past history of the late-type (M2) pre-main sequence star V350 Cep (α_{2000} = $21^h43^m00.00^s$, δ_{2000} $+66°11'28.0''$) in NGC 7129, a region of active star formation (Dahm & Hillenbrand 2015 and references therein) located at 1150 pc (Straižys et al. 2014). The target was undetected (i.e. B >21 mag) on the 1954 Palomar plates, but a brightness (about B= 17.5) was found in the middle of the 1970s. From 1978 until 2004, V350 Cep remained at the same level of brightness (B ∼17) as shown by Pogosyants (1991), and Semkov (2004, and references therein). As a consequence, all the following spectroscopic investigations were obtained at a high level of brightness, and, substantially, all confirm the classical T Tauri (CTTS) nature of V350 Cep. Herbig (2008) also examined the high-resolution spectrum discussing important dynamical details, suggesting that V350 cannot be classified as an EXor source. Ibryamov et al. (2014) provide the result of their *UBVRI* photometry in the period 2004-2014, during which the star maintained its maximum brightness (for a complete view of the historical light curve, see their Fig. 1). The V-band light curve retrievable from the ASASSN [1] database confirms that V350 Cep is even now at the same high level of brightness. The simultaneous presence of an emission line spectrum and the apparent lack of a repetitive activity represent contrasting evidences toward a certain classification of V350 Cep. Further ambiguities stem from the recent observations by Semkov et al. (2017), who registered a deep fading (ΔB = 2.16, ΔV = 1.77) in the period between March and May 2016, followed by a quick restoration (occurring in the second half of 2016) of its maximum brightness. They suggest that such an event is compatible with an obscuration from clumps orbiting the star or with a decrease in the accretion rate, or with a combination of both mechanisms.

2.3. ASASSN-15qi

ASASSN-15qi (α_{2000} = $20^h56^m08.82^s$, δ_{2000} $+51°31'04.1''$) recently (2015 Oct 2nd/3rd) underwent a sudden brightening (ΔV = 3.5 mag) in less than one day. Strong P-Cyg profiles with red emission wings traced a very fast wind with a velocity up to 1000 km s^{-1} that faded while the central source returned to quiescence (Maehara et al. 2015, Herczeg et al. 2016). The distance estimate for ASASSN-15qi is around 3.24 kpc. Assuming the values of the pre-outburst photometry, Hillenbrand et al. (2015) derived an A_V of about 5 mag and a luminosity of ∼125 $L_\odot$. Consequently, they also derived a progenitor source roughly 2.5-3.0 $M_\odot$, and concluded the source cannot be easily classified into the FUor and EXors classes according to our current knowledge of the defining criteria. Connelley et al. (2015) obtained an early near-IR spectrum showing a strong veiling, a number of emission lines (with strong P-Cyg), and CO bandheads in emission. They also revealed a very faint nebulosity seen only in the J band), likely due to a reflection nebula. A thorough collection of UV, optical, near- and mid-IR and sub-mm observations, together with archival photometry (mainly obtained in 2000 and 2015), was presented by Herczeg el al. (2016). They were able to build-up reliable Spectral Energy Distributions (SEDs) of ASASSN-

[1] All-Sky Automated Survey for Supernovae (https://asas-sn.osu.edu/)

15qi during quiescence, outburst, peak, decay, and quiescence again. They also provide an accurate description of the dynamical events during the different phases. Nevertheless, the observations cannot easily be explained in the framework of FUor and EXor outbursts, and, in principle, even a rapid decrease in the extinction could be responsible for the increased brightness. The V-band light curve (2015-2017) from the ASASSN database provides significant upper limits ($V < 17$ mag) confirming that ASASSN-15qi is currently in a quiescence period

3. Data acquisition

3.1. Asiago archive plates

Two Schmidt telescopes were operated with photographic plates at the Astronomical Observatory in Asiago. The smaller one (SP, 40/50 cm, 100 cm focal length) observed between 1958 and 1992, with photographic films covering a circular area 5° in diameter. The larger telescope (SG, 67/92 cm, 208 cm focal length) exposed square glass photographic plates imaging a 5°×5° portion of the sky. It operated with photographic plates between 1965 and 1998, after which large format CCDs were used as detectors. Nearly all plates from both telescopes go very deep, B~18.5 and B~17.8 mag being the typical limiting magnitude for blue sensitive plates exposed with the SG and SP telescopes, respectively.

The Asiago plates were usually exposed as 103a-O + GG13, 103a-E + RG1, Tri-X + GG14, and IN + RG5 combinations of Kodak plates and Schott astronomical filters, matching the passband of Johnson-Cousins B, R_C and I_C photometric system (Moro & Munari 2000). A large number of plates were exposed as unfiltered 103a-O, thus nominally covering both the Johnson B and U bands thanks to the high ultraviolet transparency of the UBK-7 corrector plates at both Schmidt telescopes. For low temperature and/or reddened objects, especially if they were observed at large airmass, the amount of proper U-band photons collected by an unfiltered 103a-O plate is however minimal compared to those arriving through the B-band portion of the interval of sensitivity of 103a-O emulsion. In such conditions (and provided that the selected comparison stars are themselves of low temperature and/or high reddening), 103a-O + GG13 pairs and unfiltered 103a-O plates are almost equally well replicating the standard Johnson B band (Munari & Dallaporta 2014).

The Asiago Schmidt plates cover an uninterrupted interval of 40 years, and are accurately preserved in a controlled environment. We note that their time spans overlap the so-called *Menzel Gap* when for about ten years the acquisition of plates with Harvard telescopes distributed around the globe was greatly reduced. A total of 90, 68, and 115 Asiago plates were found to image, respectively, the three program stars V2492 Cyg, V350 Cep and ASASSN-15qi. The resulting magnitudes are listed in Tables 1, 2, and 3 (electronic only).

3.2. Harvard plates

In order to expand our search for old starbursts of our program stars as far back as possible into the past, we turned to the Harvard College Observatory (HCO) plate stack in Cambridge, Massachusetts, home of one of the largest and best preserved archives of astronomical photographic plates taken with many different astrographs located at various sites distributed in both hemispheres beginning around 1880. The limited focal length and aperture of these astrographs result in detection limits which are typically some magnitudes brighter than those of the far deeper Asiago plates.

V350 Cep by lucky coincidence happens to be located in a region of the sky where all HCO plates have been digitized and measured as part of the DASCH project (Grindlay et al. 2012), that we were allowed to access prior to publication (E. Los, 2017 private communication). The other two targets, V2492 Cyg and ASASSN-15qi, are in regions of the sky not covered by DASCH, so we personally went to the HCO plate stack, located and retrieved the relevant plates, and inspected them at the microscope against local photometric sequences extracted from the all-sky APASS photometric survey (Henden & Munari 2014). The process is tedious and therefore we decided to limit the inspection to HCO plates from instruments that were expected to pass a limiting magnitude of 13 in B band (almost all of the old HCO plates are blue sensitive with a response comparable to that of modern B band).

About 535 plates for V2492 Cyg and 162 for ASASSN-15qi were selected for visual inspection. About 198 for V2492 Cyg and 40 for ASASSN-15qi were found to be inadequate for the task for a variety of reasons (emulsion defects, fogging, poor guiding/seeing, plate missing or imaging an incorrect field, etc.), leaving 337 suitable plates for V2492 Cyg and 122 for ASASSN-15qi. In none of them were the program stars detected. The same holds true for V350 Cep, which is undetected on all plates digitized by DASCH. A random selection of the latter was inspected at the microscope to compare our estimates with DASCH limiting magnitudes, and similar results were found (incidentally, the photometric calibration of DASCH scans is done based on the APASS survey too). Figure 4 presents the upper limits from HCO plates to the brightness of our program stars in graphical form.

3.3. Brightness measurement

To derive the brightness of our targets, we compared them at a high quality Zeiss microscope against a local photometric sequence established around each target. Such a sequence, composed of stars of roughly the same colour as the variable, and widely distributed in magnitude so as to cover both quiescence and outburst states, was extracted primarily from the APASS $BVg'r'i'$ all-sky survey (Henden et al. 2012, Henden & Munari 2014), with porting to Landolt R_C and I_C bands following Munari (2012) and Munari et al. (2014) prescriptions. To evaluate the measurement errors a number of plates were re-estimated after several days when all memories had vanished from the observer(s). The typical error is 0.1 mag, comparable to that intrinsic to the photographic plate itself so that the observer adds little to it. For plates not recording the variable star due to it being too faint, we noted the magnitude of the faintest but still clearly visible star of the comparison sequence. The latter was composed by field stars closely distributed around the variable and typically by 0.35 mag in brightness.

4. Historical light curves

Because of the limits imposed by the Harvard plate, the analysis presented hereinafter will be based on the Asiago plates only. The $BVRI$ light curves of V2492 Cyg, V350 Cep, and ASASSN 15qi corresponding to their plate photometry (Tables 1, 2 and 3) are given in Figures 1, 2, and 3, respectively. In Table 4 some statistics are provided for the source ASASSN-15qi, the only one for which we can infer, for the first time, meaningful averaged values for the quiescence level. Determining this level

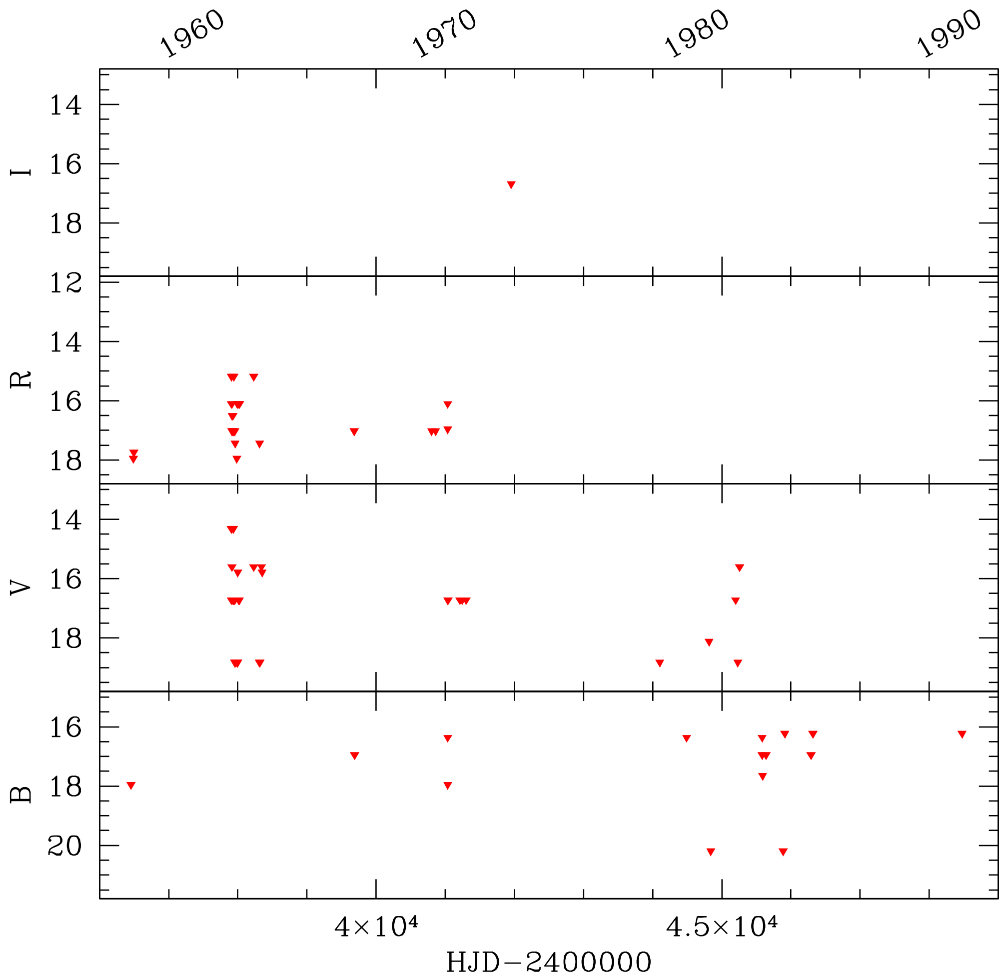

Fig. 1. *BVRI* magnitude upper limits (solid red triangles) for V2492 Cyg.

is fundamental to have a solid reference for accurately computing physical changes once the outburst values are obtained. In each band, we list the number of observations, the median value (basically the quiescence magnitude) together with the standard deviation of the data points, and the peak brightness. We note how this source presents, in quiescence, a level of modest variability quantified by considering the standard deviation of the measurements (0.3-0.4 mag).

5. Analysis and discussion

5.1. V2492 Cyg

During our monitoring period V2492 Cyg remained always undetected at our sensitivity, therefore the light curve depicted in Fig. 1 displays only upper limit values at different levels, as explained in Sect. 3. As a consequence, no fading or outbursting event can be detected, nevertheless some useful information can be derived. As mentioned above, after its discovery in 2010, V2492 underwent a long-lasting period of strong activity with intermittent burst and fading events (see Hillenbrand et al. 2013 and AAVSO [2] data) and reached its maximum recorded brightness in 2017 (Giannini et al. 2017). During most of this period, the source was sampled with an almost daily cadence and, for long time intervals, remained brighter than the following values: B<18, V<16, R<15, and I<14 mag. In comparison, our plate measurements are largely undersampled, presenting long periods (up to a decade) without any data. In any case (not considering the I band, which is practically uncovered, and the B band, which presents no significant upper limits), our V and R-band upper limits tentatively suggest that duringa period of about 30 yr from 1958 to 1987 an activity similar (both in duration and in brightness) to that more recently (2010-2017) monitored, did not occur. Indeed, we note that for a significant amount of time the source is brighter than the level indicated by our upper limits, thus suggesting that, in the past, the activity of V2492 Cyg was not as strong as it is now. The above scenario, if correctly described, means that an enhanced brightness variability could be an infrequent feature of V2492 Cyg. Such circumstances favour an accretion- more than an extinction-driven origin for the bursts. Indeed, the former is expected to occur with a long and irregular cadence related to the viscous motion of the matter toward the inner edge of the disk, while the latter should occur more frequently and regularly, according to the orbital motion of the obscuring matter along the line of sight.

[2] American Association of Variable Star Observers (https://www.aavso.org)

Table 1. Plate photometry of V2492 Cyg. Columns provide: date and central UT of any exposure, exposure time, plate emulsion, the adopted filter, the telescope, the plate number, and the magnitude derived for the source (see text for further details).

HJD	Date	UT	Expt	Emulsion	Filter	Tel	Plate	mag
2436454.42875	1958-09-07	22:13	30	103a-O	....	SP	00031	B> 17.95
2436488.31134	1958-10-11	19:25	60	103a-E	RG 1	SP	00049	R> 17.95
2436494.29375	1958-10-17	19:00	40	103 a-E	RG 1	SP	00052	R> 17.74
2437905.46837	1962-08-28	23:10	15	PANROY	....	SP	03028	V> 14.32
2437907.44614	1962-08-30	22:38	15	PANROY	....	SP	03037	V> 16.72
2437907.46420	1962-08-30	23:04	15	103 a-E	RG 1	SP	03038	R> 15.18
2437908.48295	1962-08-31	23:31	40	103 a-E	RG 1	SP	03045	R> 16.10
2437913.51001	1962-09-05	24:10	15	PANROY	....	SP	03055	V> 15.60
2437913.55098	1962-09-05	25:09	30	103 a-E	RG 1	SP	03056	R> 16.10
2437915.47180	1962-09-07	23:15	30	103 a-E	RG 1	SP	03060	R> 17.02
2437916.44819	1962-09-08	22:41	40	103 a-E	RG 1	SP	03065	R> 17.02
2437917.48776	1962-09-09	23:38	40	103 a-E	RG 1	SP	03075	R> 16.50
2437926.33139	1962-09-18	19:53	30	103 a-E	RG 1	SP	03083	R> 17.02
2437929.32509	1962-09-21	19:44	40	103 a-E	RG 1	SP	03095	R> 16.50
2437930.37645	1962-09-22	20:58	15	PANROY	....	SP	03101	V> 16.72
2437933.46666	1962-09-25	23:08	40	103 a-E	RG 1	SP	03118	R> 17.02
2437936.52909	1962-09-28	24:38	15	PANROY	....	SP	03133	V> 14.32
2437938.42557	1962-09-30	22:09	15	PANROY	....	SP	03146	V> 16.72
2437939.40401	1962-10-01	21:38	15	PANROY	....	SP	03161	V> 16.72
2437940.35468	1962-10-02	20:27	40	103 a-E	RG 1	SP	03170	R> 17.02
2437942.37337	1962-10-04	20:54	40	103 a-E	RG 1	SP	03189	R> 15.18
2437955.28264	1962-10-17	18:44	15	PANROY	....	SP	03208	V> 16.72
2437956.29024	1962-10-18	18:55	30	103 a-E	RG 1	SP	03213	R> 17.02
2437957.28742	1962-10-19	18:51	20	PANROY	....	SP	03219	V> 18.82
2437960.28591	1962-10-22	18:49	40	103 a-E	RG 1	SP	03225	R> 17.43
2437961.27892	1962-10-23	18:39	20	PANROY	....	SP	03240	V> 18.82
2437962.30805	1962-10-24	19:21	20	PANROY	....	SP	03249	V> 18.82
2437985.23194	1962-11-16	17:33	40	103a-E	RG 1	SP	03294	R> 17.95
2437991.24829	1962-11-22	17:57	20	PANROY	....	SP	03298	V> 18.82
2437992.23296	1962-11-23	17:35	40	103 a-E	RG 1	SP	03311	R> 16.10
2437995.21822	1962-11-26	17:14	20	PANROY	....	SP	03337	V> 18.82
2437998.21251	1962-11-29	17:06	15	PANROY	....	SP	03347	V> 18.82
2437999.23328	1962-11-30	17:36	40	103 a-E	RG 1	SP	03367	R> 16.10
2438000.23601	1962-12-01	17:40	10	PANROY	....	SP	03382	V> 15.78
2438013.25477	1962-12-14	18:08	15	PANROY	....	SP	03440	V> 16.72
2438015.21369	1962-12-16	17:09	30	103 a-E	RG 1	SP	03447	R> 16.10
2438017.21429	1962-12-18	17:10	30	103 a-E	RG 1	SP	03466	R> 16.10
2438019.23502	1962-12-20	17:40	15	PANROY	....	SP	03483	V> 16.72
2438020.24677	1962-12-21	17:57	30	103 a-E	RG 1	SP	03493	R> 16.10
2438021.21201	1962-12-22	17:07	15	PANROY	....	SP	03507	V> 16.72
2438024.21394	1962-12-25	17:10	30	103a-E	RG 1	SP	03525	R> 16.10
2438229.49955	1963-07-18	23:56	10	PANROY	....	SP	04082	V> 15.60
2438230.50514	1963-07-19	24:04	30	103 a-E	RG 1	SP	04091	R> 15.18
2438311.30172	1963-10-08	19:11	13	PANROY	....	SP	04095	V> 18.82
2438314.31482	1963-10-11	19:30	30	103 a-E	RG 1	SP	04108	R> 17.43
2438321.30761	1963-10-18	19:20	22	PANROY	....	SP	04150	V> 18.82
2438342.26500	1963-11-08	18:20	15	PANROY	....	SP	04229	V> 15.60
2438351.24371	1963-11-17	17:50	15	PANROY	....	SP	04238	V> 15.78
2439681.53672	1967-07-09	24:50	60	103a-E	RG 1	SG	00741	R> 17.02
2439685.47923	1967-07-13	23:27	90	103a-E	RG 1	SG	00754	R> 17.02
2439688.53768	1967-07-16	24:51	30	0a-O		SG	00768	B> 16.95
2440802.49793	1970-08-03	23:53	60	Ia-E	RG 6450	SG	03527	R> 17.02
2440859.42767	1970-09-29	22:12	60	103a-E	RG 6450	SG	03654	R> 17.02
2441035.62019	1971-03-24	26:57	15	103 a-O	GG 13	SP	08717	B> 16.36
2441035.62575	1971-03-24	27:05	10	103a-O	GG 13	SG	04262	B> 17.95
2441035.63616	1971-03-24	27:20	10	103 a-E	RG 1	SP	08718	R> 16.95
2441035.63686	1971-03-24	27:21	10	103a-D	GG 14	SG	04263	V> 16.72
2441035.65144	1971-03-24	27:42	20	103a-E	RG 1	SG	04264	R> 16.10
2441040.64879	1971-03-29	27:38	15	103a-D	GG 14	SG	04281	V> 16.72
2441213.40778	1971-09-18	21:43	20	TRI X	GG 14	SP	09022	V> 16.72
2441243.45344	1971-10-18	22:50	20	TRI X	GG 14	SP	09122	V> 16.72
2441303.29768	1971-12-17	19:10	20	TRI X	GG 14	SP	09312	V> 16.72
2441954.46936	1973-09-28	23:12	20	IN Sen	RG 5	SG	06655	I> 16.69
2444101.43147	1979-08-15	22:17	30	103a-D	GG 14	SG	10133	V> 18.82
2444490.47666	1980-09-07	23:22	8	103 a-O	GG 13	SP	14349	B> 16.36
2444814.50196	1981-07-28	23:59	30	103a-D	GG 14	SG	11050	V> 18.12
2444841.49961	1981-08-24	23:55	30	103a-O	GG 13	SG	11084	B> 20.19
2445199.48844	1982-08-17	23:39	15	TRI X	....	SP	14906	V> 16.72
2445231.39041	1982-09-18	21:18	30	103a-D	GG 14	SG	11682	V> 18.82
2445258.38896	1982-10-15	21:17	15	TRIX	....	SP	14982	V> 15.60
2445259.39656	1982-10-16	21:28	15	TRIX	....	SP	14994	V> 15.60
2445582.38849	1983-09-04	21:15	15	103 a-O	GG 13	SP	15354	B> 16.95

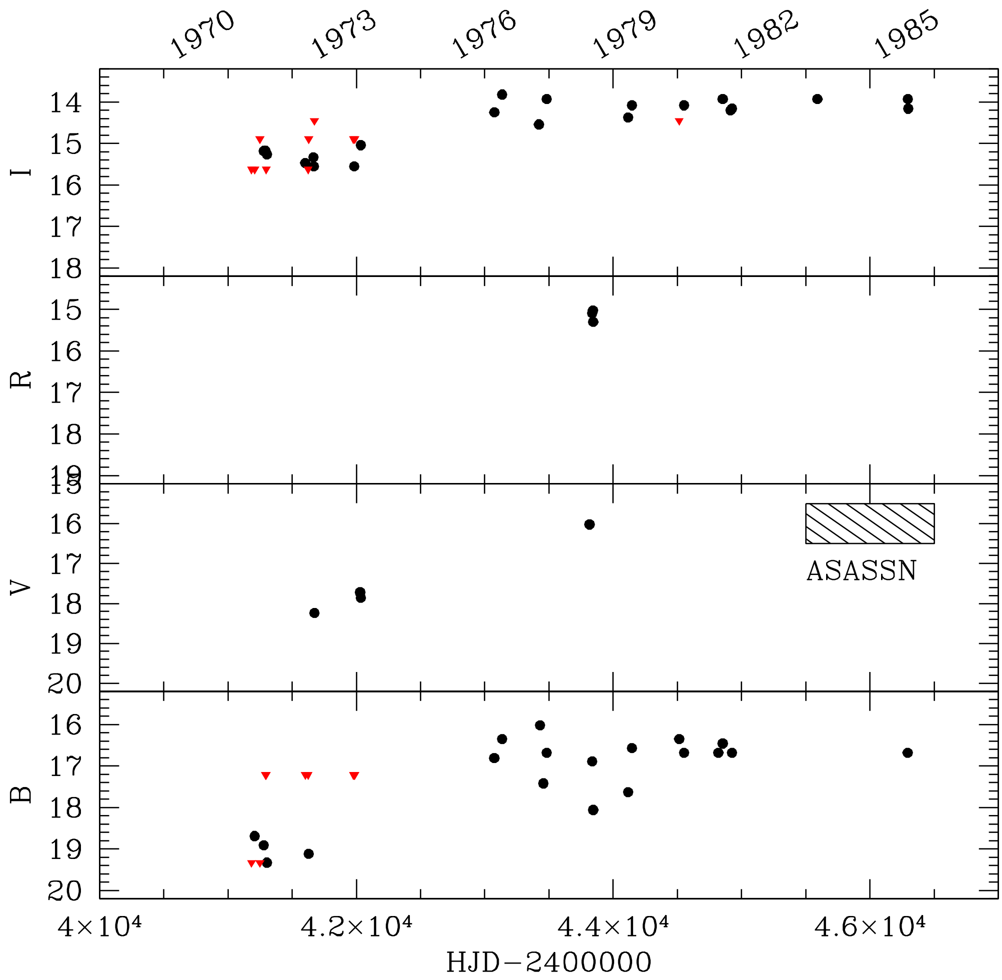

Fig. 2. *BVRI* light curves of V350 Cep. Upper limits are given as solid red triangles. The hatched box on the right-hand side of the V-band panel indicates the spread of magnitudes obtained in the period 2014-2017 by the survey ASASSN (see text).

Table 1. Continued.

2445583.38015	1983-09-05	21:03	15	103 a-O	GG 13	SP	15361	B> 16.36
2445590.41065	1983-09-12	21:47	10	103 a-O	....	SP	15380	B> 17.65
2445641.38819	1983-11-02	21:17	12	103 a-O	....	SP	15480	B> 16.95
2445886.49766	1984-07-04	23:54	30	103a-O	GG 13	SG	12519	B> 20.19
2445912.46799	1984-07-30	23:10	10	103 a-O	....	SP	15930	B> 16.23
2446290.50297	1985-08-12	24:00	12	103a-O	....	SP	16379	B> 16.95
2446318.42526	1985-09-09	22:08	10	103a-O	....	SP	16461	B> 16.23
2448476.44454	1991-08-07	22:36	10	103 a-O	GG 13	SP	18248	B> 16.23
2448539.46904	1991-10-09	23:12	8	103 a-O	GG 13	SP	18303	B> 16.36

5.2. V350 Cep

As depicted in Fig. 2, our 15-year coverage (1971-1985) presents a significant sequence of data in the *B* and *I* bands only. These data substantially confirm the behaviour of V350 Cep illustrated in Sect.1: namely a burst occurred in the middle of the 1970s, after which V350 became well detectable, at a roughly constant level of brightness. To our knowledge, the available literature does not point out any sign of a peculiar activity until the sudden fading and quick restoring of its maximum brightness, occurring in the *B* band during 2016 (Semkov et al 2017). Our data indicate this has not been a unique event. Indeed, between 1977 and 1980, in the same band, there is evidence of intermittent luminosity variations of ΔB $\sim$ 1-1.5 mag on a time-scale of months. A lesser variation is barely recognisable also in the I band. The existence of (at least) two fading episodes in few decades makes it difficult to classify V350 Cep as a pure FUor star, although its relevant brightening occurred in the 1970s. On the other hand, albeit increasing the monitoring coverage, the lack of significant outbursts remains confirmed, and therefore, also the EXor hypothesis does not seem viable. A longer and continuous multi-band monitoring could provide a more certain classification, but, at the present stage, we note that the presence of an orbiting structure along the line of sight (UXor hypothesis) has a role in determining its light curve. The strict similarity between the two fading episodes highlighted by our observations corroborates such a conclusion.

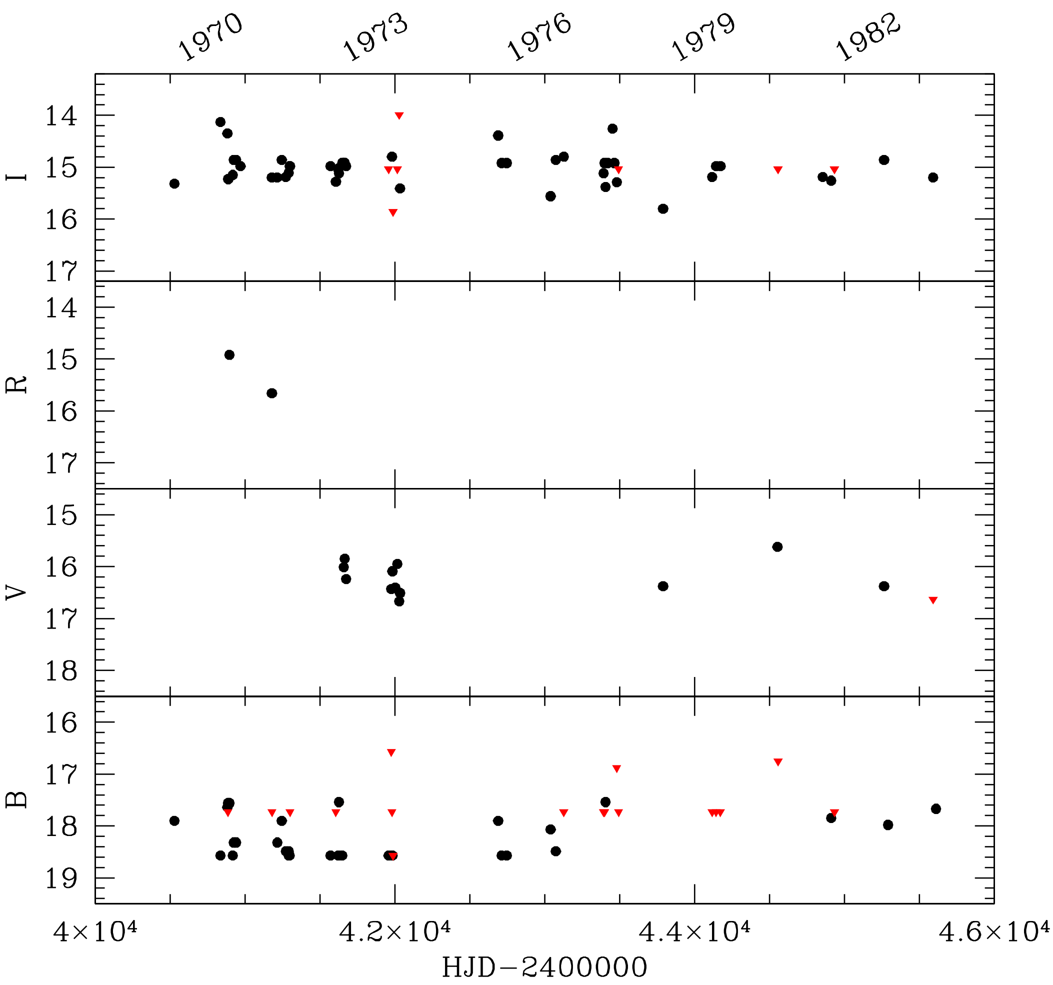

Fig. 3. *BVRI* light curves of ASASSN 15qi. Upper limits are given as solid red triangles. The horizontal segment in the right side of the V-band panel indicates the level of upper limit magnitudes obtained in the period 2015-2017 by the survey ASASSN (see text).

5.3. ASASSN-15qi

Although much more frequently sampled and for a much longer period, our data substantially agree with the archival photometry given by Herczeg et al. (2016) (see their Table 1). Our monitoring refers to a long-lasting (1970-1983) quiescence period during which brightness fluctuations (up to 1 mag) in the B, V, and I bands occurred. Therefore, ASASSN-15qi behaved in the past as a moderately active young source similar to the classical T Tauri stars, albeit more massive and luminous. It should be noted that a very fast event (lasting about 10 days) analogous to that recently pointed out by Maehara et al. (2015) (see Sect.1) would, theoretically, never have been detected by our monitoring, whose sampling is not frequent enough. As a consequence, we can only confirm the doubts already expressed by Herczeg et al. (2016) about the classification of this object. However, we can provide an argument related to the colour-magnitude plot (see following section 4.4) not supporting a pure UXor classification.

5.4. Colour-magnitude diagrams

Given the available data we can only build the colour-magnitude plots B versus $[B-I]$ for the sources V350 Cep and ASASSN-15qi, using only magnitudes obtained within 1 day in B and I bands. They are given in Fig. 5 and essentially support the above considerations. In fact, while data points of V350 Cep (left panel) are well aligned along the extinction vector, ASASSN-15qi (right panel) comparatively shows a more dispersed distribution, typical of sources whose fluctuations cannot be reconciled with a pure extinction origin.

6. Concluding remarks

Archival plate analysis is a tool well suited to searching the past history of young variables identified as eruptive stars, and hence to improve their classification. We investigated the Asiago Schmidt plate collection for observations of the selected fields where the three eruptive sources V2492 Cyg, V350 Cep, and ASASSN-15qi are located. Observations of these regions were repeatedly carried out at Asiago over various time periods from 12 to 30 years. The analysis of Harvard plates of the same sources rules out the occurrence of large outbursts in the past. We provide one of the best-sampled photometric datasets ever obtained of the past history of the three targets. In particular, V2492 historical upper limits do not seem compatible with the level of brightness of the present activity. Hence, this latter could have appeared only recently, possibly dominated by accretion phenomena more than by repetitive obscuration. For V350,

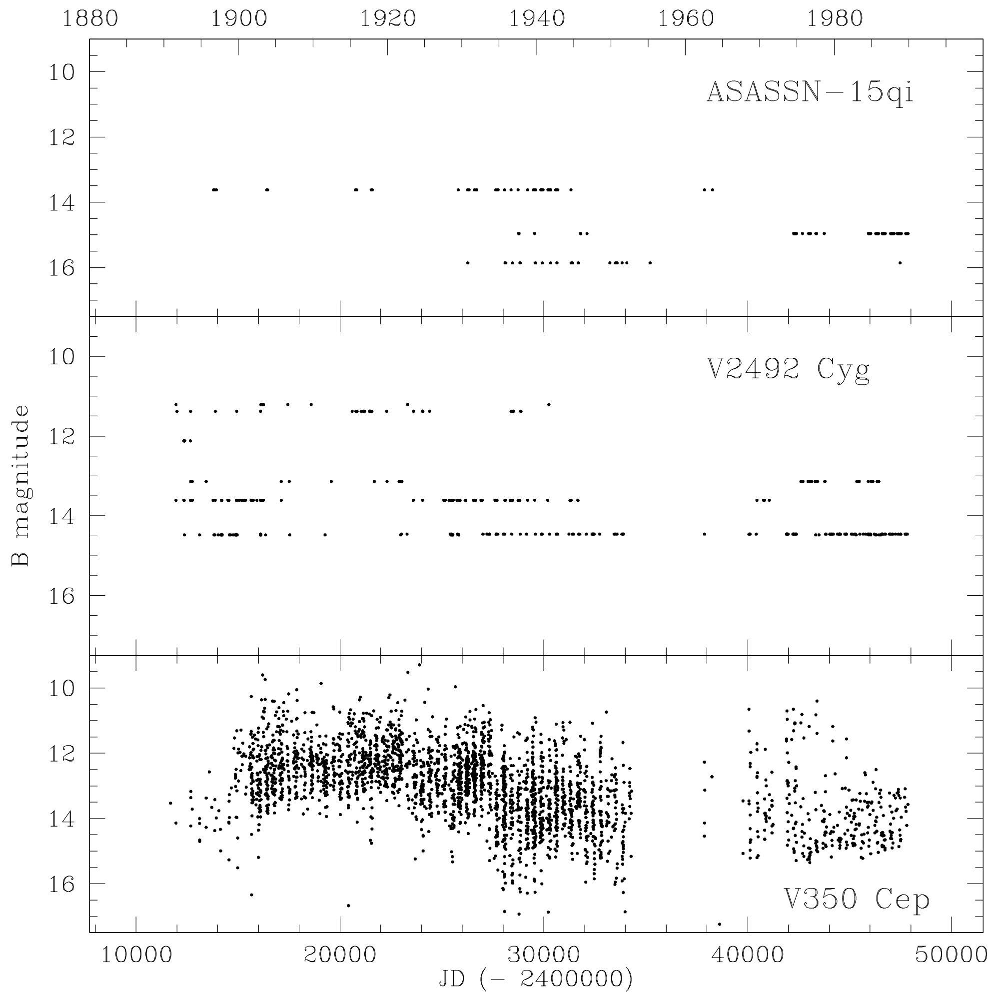

Fig. 4. Limiting magnitude for the Harvard plates inspected in the search for past bright episodes of the program stars. For V2492 Cyg and ASASSN-15qi, we have plotted the B-band magnitude of the faintest APASS star visible at the microscope in the immediate surroundings of the targets. For V350 Cep we plot the limiting magnitude as derived by DASCH as part of the calibrations of the plate scans.

our monitoring has pointed out that sudden fading followed by rapid restoring of the previous brightness is not a unique and isolated event, and, as such, it may be attributable to an orbiting structure along the line of sight. During the monitored quiescence, ASASSN-15qi presents a level of moderate variability (0.5-1 mag) that is comparable with that of classical T Tauri stars. We are not able to fill in any gaps existing in the available literature about its nature. We can only say that a pure extinction origin does not seem to be the only mechanism responsible for the observed fluctuations.

Acknowledgements. We acknowledge with thanks the variable star observations from the AAVSO International Database contributed by observers worldwide and used in this research.
We thank the ASAS-SN project that is supported by the Gordon and Betty Moore Foundation through grant GBMF5490 to the Ohio State University and NSF grant AST-1515927.
We are thankful to the people of the Harvard College Observatory for their kind support.
R.J.S. thanks the INAF Astronomical Observatory of Padova for the hospitality during the stay in Asiago and for permission to use the historical plate archive of the Asiago Observatory. This work was supported in part by the Croatian Science Foundation under the project 6212 Solar and Stellar Variability and by the University of Rijeka under the project number 13.12.1.3.03.

References

Antoniucci, S., Arkharov, A. A., Di Paola, A., et al. 2013, Protostars and Planets VI Posters, 2
Antoniucci, S., Arkharov, A. A., Di Paola, A., et al. 2014, A&A, 565, L7
Aspin, C. 2011, AJ, 141, 196
Audard, M., Ábrahám, P., Dunham, M. M., et al. 2014, Protostars and Planets VI, 387
Bally, J., & Reipurth, B. 2003, AJ, 126, 893
Connelley, M.S., Reipurth, B. & Hillenbrand, L.A. 2015, Astronomer's Telegram #8333
Covey, K.R., et al. 2011, AJ, 141, 40
Dahm, S.E., & Hillenbrand, L.A. 2015, AJ, 149, 200
D'Angelo, C.R., & Spruit, H.C. 2010, MNRAS, 406, 1208
D'Angelo, C.R., & Spruit, H.C. 2012, MNRAS, 420, 416
Giannini, T., Lorenzetti, D., Antoniucci, S., et al. 2016, ApJ, 819, L5
Giannini, T. et al. 2017, A&A, in press (arXiv:1710.08151).
Grindlay J., Tang S., Los E., & Servillat M., 2012, IAUS, 285, 29
Grinin, V.P. 1988, Soviet Astronomy Letters, 14, 27
Hartmann, L., Herczeg, G. & Calvet, N. 2016 ARAA, 54, 135
Hartmann, L., & Kenyon, S. 1985, ApJ, 299, 462
Henden, A. A., Levine, S. E., Terrell, D., Smith, T. C., & Welch, D. 2012, Journal of the American Association of Variable Star Observers (JAAVSO), 40, 430
Henden, A., & Munari, U. 2014, Contributions of the Astronomical Observatory Skalnate Pleso, 43, 518
Herbig, G.H. 1989, Proc. of the ESO Workshop on *Low Mass Star Formation and Pre-Main Sequence Objects*, ed. B. Reipurth, p.233
Herbig, G.H. 2008, AJ, 135, 637
Herczeg, G.J. et al. 2016. ApJ, 831, 133
Hillenbrand, L.A. et al. 2013, AJ, 145, 59
Hillenbrand, L.A., Reipurth, B. & Connelley, M.S. 2015, Astronomer's Telegram #8331

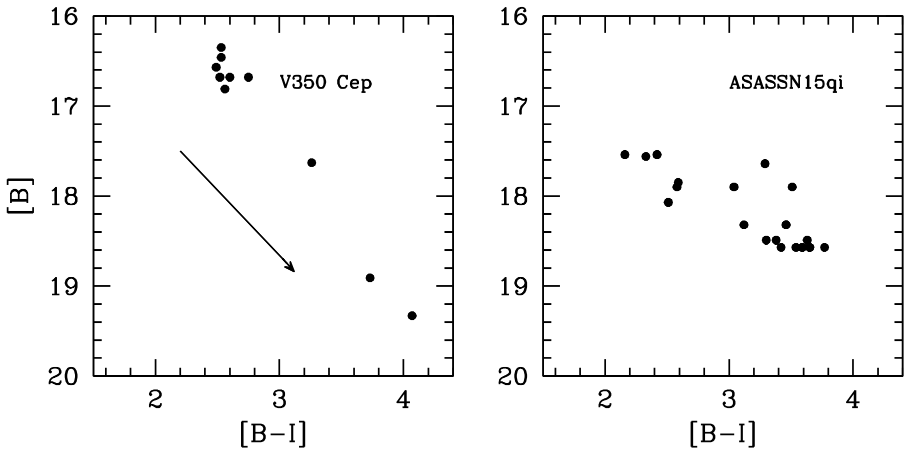

Fig. 5. B vs. $[B-I]$ colour-magnitude plot of V350 Cep (left) and ASASSN-15qi (right). In the lower-left corner the arrow indicates an extinction of $A_V = 1$ mag, according to the law by Rieke & Lebofsky (1985).

Ibryanov, S. & Semkov, E. 2017, Astronomer's Telegram #10170
Ibryanov, S., Semkov, E. & Peneva, S. 2014, Research in Astron. & Astroph., 14, 1264
Itagaki, K.& Yamaoka, H. 2010 CBET, No.2426,#1
Jurdana-Šepić, et al. 2017, A&A, 602, A99
Jurdana-Šepić, R., & Munari, U. 2016, New A., 43, 87
Kóspál, Á., Ábrahám, P., Acosta-Pulido, J. A., et al. 2011, A&A, 527, A133
Kóspál, Á., Ábrahám, P., Westhues, Ch. & Haas, M. 2017, A&A, 597, L10
Kraus, S. et al. 2016 MNRAS, 462, L61
Lorenzetti, D., Larionov, V. M., Giannini, T., et al. 2009, ApJ, 693, 1056
Lorenzetti, D., Antoniucci, S., Giannini, T., et al. 2012, ApJ, 749, 188
Maehara, H. et al. 2015, Astronomer's Telegram #8147
Moro, D., & Munari, U. 2000, A&AS, 147, 361
Munari U., 2012, JAVSO, 40, 582
Munari, U., Henden, A., Frigo, A., et al. 2014, AJ, 148, 81
Munari, U., & Dallaporta, S. 2014, New A, 27, 25
Munari, U. et al. 2017, Astronomer's Telegram #10183
Pogosyants, A. Yu. 1991, Inf. Bull. Variable Stars 3624
Rieke, G.H., & Lebofsky, M.J. 1985, ApJ, 288, 618
Semkov, E.H. 2004, IBVS, 5556, 1
Semkov, E.H., Ibryamov, S.I, & Peneva, S.P. 2017 Bulgarian Astronomical Journal, arXiv: 1706.01076S
Sicilia-Aguilar, A. et al. 2008, ApJ, 673, 382
Sicilia-Aguilar, A., Kóspál, Á., Setiawan, J., et al. 2012, A&A, 544, A93
Straižys, V. et al. 2014, MNRAS, 438, 1848
Zhu, Z., Hartmann, L., & Gammie, C., 2009, ApJ, 694, 1045
Xiao, L., Kroll, P., & Henden, A.A. 2010, AJ, 139, 1527

Table 2. As in Table1, for V350 Cep.

HJD	date	UT	expt	emulsion	filter	tel	plate	mag
2441183.55876	1971-08-19	25:23	20	103a-O	....	SG	04613	B>19.33
2441183.58515	1971-08-19	26:01	20	I-N sen	RG 5	SG	04614	I>15.62
2441207.40035	1971-09-12	21:34	20	103a-O	GG 13	SG	04619	B=18.69
2441207.45521	1971-09-12	22:53	30	I-N sen	RG 5	SG	04621	I>15.62
2441248.39933	1971-10-23	21:32	20	103a-O	GG 13	SG	04827	B>19.33
2441248.42086	1971-10-23	22:03	30	I-N sen	RG 5	SG	04828	I>14.89
2441279.28642	1971-11-23	18:50	30	I-N sen	RG 5	SG	04967	I=15.18
2441279.35239	1971-11-23	20:25	20	103a-O	GG 13	SG	04970	B=18.91
2441293.26107	1971-12-07	18:14	30	I-N sen	RG 5	SG	05013	I=15.18
2441293.28121	1971-12-07	18:43	20	Ia-O	GG 13	SG	05014	B>17.21
2441298.30883	1971-12-12	19:23	20	Ia-O	GG 13	SG	05068	B>17.21
2441298.32897	1971-12-12	19:52	30	I-N sen	RG 5	SG	05069	I>15.62
2441303.26285	1971-12-17	18:17	30	I-N sen	RG 5	SG	05117	I=15.26
2441303.28784	1971-12-17	18:53	20	103a-O	GG 13	SG	05118	B=19.33
2441601.46877	1972-10-10	23:12	20	103a-O	GG 13	SG	05665	B>17.21
2441601.49169	1972-10-10	23:45	30	I-N sen	RG 5	SG	05666	I=15.47
2441624.30411	1972-11-02	19:15	20	103a-O	GG 13	SG	05746	B>17.21
2441624.32495	1972-11-02	19:45	30	I-N sen	RG 5	SG	05747	I>15.62
2441628.29157	1972-11-06	18:57	20	103a-O	GG 13	SG	05806	B=19.12
2441628.31240	1972-11-06	19:27	30	I-N sen	RG 5	SG	05807	I>14.89
2441668.22049	1972-12-16	17:16	25	I-N sen	RG 5	SG	05955	I=15.55
2441665.43030	1972-12-13	22:18	05	I-N sen	RG 5	SG	06003	I=15.33
2441674.21960	1972-12-22	17:15	30	I-N sen	RG 5	SG	06015	I>14.45
2441674.23974	1972-12-22	17:44	20	103a-D	GG 14	SG	06016	V=18.24
2441977.49586	1973-10-21	23:51	20	103a-O	GG 13	SG	06739	B>17.21
2441977.51461	1973-10-21	24:18	30	I-N sen	RG 5	SG	06740	I>14.89
2441983.33958	1973-10-27	20:06	30	I-N sen	RG 5	SG	06800	I=15.55
2441983.36181	1973-10-27	20:38	20	103a-O	GG 13	SG	06801	B>17.21
2441988.42565	1973-11-01	22:10	30	I-N sen	RG 5	SG	06854	I>14.89
2441988.44996	1973-11-01	22:45	20	103a-O	GG 13	SG	06855	B>17.21
2442029.21438	1973-12-12	17:07	30	103a-D	GG 14	SG	06922	V=17.72
2442034.26005	1973-12-17	18:13	20	103a-D	GG 14	SG	06945	V=17.86
2442034.28088	1973-12-17	18:43	30	I-N sen	RG 5	SG	06946	I=15.04
2443074.36738	1976-10-22	20:46	30	103a-O	GG 13	SG	08724	B=16.81
2443074.42225	1976-10-22	22:05	30	I-N sen	RG 5	SG	08727	I=14.25
2443135.31196	1976-12-22	19:28	30	103a-O	GG 13	SG	08818	B=16.35
2443135.33696	1976-12-22	20:04	30	I-N sen	RG 5	SG	08819	I=13.82
2443421.44929	1977-10-04	22:44	30	I-N sen	RG 5	SG	09235	I=14.54
2443430.50003	1977-10-13	23:57	20	103a-O	GG 13	SG	09252	B=16.02
2443430.52364	1977-10-13	24:31	30	I-N sen	RG 5	SG	09253	I=14.01
2443456.49987	1977-11-08	23:57	30	I-N sen	RG 5	SG	09292	I=14.37
2443456.52279	1977-11-08	24:30	20	103a-O	GG 13	SG	09293	B=17.42
2443482.25558	1977-12-04	18:06	30	103a-O	GG 13	SG	09352	B=16.68
2443482.28058	1977-12-04	18:42	30	I-N sen	RG 5	SG	09353	I=13.93
2443816.39439	1978-11-03	21:25	30	103a-D	GG 14	SG	09723	V=16.02
2443837.31348	1978-11-24	19:29	20	103a-O	GG 13	SG	09793	B=16.89
2443837.33500	1978-11-24	20:00	30	103a-E	RG 1	SG	09794	R=15.09
2443842.35919	1978-11-29	20:35	30	103a-E	RG 1	SG	09804	R=15.02
2443845.35008	1978-12-02	20:22	30	103a-E	RG 1	SG	09825	R=15.30
2443845.37231	1978-12-02	20:54	20	103a-O	GG 13	SG	09826	B=18.06
2444116.51532	1979-08-30	24:20	20	103a-O	GG 13	SG	10164	B=17.63
2444116.53755	1979-08-30	24:52	30	I-N sen	RG 5	SG	10165	I=14.37
2444146.36243	1979-09-29	20:39	30	I-N sen	RG 5	SG	10197	I=14.08
2444146.39090	1979-09-29	21:20	20	103a-O	GG 13	SG	10198	B=16.57
2444514.28954	1980-10-01	18:54	30	I-N sen	RG 5	SG	10629	I>14.45
2444514.33746	1980-10-01	20:03	30	103a-O	GG 13	SG	10630	B=16.35
2444551.49850	1980-11-07	23:55	20	103a-O	GG 13	SG	10662	B=16.68
2444551.52072	1980-11-07	24:27	30	I-N sen	RG 5	SG	10663	I=14.08
2444819.49780	1981-08-02	23:56	30	103a-O	GG 13	SG	11056	B=16.68
2444853.32451	1981-09-05	19:45	30	I-N sen	RG 5	SG	11089	I=13.93
2444853.35090	1981-09-05	20:23	30	103a-O	GG 13	SG	11090	B=16.46
2444913.36104	1981-11-04	20:37	30	I-N sen	RG 5	SG	11168	I=14.20
2444926.33862	1981-11-17	20:05	30	I-N sen	RG 5	SG	11191	I=14.16
2444926.36292	1981-11-17	20:40	30	103a-O	GG 13	SG	11192	B=16.68
2445591.38996	1983-09-13	21:19	30	I-N sen	RG 5	SG	12208	I=13.93
2446293.45032	1985-08-15	22:47	30	IIa-O	GG 13	SG	12930	B=16.68
2446295.46427	1985-08-17	23:07	30	I-N sen	RG 5	SG	12939	I=13.93
2446297.44280	1985-08-19	22:36	30	I-N sen	RG 5	SG	12948	I=14.16

Table 3. As in Table1, for ASASSN-15qi.

HJD	date	UT	expt	emulsion	filter	tel	plate	mag
2440529.26267	1969-11-03	18:14	30	103 a-O	GG 13	SG	02750	B=17.90
2440529.28697	1969-11-03	18:49	30	I-N sen	RG 5	SG	02751	I=15.32
2440836.43372	1970-09-06	22:21	30	103 a-O	GG 13	SG	03617	B=18.57
2440836.46011	1970-09-06	22:59	30	I-N sen	RG 5	SG	03618	I=14.13
2440882.44129	1970-10-22	22:31	30	103 a-O	GG 13	SG	03757	B=17.64
2440882.46560	1970-10-22	23:06	30	I-N sen	RG 5	SG	03758	I=14.35
2440885.41835	1970-10-25	21:58	30	103 a-O	GG 13	SG	03781	B>17.73
2440888.48568	1970-10-28	23:35	30	I-N sen	RG 5	SG	03826	I=15.23
2440888.51207	1970-10-28	24:13	30	103 a-O	GG 13	SG	03827	B=17.56
2440895.43001	1970-11-04	22:15	40	103 a-E	RG 1	SG	03861	R=14.92
2440895.45779	1970-11-04	22:55	30	103 a-O	GG 13	SG	03862	B=17.56
2440918.23491	1970-11-27	17:35	30	I-N sen	RG 5	SG	03951	I=15.15
2440918.25922	1970-11-27	18:10	30	103 a-O	GG 13	SG	03952	B=18.57
2440924.31731	1970-12-03	19:34	31	I-N sen	RG 5	SG	04019	I=14.86
2440924.34231	1970-12-03	20:10	30	103 a-O	GG 13	SG	04020	B=18.32
2440941.25820	1970-12-20	18:10	40	II a-O	GG 13	SG	04084	B=18.32
2440941.28597	1970-12-20	18:50	30	I-N sen	RG 5	SG	04085	I=14.86
2440970.23026	1971-01-18	17:32	30	I-N sen	RG 5	SG	04149	I=14.98
2441179.47520	1971-08-15	23:22	30	103 a-O	GG 13	SG	04574	B>17.73
2441179.50367	1971-08-15	24:03	40	103 a-E	RG 1	SG	04575	R=15.66
2441179.53284	1971-08-15	24:45	30	I-N sen	RG 5	SG	04576	I=15.20
2441215.47854	1971-09-20	23:25	30	0a-O	GG 13	SG	04660	B=18.32
2441215.50910	1971-09-20	24:09	40	I-N sen	RG 5	SG	04661	I=15.20
2441245.40311	1971-10-20	21:36	20	103 a-O	GG 13	SG	04796	B=17.90
2441245.42325	1971-10-20	22:05	30	I-N sen	RG 5	SG	04797	I=14.86
2441272.39362	1971-11-16	21:23	30	103 a-O	GG 13	SG	04934	B=18.49
2441272.42556	1971-11-16	22:09	40	I-N sen	RG 5	SG	04935	I=15.19
2441291.23044	1971-12-05	17:29	25	103 a-O	GG 13	SG	04998	B=18.57
2441292.21373	1971-12-06	17:05	35	I-N sen	RG 5	SG	05004	I=15.11
2441292.23803	1971-12-06	17:40	25	103 a-O	GG 13	SG	05005	B=18.49
2441297.24753	1971-12-11	17:54	40	I-N sen	RG 5	SG	05050	I=14.98
2441297.27600	1971-12-11	18:35	30	Ia-O	GG 13	SG	05051	B=18.57
2441300.20851	1971-12-14	16:58	40	I-N sen	RG 5	SG	05078	I=14.98
2441300.23628	1971-12-14	17:38	30	Ia-O	GG 13	SG	05079	B>17.73
2441570.44841	1972-09-09	22:42	20	103 a-O	GG 13	SG	05598	B=18.57
2441570.47411	1972-09-09	23:19	30	I-N sen	RG 5	SG	05599	I=14.98
2441606.40035	1972-10-15	21:32	30	I-N sen	RG 5	SG	05682	I=15.28
2441606.42049	1972-10-15	22:01	20	103 a-O	GG 13	SG	05683	B>17.73
2441622.39813	1972-10-31	21:29	20	103 a-O	GG 13	SG	05724	B=18.57
2441622.42174	1972-10-31	22:03	30	I-N sen	RG 5	SG	05725	I=15.03
2441626.34181	1972-11-04	20:08	20	103 a-O	GG 13	SG	05776	B=17.54
2441626.36750	1972-11-04	20:45	30	I-N sen	RG 5	SG	05777	I=15.12
2441649.22587	1972-11-27	17:22	30	I-N sen	RG 5	SG	05908	I=14.92
2441649.24601	1972-11-27	17:51	20	103 a-O	GG 13	SG	05909	B=18.57
2441659.28309	1972-12-07	18:45	20	103 a-D	GG 14	SG	05972	V=16.01
2441659.30254	1972-12-07	19:13	30	I-N sen	RG 5	SG	05973	I=14.92
2441665.45712	1972-12-13	22:56	30	I-N sen	RG 5	SG	06004	I=14.92
2441665.47725	1972-12-13	23:25	30	103 a-D	GG 14	SG	06005	V=15.85
2441675.21358	1972-12-23	17:06	30	I-N sen	RG 5	SG	06018	I=14.98
2441675.23372	1972-12-23	17:35	20	103 a-D	GG 14	SG	06019	V=16.24
2441958.54820	1973-10-02	25:05	30	I-N sen	RG 5	SG	06671	I>15.04
2441958.57111	1973-10-02	25:38	20	103 a-O	GG 13	SG	06672	B=18.57
2441976.42464	1973-10-20	22:07	30	103 a-D	GG 14	SG	06733	V=16.43
2441976.46491	1973-10-20	23:05	20	103 a-O	GG 13	SG	06734	B>16.57
2441980.47391	1973-10-24	23:18	30	I-N sen	RG 5	SG	06767	I=14.80
2441980.49683	1973-10-24	23:51	20	103 a-O	GG 13	SG	06768	B>17.73
2441983.38291	1973-10-27	21:07	20	103 a-O	GG 13	SG	06802	B=18.57
2441983.40166	1973-10-27	21:34	20	103 a-D	GG 14	SG	06803	V=16.09
2441987.46410	1973-10-31	23:04	20	103 a-O	GG 13	SG	06850	B>18.57
2441987.48563	1973-10-31	23:35	30	I-N sen	RG 5	SG	06851	I>15.86
2442002.31516	1973-11-15	19:30	20	103 a-D	GG 14	SG	06879	V=16.41
2442017.39450	1973-11-30	21:25	30	103 a-D	GG 14	SG	06899	V=15.95
2442017.42228	1973-11-30	22:05	30	I-N sen	RG 5	SG	06900	I>15.04
2442029.24260	1973-12-12	17:47	20	103 a-D	GG 14	SG	06923	V=16.67
2442029.26760	1973-12-12	18:23	30	I-N sen	RG 5	SG	06924	I>13.99
2442034.30694	1973-12-17	19:20	30	I-N sen	RG 5	SG	06947	I=15.41
2442034.32777	1973-12-17	19:50	20	103 a-D	GG 14	SG	06948	V=16.51
2442689.36765	1975-10-03	20:45	30	103 a-O	GG 13	SG	08102	B=17.90
2442689.38917	1975-10-03	21:16	30	I-N sen	RG 5	SG	08103	I=14.39
2442712.38848	1975-10-26	21:15	30	103 a-O	GG 13	SG	08151	B=18.57
2442712.41626	1975-10-26	21:55	30	I-N sen	RG 5	SG	08152	I=14.92
2442746.31470	1975-11-29	19:30	20	103 a-O	GG 13	SG	08206	B=18.57

Table 3. Continued.

2442746.33693	1975-11-29	20:02	30	I-N sen	RG 5	SG	08207	I=14.92
2443039.46808	1976-09-17	23:10	20	103 a-O	GG 13	SG	08684	B=18.07
2443039.48961	1976-09-17	23:41	30	I-N sen	RG 5	SG	08685	I=15.56
2443074.31698	1976-10-22	19:32	30	I-N sen	RG 5	SG	08722	I=14.86
2443074.34129	1976-10-22	20:07	30	103 a-O	GG 13	SG	08723	B=18.49
2443127.39735	1976-12-14	21:30	30	103 a-O	GG 13	SG	08797	B>17.73
2443127.42165	1976-12-14	22:05	30	I-N sen	RG 5	SG	08798	I=14.80
2443392.47259	1977-09-05	23:17	30	I-N sen	RG 5	SG	09166	I=15.12
2443392.49481	1977-09-05	23:49	20	103 a-O	GG 13	SG	09167	B>17.73
2443398.46027	1977-09-11	22:59	30	I-N sen	RG 5	SG	09199	I=14.92
2443398.48527	1977-09-11	23:35	20	103 a-O	GG 13	SG	09200	B>17.73
2443405.43198	1977-09-18	22:18	20	103 a-O	GG 13	SG	09213	B=17.54
2443405.46254	1977-09-18	23:02	30	I-N sen	RG 5	SG	09214	I=15.38
2443420.40376	1977-10-03	21:37	30	I-N sen	RG 5	SG	09224	I=14.92
2443452.27862	1977-11-04	18:37	30	I-N sen	RG 5	SG	09273	I=14.26
2443464.35194	1977-11-16	20:23	30	I-N sen	RG 5	SG	09324	I=14.92
2443480.35415	1977-12-02	20:27	30	103 a-O	GG 13	SG	09347	B>16.88
2443480.43262	1977-12-02	22:20	30	I-N sen	RG 5	SG	09350	I=15.29
2443492.30361	1977-12-14	19:15	30	I-N sen	RG 5	SG	09372	I>15.04
2443492.38139	1977-12-14	21:07	30	103 a-O	GG 13	SG	09375	B>17.73
2443789.40935	1978-10-07	21:45	30	103 a-D	GG 14	SG	09652	V=16.38
2443789.43366	1978-10-07	22:20	30	I-N sen	RG 5	SG	09653	I=15.80
2444116.38069	1979-08-30	21:05	30	I-N sen	RG 5	SG	10162	I=15.19
2444116.49528	1979-08-30	23:50	20	103 a-O	GG 13	SG	10163	B>17.73
2444143.44325	1979-09-26	22:34	30	I-N sen	RG 5	SG	10186	I=14.98
2444143.47172	1979-09-26	23:15	20	103 a-O	GG 13	SG	10187	B>17.73
2444172.45030	1979-10-25	22:44	20	103 a-O	GG 13	SG	10249	B>17.73
2444172.47182	1979-10-25	23:15	30	I-N sen	RG 5	SG	10250	I=14.98
2444552.47852	1980-11-08	23:25	20	103 a-D	GG 14	SG	10668	V=15.62
2444557.42771	1980-11-13	22:12	20	103 a-O	GG 13	SG	10672	B>16.75
2444557.45479	1980-11-13	22:51	30	I-N sen	RG 5	SG	10673	I>15.04
2444854.40387	1981-09-06	21:38	30	I-N sen	RG 5	SG	11099	I=15.19
2444911.34879	1981-11-02	20:18	30	I-N sen	RG 5	SG	11152	I=15.26
2444911.37726	1981-11-02	20:59	30	103 a-O	GG 13	SG	11153	B=17.85
2444933.41070	1981-11-24	21:48	30	103 a-O	GG 13	SG	11241	B>17.73
2444933.44195	1981-11-24	22:33	30	I-N sen	RG 5	SG	11242	I>15.04
2445264.32394	1982-10-21	19:42	25	I-N sen	RG 5	SG	11723	I=14.86
2445264.35310	1982-10-21	20:24	30	103 a-D	GG 14	SG	11724	V=16.38
2445290.37764	1982-11-16	21:00	30	103 a-O	GG 13	SG	11740	B=17.98
2445591.41726	1983-09-13	21:57	30	I-N sen	RG 5	SG	12209	I=15.20
2445591.44296	1983-09-13	22:34	30	103 a-D	GG 14	SG	12210	V>16.63
2445611.46209	1983-10-03	23:01	30	103 a-O	GG 13	SG	12228	B=17.67
2449223.38669	1993-08-23	21:14	30	103 a-E	RG 1	SG	15636	R>15.05

Table 4. Ranges of photometric variability for ASASSN-15qi. For each band, we list the number of observations not considering the upper limits (Column 3), the median, which basically indicates the magnitude in quiescence (Column 4), the standard deviation data point distribution (Column 5), and the magnitude corresponding to the peak brightness (Column 6).

Source	Band	N_{obs}	Median	σ (mag)	Peak
ASASSN-15qi	B	29	18.32	0.40	17.54
	V	12	16.38	0.32	15.62
	R	3	15.05	0.39	14.92
	I	45	14.98	0.31	14.13